FACULDADE DE CIÊNCIAS SOCIAIS E HUMANAS
UNIVERSIDADE NOVA DE LISBOA

O Impacto do Turismo de Natureza e da Paisagem na Saúde. O Caso das Levadas na Madeira

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Tese de Doutoramento em

Geografia e Planeamento Territorial

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Tese apresentada para cumprimento dos requisitos necessários à obtenção do grau de Doutor em Geografia e Planeamento Territorial, realizada sob a orientação científica do Prof. Doutor Jorge Ricardo Ferreira e a coorientação da Prof.ª Doutora Maria do Rosário Oliveira.

DECLARAÇÕES

Declaro que esta tese é o resultado da minha investigação pessoal e independente. O seu conteúdo é original e todas as fontes consultadas estão devidamente mencionadas no texto, nas notas e na bibliografia.

O(A) candidato(a),

Lisboa, 24 de setembro de 2020

Declaro que esta tese se encontra em condições de ser apreciada pelo júri a designar.

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Lisboa, 24 de SETEMBRO de 2020

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O IMPACTO DO TURISMO DE NATUREZA E DA PAISAGEM NA SAÚDE.

O CASO DAS LEVADAS NA MADEIRA

TESE DE DOUTORAMENTO

MARIA JOÃO DE GOUVEIA ABREU FREITAS

RESUMO

O turismo de natureza assume grande relevância no desenvolvimento de pequenos territórios insulares e a paisagem parece estar associada ao bem-estar mental, físico e social. O objetivo central do presente estudo foi triplo: (1) identificar os benefícios de saúde mental e física que resultam das caminhadas nas levadas/trilhos pelos turistas; (2) identificar as características da paisagem (percecionadas pelos turistas) que atraem os utilizadores das levadas/trilhos e (3) identificar outros parâmetros da paisagem, por exemplo, a distância, a duração, a subida acumulada e a descida acumulada.

A amostra foi constituída por 1626 turistas, 974 mulheres e 652 homens, com idades compreendidas entre os 5 e os 84 anos. Os sons, os afetos principais e a experiência restaurativa foram avaliados através do *Swedish Soundscape-Quality Protocol*, *Swedish Core Affect Scale* e *Perceived Restorativeness Scale*, respetivamente. A atividade física foi estimada via acelerometria, sensor de passada e monitor de frequência cardíaca. A aptidão física foi avaliada através da resistência cardiorrespiratória. A correlação, a ANOVA de medidas repetidas e a regressão (linear, hierárquica e multinível) foram as técnicas estatísticas utilizadas na análise dos dados.

A vegetação, a água, as montanhas, o verde e o azul emergiram como os principais elementos e cores da paisagem. Os turistas aumentaram os afetos positivos ao longo da caminhada. O cheiro natural foi um preditor positivo e significativo dos afetos principais. As variáveis sociodemográficas, as características do envolvimento, as caraterísticas dos trilhos e a qualidade restaurativa explicaram um máximo de 56,2% de variância nos afetos principais, na primeira metade das levadas e trilhos e 34,5%, na segunda metade. O distanciamento das preocupações do dia-a-dia e o envolvimento positivo com o ambiente mediaram a relação entre a paisagem e os afetos principais.

As levadas e os trilhos foram descritos em termos de distância, duração, subidas acumuladas, descidas acumuladas, comprimento da passada e velocidade. Cerca de metade dos turistas (52,5%) alcançou 150 a 300 minutos de atividade física moderada-a-vigorosa. A totalidade dos turistas alcançou, pelo menos, 42 minutos na zona ótima de frequência cardíaca. Os turistas mais velhos apresentaram menos tempo em atividade física moderada-a-vigorosa do que os turistas mais novos. Uma percentagem de gordura corporal elevada e levadas e trilhos exigentes estavam associados a níveis mais baixos de atividade física moderada-a-vigorosa. As levadas e trilhos longos e as subidas acumuladas estavam associados a valores mais elevados de atividade física moderada-a-vigorosa.

Os estímulos negativos, tais como os ruídos e o lixo, reduziram a qualidade da paisagem. O turismo de natureza e a paisagem estão associados ao bem-estar mental e ao bem-estar físico. As entidades governativas e os profissionais de turismo podem utilizar esta informação no delineamento de estratégias no turismo, partindo da sua importância para a saúde e para o desenvolvimento regional, e na promoção e *marketing* das caminhadas nas levadas e trilhos da Madeira.

PALAVRAS-CHAVE: turismo baseado na natureza, paisagem, emoções, caminhada, saúde, Levadas - Madeira

ABSTRACT

Nature tourism is vitally important in the development of small insular territories and landscape seems to be associated with mental, physical, and social well-being. The main objective of the current study was threefold: (1) to identify mental and physical health benefits that result from hiking on the levadas/trails by tourists; (2) to identify the landscape features (perceived by tourists) that attract users of the levadas/trails and (3) to identify other landscape features, for example, distance, duration, elevation gain, elevation loss.

The sample included 1626 nature-based tourists, 974 females and 652 males, aged 5-84 years. The sounds, core affect and nature-based restorative experience were assessed through the 'Swedish Soundscape-Quality Protocol', 'Swedish Core Affect Scale' and 'Perceived Restorativeness Scale', respectively. Physical activity was assessed through accelerometery, stride sensor and heart rate monitor, while physical fitness was assessed through the cardiorespiratory endurance. Correlation, repeated measures ANOVA and regression (linear, hierarchical, and multilevel) were the statistical techniques used to analyse the data.

The vegetation, water, mountains, green and blue emerged as main elements and colours of the landscape. Nature-based tourists increased valence, pleasant activation and pleasant deactivation from the beginning to the middle and from the middle to the end of the 'levadas' and trails. Nature smells were among the positive significant predictors in the two-halves of the trails. Socio-demographic variables, environmental characteristics, hike features and nature-based restorative experience explained a maximum of 56.2% of the variance of core affect in the first half and 34.5% in the second. Being away and fascination mediated the relationship between landscape and core affect.

The 'levadas' and trails were described in terms of distance, duration, elevation gain, elevation loss, stride length and walking speed. Around half (52.6%) of the participants were in the target range of 150 to 300 minutes of moderate-to-vigorous physical activity. Nature-based tourists attained at least 42 minutes at or above 70% of their maximal heart rate. Older nature-based tourists presented lower levels of moderate-to-vigorous physical activity than younger peers. A high percent of body fat and high demanding 'levadas' and trails were associated with low levels of moderate-to-vigorous physical activity. Long 'levadas' and trails and elevation gain were associated with high levels of moderate-to-vigorous physical activity.

Incongruent sensory stimuli, like noise and waste smell, reduced landscape quality. Nature-based tourism and landscape were associated with mental and physical well-being. Public authorities and tourism professionals can use this information in designing tourism strategies, based on its importance for health and regional development, and promoting and marketing walking experiences.

KEYWORDS: nature-based tourism, landscape, emotions, hiking, health, 'Levadas' - Madeira

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ACSM	*American College of Sports Medicine*
ANOVA	*Analysis of variance*
ARM	*Autonomous Region of Madeira*
ART	*Attention Restoration Theory*
AVC	Acidente vascular cerebral
CDC	*Centers for Disease Control and Prevention*
DAC	Doença arterial coronária
DLR	Decreto Legislativo Regional
DREM	Direção Regional de Estatística da Madeira
DRTM	Direção Regional de Turismo da Madeira
GPS	*Global Positioning System*
IBM	*International Business Machines Corporation* (IBM Corp. Released)
ICC	*Intraclass correlation coefficient*
ICNF	Instituto da Conservação da Natureza e das Florestas
IFCN, IP-RAM	Instituto das Florestas e da Conservação da Natureza, Instituto Público da RAM
IP-RAM	Instituição Pública da Região Autónoma da Madeira
iTRA	*International Trail Running Association*
LevMadeira	Turismo de natureza, paisagem e saúde
M	*Mediator*
MTVPA	*Moderate-to-vigorous physical activity*
NOVA	Universidade Nova de Lisboa
PAUD	*Pleasant activation-unpleasant deactivation*
PBF	*Percent body fat*
PHR	*1 minute post heart rate*
PIB	Produto Interno Bruto
POT	Programa de Ordenamento Turístico
PRS	*Perceived Restorativeness Scale*
RAM	Região Autónoma da Madeira
SCAS	*Swedish Core Affect Scale*
SPSS	*Statistical Package for the Social Sciences*

STATA	*Software for Statistics and Data Science*
UAPD	*Unpleasant activation-pleasant deactivation*
UNESCO	*United Nations Educational, Scientific and Cultural Organization*
UNWTO	*United Nations Agency World Tourism Organization*
VIFs	*Variance inflation factors*
VO_{2max}	Consumo máximo de oxigénio
WHO	*Word Health Organization*
WTA	*World Travel Awards*
YMCA	*Young Men's Christian Association*

Capítulo 1

Introdução

1. Introdução

1.1. Contexto teórico e pertinência do estudo

O turismo, como setor de atividade, tem vindo a se impor na dinâmica económica mundial e é dos que mais experimenta um forte e rápido crescimento (Danish & Wang, 2018). O total de chegadas de 1400 milhões de turistas internacionais, em 2018, representou um crescimento de 5%, face ao ano anterior, e gerou ganhos de 1,7 biliões de dólares americanos [Word Tourism Organization (UNWTO), 2019]. As ilhas, exemplificadas nos pequenos estados insulares, têm atraído um significativo e crescente número de visitantes (UNWTO, 2020; Grilli, Mohan, & Curtis, 2020). A insularidade fascina e é parte do imaginário turístico que emerge do distanciamento e, por conseguinte, de culturas e ambientes naturais exóticos (Chang & Lin, 2020; Reis, 2015). De modo similar, o turismo desempenha um importante papel na economia das ilhas e arquipélagos (Sanfiel-Fumero, Armas-Cruz, & González-Morales, 2017; Seetanah, 2011).

O turismo na Madeira tem uma história de mais de duzentos anos e é dado como ‘propulsor do desenvolvimento insular’, a partir da década de 40 do século XX (Vieira, 2008). Nos últimos anos, foi um dos grandes pilares, senão o principal, da economia da Região Autónoma da Madeira (RAM). A última Conta Satélite do Turismo refere que o consumo do turismo no território económico representa 26,6% do Produto Interno Bruto (PIB) [Direção Regional de Estatística da Madeira (DREM): CST-M, 2015]. Esta forte dependência do turismo é preocupante quando as estatísticas oficiais recentes indicam que a Madeira está em contraciclo ao crescimento positivo das chegadas de turistas internacionais, na Europa e no Mundo [UNWTO (*World Tourism Organization*), 2019]. Em 2018, o número de hóspedes entrados estrangeiros nas ilhas do Arquipélago, como variável de aproximação, foi -0,3% face ao ano anterior (DREM: Estatísticas do Turismo, 2018). Este abrandamento acontece quando a Madeira acumulava, à data, quatro prémios de ‘Melhor Destino Insular do Mundo’ e cinco prémios de ‘Melhor Destino Insular na Europa’ [Direção Regional de Turismo da Madeira (DRTM) – Visit Madeira, 2020].

A exiguidade do espaço geográfico da ilha da Madeira e a antiguidade da sua demanda turística obrigam a uma constante renovação de modelos estratégicos de desenvolvimento turístico. O turismo, quando na base da economia de muitos locais e, em particular, de pequenos territórios insulares (Dehoorne, Ilies, & Ilies, 2010) obriga à monitorização e atualização dos planos para o sector. Paralelamente, o aparecimento de novos destinos turísticos torna a oferta extremamente competitiva. O atual Programa de Ordenamento Turístico (POT) da RAM, delineado para o período 2017-2027, tem como objetivos, entre outros, reforçar a formatação de produtos de nicho e desenvolver novos produtos turísticos que amplifiquem as motivações da opção Madeira [Decreto Legislativo Regional (DLR) n.º 15/2017/M]. Neste contexto, é importante conhecer os mais recentes nichos de mercado, perceber as rotinas e as alterações na procura da ilha e voltar a criar expectativas fundamentadas sobre o 'velho' destino turístico. As pequenas ilhas, como é o caso da Madeira, gozam de um certo determinismo de destino, ao qual se associam as características singulares, as imagens únicas e as marcas próprias; contudo, o mercado do turismo é volátil e isso implica inovar e experimentar, numa tentativa de se ajustarem às novas tendências (Nesticò & Maselli, 2020; Puig-Cabrera & Foronda-Robles, 2019; d'Hauteserre & Funck, 2016).

O destino Madeira é referido no POT 2017-2027 (DLR n.º 15/2017/M) como disponível todo o ano, de sol e clima ameno, seguro, de acesso fácil, cosmopolita, capaz de proporcionar um vasto leque de experiências e de beleza natural ímpar. O mesmo documento indica o modelo territorial para o desenvolvimento turístico, mais especificamente, a segmentação em 'espaço urbano', 'espaço rural' e 'espaços naturais e áreas protegidas'. Estes ambientes, ocupados ou livres de vida humana, imprimem paisagens que têm sido importantes recursos turísticos da ilha. A paisagem e o turismo estão intrinsecamente ligados e muitas experiências turísticas são adquiridas e produzidas através da paisagem (Marujo & Santos, 2012). A Convenção Europeia da Paisagem (ver Decreto n.º 4/2005) refere que a paisagem é um elemento importante da qualidade de vida de um indivíduo e que esta não se pode dissociar das rápidas alterações da atividade económica mundial. Também ao valor da beleza da paisagem, parecem estar associados o bem-estar emocional, a redução do stress, a melhoria da saúde física e o desenvolvimento de aptidões de comunicação pessoal e social (Hartig, Mitchell, de Vries, & Frumkin, 2014; Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007). A promoção das paisagens da ilha é recorrente, sobretudo as vistas de miradouros ou as de algum ponto do percurso de uma caminhada pelas levadas e trilhos recomendados (DRTM, 2019).

A paisagem natural, ou predominantemente natural, é inerente ao turismo de natureza. A caminhada em paisagens naturais tem sido referida como um exercício físico benéfico (Lee, Manthiou, Chiang, & Tang, 2018; Kim, Woo, & Uysal, 2015). A exposição à natureza, em particular os espaços verdes, está associada a efeitos positivos na saúde (Dzhambov, Browning, Markevych, Hartig, & Lercher, 2020; Cox et al., 2017). O interesse sobre o turismo de natureza, a paisagem e a saúde emerge do incremento da obesidade e doença coronária (Grill et al., 2020; Thompson, 2011; Bird, 2004), do aumento das perturbações mentais (Coldwell & Evans, 2018; Abraham, Sommerhalder, & Abel, 2010; Barton & Pretty, 2010) e das preocupações com o bem-estar social, sobretudo no adulto idoso (Hartig et al., 2014; Milligan, Gatrell, & Bingley, 2004). A isto, acresce, 'um novo tipo de culto e proteção da saúde' [Instituto da Conservação da Natureza e das Florestas (ICNF), 2020]. Há, ainda, evidência que intervenções para aumentar os níveis de atividade física, baseadas na promoção de atividades como o 'andar a pé', estão relacionadas a mudanças de comportamento e estilo de vida mais duradoiras do que aquelas que requerem equipamentos e técnicos especializados (Thompson, 2013; UK Department of Health, 2004).

O 'andar a pé', em levadas e trilhos, é acessível aos jovens e aos adultos idosos, aos mais e menos ricos e alguns não exigem habilidades motoras elevadas (Thompson, 2013; UNWTO, 2020). É, pois, na interação 'turismo de natureza, paisagem e saúde' que se posiciona o presente estudo, com especial relevo para o bem-estar físico e mental.

1.2. Modelo de referência

A análise das relações entre o turismo de natureza, a paisagem e a saúde, teve por base o modelo desenvolvido por Hartig et al. (2014). A Figura 1.1. apresenta um exercício de aplicação do referido modelo de análise ao estudo, i.e., os trajetos pelos quais o ambiente natural pode beneficiar a saúde dos turistas, ao 'andar ou caminhar' numa levada ou trilho.

Quatro destes trajetos ocorrem do contacto com a natureza, ao longo das levadas e trilhos. Dois outros trajetos são diretos do ambiente natural (por exemplo, a floresta Laurissilva) para a qualidade da paisagem/envolvência (inclui a *soundscape* e a *smellscape*) e para o stress (redução). Nestes últimos, o ambiente natural pode beneficiar a saúde sem que o indivíduo, ou grupo, esteja conscientemente ligado à natureza. As associações entre as variáveis, nas diferentes etapas de um trajeto, estão sujeitas a mudanças pelas características do contexto e/ou indivíduo. A seta de duas pontas entre o ambiente natural e o contacto com a natureza define uma ligação recíproca. As setas de duas pontas entre as variáveis que designam os trajetos (qualidade da paisagem/envolvência, atividade física, contactos sociais e stress) indicam, também, reciprocidade; contudo, cada uma das variáveis pode estar relacionada com todas as outras e não apenas com as variáveis adjacentes.

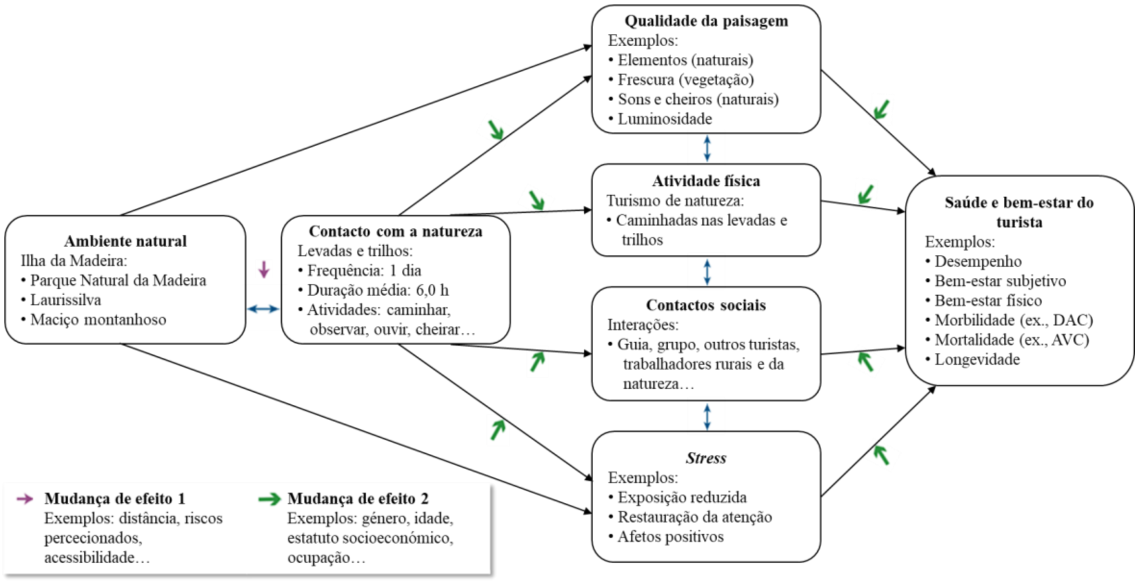

Figura 1.1 Trajetos através dos quais o ambiente natural pode afetar a saúde dos turistas caminheiros, nas levadas e trilhos da ilha da Madeira [Adaptado de Hartig et al. (2014)]. DAC, doença arterial coronária; AVC, acidente vascular cerebral.

1.3. Temas centrais de estudo

1.3.1. Turismo baseado na natureza

O turismo de natureza é um termo holístico integrando várias formas de turismo (Goodwin, 1996). O termo emerge da relação ‘turismo e ambiente’ e com o objetivo de cuidar e preservar a identidade e os recursos naturais de forte pendor atrativo de um lugar (Mok, 2005). Tangeland, Aas e Odden (2013) definem o turismo de natureza como uma ‘atividade em que o turista explora e aprecia a natureza e os recursos naturais’. Cunha e Abrantes (2013) sublinham que ‘a motivação dominante’ está no ‘desejo de regresso à natureza’. O turismo de natureza é ‘viver experiências de grande valor simbólico, interagir e usufruir da natureza’ (Turismo de Portugal, 2006). A atividade baseada na natureza assume características *soft* e *hard*. A primeira inclui, entre outras, as atividades de baixa intensidade, como as caminhadas e a observação da fauna e flora; a segunda, envolve as atividades de grande intensidade (desportos de aventura) ou, pelo contrário, as atividades de concentração e conhecimento (observação de aves) (Turismo de Portugal, 2006). As atividades na natureza desenvolvem-se, preferencialmente, na floresta, montanha e áreas costeiras (Breiby, 2014; Packer, Ballantyne, & Hughes, 2014; Bimonte, & Faralla, 2012; Gios, Goio, Notaro, & Raffaelli, 2006). A escolha deve ocorrer em função da aptidão física e saúde de cada pessoa (ICNF, 2020). Em sentido inverso, a natureza atrai os visitantes e o retorno parece ser 'mais' e 'melhor saúde'.

O turismo de natureza pode ir ao encontro do turismo de saúde e do turismo *wellness*, pelo menos nos seus segmentos mais informais. Neste contexto, o indivíduo é motivado pela prevenção, bem-estar ou recuperação da forma através do desfrute das condições de ambiente existentes, visando o repouso, a evasão ou o contacto com a natureza (Cunha, 2006). Também tais 'acoplagens' parecem emergir de preocupações com o aumento da obesidade, diabetes tipo 2, doença cardiovascular, cancro e doença mental, além dos custos associados à doença, nas sociedades desenvolvidas (Thompson, 2013; Mytton, Townsend, Rutter, & Foster, 2012).

No nicho 'turismo de pedestrianismo', as caminhadas e os benefícios da atividade física inerente, sobretudo em paisagens naturais, tem vindo a colher o interesse de investigadores e de profissionais do setor (Kim et al., 2015). O bem-estar mental está associado ao prazer, à excitação e ao relaxamento em destinos turísticos de caminhadas (Lee t al., 2018; Sánchez, Callarisa, Rodríguez, & Moliner, 2006). A UNWTO refere que a crescente popularidade do turismo de caminhadas (*walking tourism*) é resultante da experiência do lugar, através dos 5 sentidos, e da necessidade de realizar atividade física. O 'andar ou caminhar' não requer habilidades especiais ou força física dos turistas (UNWTO, 2020).

1.3.2. Paisagem

A paisagem constitui o primeiro e mais duradoiro meio de contacto entre o turista e o lugar (Terkenli, 2004). A paisagem não se resume ao que está à frente dos nossos olhos, mas o que está dentro da nossa cabeça (Meinig, 1979). É através dos diferentes 'olhares' projetados para a paisagem, e percebidos através dela, que o turista constrói novas imagens, novos signos e novas experiências (Marujo & Santos, 2012). A paisagem como 'território visto e sentido' exprime uma multidimensionalidade que congrega aspetos biofísicos, culturais e estéticos (Lavrador-Silva, Pereira, & Carvalho, 2004; Salgueiro, 2001). A 'paisagem designa uma parte do território, tal como é apreendida pelas populações, cujo carácter resulta da ação e interação de fatores naturais e/ou humanos'; a paisagem 'é uma entidade dinâmica que se altera com o tempo' (Convenção Europeia da Paisagem, Decreto-Lei n.º4/2005, de 14 de fevereiro de 2005). Esta delimitação concetual inclui: (1) as paisagens determinadas pela sucessão da natureza selvagem e território planificado e (2) as paisagens percecionadas.

A paisagem percecionada emerge de experiências multissensoriais que nela ocorrem, i.e., através da visão, audição, tato e cheiro ou da 'perceção individual'. Ela deixa de ser objeto de contemplação pictórica e passa a cenário de uso, emoção, prazer e experiência (DLR n.º 15/2017/M). A paisagem encerra, em si, a perceção e trajetórias individuais; isto significa um conceito analítico caracterizado pela relação dialética entre a realidade física e a construção social/metafórica (Abraham et al., 2010). A paisagem 'é moldada às abordagens e às particularidades dos diferentes utilizadores' e, por isso, defini-la é um exercício complexo (Cancela d'Abreu, Correia, & Oliveira, 2004). Ainda a este propósito, Stobbelaar e Pedroli (2011) reforçaram a paisagem como a 'perceção singular de um lugar'.

Os sentidos, além da visão, podem ter forte impacte na perceção e interação de cada indivíduo sobre o ambiente (Lindquis et al., 2016). Jiang, Zhang, Zhang, & Yan (2017) alertaram para a necessidade de estudos sobre a paisagem sonora em ambiente turístico. O termo *soundscape* tem sido usado para descrever a relação entre a paisagem e os seus sons (Pijanowski et al., 2011). Schafer (1969) referiu-se à *soundscape* como 'o envolvimento criado pelo som'. Mais recentemente, Davies (2013), Brown (2011) e Truax (2001) acrescentaram à definição anterior 'a forma como o som é percebido e entendido por um indivíduo, grupo ou sociedade', i.e., a *soundscape* exige a perceção humana associada ao tempo, ao lugar e à atividade. Investigação recente tem sugerido a preferência por sons naturais (Jiang et al., 2017; Benfield, Bell, Troup, & Soderstrom, 2010; Porteous & Mastin, 1985).

O 'olfato' é um outro sentido característico das pessoas e 'lugares' (Dann & Jacobsen, 2003) e, assim, da paisagem (Abraham et al., 2010). Porteous (1985) refere-se à *smellscape* como a 'orientação espacial do cheiro/aroma/odor' e a sua relação com o lugar. A concetualização da *smellscape* deve ser entendida como descontínua, fragmentada no espaço e no tempo, e limitada pela altura do nariz ao solo (Henshaw, 2014; Porteous, 1985). O carácter único de um lugar é transmitido pelos seus aromas; a paisagem olfativa corresponde ao ambiente olfativo percebido e interpretado por cada um e, portanto, influenciado pelas experiências e memórias individuais (Xiao, Tait, & Kang, 2018; Dann & Jacobsen, 2003).

1.3.3. Saúde

A saúde é 'um estado de completo bem-estar físico, mental e social, e não apenas a ausência de doença' [Word Health Organization (WHO), 2020]. Este conceito positivo, multidimensional e subjetivo de saúde, possibilita o envolvimento de vários agentes, para além dos especialistas em tratar a doença (Hartig et al., 2014). A saúde é uma condição humana com dimensões física, social e mental, e cada uma delas é caracterizada por um 'continuum' com polos positivos e negativos. A saúde positiva está associada à capacidade de fruir a vida e resistir a desafios; não é simplesmente a ausência de doença. A saúde negativa está associada à morbidade e, no extremo, à mortalidade prematura. Morbidade ou morbilidade é definida como 'qualquer afastamento, objetivo ou subjetivo, de um estado de bem-estar físico ou psicológico' (Bouchard, Shephard, & Stephens, 1994).

O efeito plausível da paisagem na saúde mental parece ser alcançado via 'restauração da atenção', redução do stress e invocação de emoções positivas. A exposição a ambientes naturais (Bratman et al., 2019; Doughty, 2013; Martens, Gutscher, & Bauer, 2011) e o acesso visual à natureza através de uma janela (Lottrup, Grahn, & Stigsdottera, 2013; Hartig, Evans, Jamner, Davis, & Gärling, 2003; S. Kaplan, 2001) estão associados a experiências restaurativas. A literatura sugere, ainda, que quanto maior é o número de espaços verdes, junto à área de residência, maior é a redução do stress (Francis, Wood, Knuiman, & Giles-Corti, 2012; Thompson et al., 2012) e que a recuperação do stress durante a exposição aos sons naturais é mais rápida do que a que é obtida em 'envolvimentos com valores elevados de ruído' (Alvarsson, Wiens, & Nilsson, 2010). Os níveis de stress são mais baixos quanto maior é a duração da visita a ambientes naturais (Adevi & Grahn, 2011). Os ambientes naturais, em conformidade com a teoria da restauração da atenção (Kaplan & Kaplan, 1989), promovem o estar longe dos pensamentos e das rotinas diárias (*being-away*), a atenção sem a exigência de esforço mental (*fascination*), a compatibilidade com os desejos das pessoas (*compatibility*) e a sensação de fazer parte de um todo maior (*extent*) (Hartig, Böök, Garvill, Olsson, & Gärling, 1996; S. Kaplan, 1995).

A paisagem exerce a sua influência no bem-estar físico através da oferta de recursos que permitem ‘andar a pé’ e/ou fazer exercício (Abraham et al., 2010; Bowler, Buyung-Ali, Knight., & Pullin, 2010). Os benefícios de saúde atribuídos aos espaços verdes estão associados a níveis mais elevados de atividade física e à redução da doença (Willis & Crabtree, 2011). De acordo com o ‘American College of Sports Medicine (ACSM)’ (2018), a atividade física e a aptidão física estão inversamente associadas ao risco prematuro de mortalidade e muitas doenças crónicas, incluindo a doença cardíaca coronária, o acidente vascular cerebral, a hipertensão, a diabetes *mellitus* tipo 2 e algumas formas de cancro, particularmente do cólon e da mama. Recentemente, o ACSM (2018) recomendou que todos os norte-americanos deveriam realizar atividade aeróbia moderada equivalente a 150 min·semana^{-1} em sessões regulares durante a semana, por exemplo, 30 minutos em 5 dias da semana ou 75 min·semana^{-1} de atividade física aeróbia vigorosa ou mesmo uma combinação de ambas para obter benefícios de saúde.

A atenção à saúde e a procura dela são cada vez mais importantes, evidenciadas não só pela preocupação com o que se come e com a prática de exercício físico, mas, também, na motivação e forma de passar o tempo livre e de lazer (Árpási, 2018). A investigação científica, sobretudo nos últimos anos e por múltiplas análises, tem demonstrado os benefícios da exposição a espaços verdes para a saúde humana (Coldwell & Evans, 2018; Van den Berg et al., 2016; Hartig et al., 2014; Pretty, Peacock, Sellens, & Griffin, 2005).

1.4. Área de estudo

A Madeira é a maior das ilhas do arquipélago português atlântico com o mesmo nome. Localizada a sudoeste do território continental de Portugal, dista 967 km, em linha reta, da cidade capital Lisboa e 700 km da costa africana, à latitude aproximada de Casablanca, Marrocos (Google *Maps*, 2018). O seu exíguo território de 758,5 km^2 encontra-se entre os paralelos 32º 38’N e 32º 52’N e os semimeridianos 16º 39’W e 17º 16’W (DRTM, 2020; Quintal, 2007).

De origem vulcânica, a ilha apresenta uma extraordinária variação de altitude, entre os zero metros em torno dos 150 km de perímetro da linha de costa e os 1862 m, no Pico Ruivo, o terceiro ponto mais elevado do país. A superfície emersa eleva-se em direção ao interior, o Maciço Montanhoso, com vários topos culminantes a superarem os 1800 m. A ilha tem a forma genérica de um escudo achatado ladeado por arribas alcantiladas e recortadas por profundos vales estreitos, curtos, de forte pendor e quase sempre perpendiculares ao contacto com o mar. As altitudes acima dos 1000 m correspondem a cerca de um terço da sua superfície e têm particular importância no relevo da ilha (Mata et al., 2013; Ribeiro, 1985).

Em direção ao interior muito elevado da ilha da Madeira, o Maciço Montanhoso apresenta orientação E-W e é uma área protegida do Parque Natural da Madeira (PNM), designada de Reserva Geológica e de Vegetação de Altitude. Integra, também, os Sítios da Rede Natura 2000 classificados como Zona de Proteção Especial (Diretiva das Aves) e Zona Especial de Conservação [Instituto das Florestas e da Conservação da Natureza, Instituto Público da RAM (IFCN, IP-RAM), 2020]. O seu relevo é uma combinação de áreas planálticas, picos, cabeceiras de vale e depressões circulares acima dos 1400 m de altitude. A partir desta imensa barreira natural, duas grandes vertentes precipitam-se em direção ao mar, a norte e a sul (Mata et al., 2013; Prada, 2000).

A vertente norte é ingreme e estende-se entre o extremo NW da ilha e o início da estreita península da Ponta de S. Lourenço, a oriente. Rasgada por vales muito apertados, profundamente talhados por cursos de água curtos, alguns são suspensos pela sua juventude ou pelo recuo rápido do litoral, devido à ação violenta das vagas do mar. As praias estreitas de calhau rolado, 'leques vulcânicos' e escorregamentos diversificam a morfologia e interferem com a linha de costa quase retilínea e de contínuas arribas altas em contacto direto com o oceano (Brum da Silveira, Madeira, Ramalho, Fonseca, & Prada, 2010; Ribeiro, 1985). A maior bacia hidrográfica da ilha, a Ribeira da Janela, localiza-se na vertente norte e ocupa 51,7 km^2 de superfície (Caetano, 2014).

A vertente sul, em oposição à norte, apresenta um pendor genérico suavizado por planuras de dimensão considerável, entre os 300 e 600 m de altitude (Brum da Silveira et al., 2010). Ainda assim, é uma sucessão de vales encaixados, curtos e perpendiculares à linha de costa. Esta mantém a sua morfologia, sobretudo, retilínea e de arribas impressionantes como a quási-vertical de 580 m do Cabo Girão, hoje reconhecido como Monumento Natural e Paisagem Protegida. As formas de acumulação costeira são raras, resultantes do desmonte das arribas e, por vezes, de movimentos de vertente mais dramáticos (IFCN, IP-RAM, 2020; Mata et al., 2013). Os cursos de água são de carácter torrencial e ao longo de quase todo o litoral sucedem-se depósitos de praia, sobretudo de cascalheiras roladas de granulometrias variáveis (Brum da Silveira et al., 2010).

O clima da ilha é, genericamente, temperado oceânico. A vertente norte exposta aos ventos alíseos de NE, frescos e húmidos, regista temperaturas médias mais baixas e totais de precipitação mais expressivos do que a vertente sul, abrigada pela crista montanhosa central (Quintal, 2007). Aqui, o clima tem características mais acentuadas de secura, de longos verões secos como o mediterrâneo; contudo, um regime de temperaturas mais regulares afastam-no dessa tipologia (Quintal, 2007; Ribeiro, 1985). Nas elevadas altitudes, as temperaturas médias mensais positivas são mais baixas e os máximos de precipitação atingem valores iguais ou superiores a 2400 mm. Neste ambiente, os nevoeiros de origem orográfica são frequentes, 235 $dias \cdot ano^{-1}$ no planalto do Paul da Serra e de 229 $dias \cdot ano^{-1}$ no Pico do Areeiro (Quintal, 2007; Prada, Sequeira, Nunes, Figueira, & Cruz, 2005).

O clima menos ameno e a agrestia do relevo desencorajam a fixação humana no norte da ilha e, por isso, a floresta e as áreas arborizadas dominam, exibindo os melhores exemplares das três comunidades da floresta indígena Laurissilva: barbuzano, til e vinhático (Capelo, Sequeira, Jardim, & Costa, 2004; IFCN, IP-RAM, 2020). As três árvores são de porte considerável e apresentam tons de verde-escuro. A Laurissilva ocupa cerca de 20,0% do total da superfície da Madeira e está protegida por legislação regional, nacional e internacional como Património Mundial da Unesco desde 1999 e Reserva Biogenética do Conselho da Europa desde 1992 (IFCN, IP-RAM, 2020). A sul, entre os territórios densamente povoados, sobrevivem matos termomediterrâneos, flora endémica das costas macaronésias e núcleos de Zambujal, todos protegidos como Sítios de Importância Comunitária e Zona Especial de Conservação.

A diversidade biológica da ilha é importante e é operacionalizada por um extenso Parque Natural (cerca de dois terços do território e a incluir áreas agrícolas e pequenos povoados), quatro reservas naturais e dezoito áreas com classificação da Rede Natura 2000. Além da riqueza das espécies vegetais, é relevante a avifauna (aves marinhas protegidas, terrestres, de rapinas e migratórias), vertebrados de interesse (por exemplo, a lagartixa), moluscos e artrópodes, todos a exibirem variados endemismos (IFCN, IP-RAM, 2020). Nenhuma espécie constitui risco para os humanos, permitindo total despreocupação aquando de maior proximidade com a natureza. A ilha é uma das 'afortunadas' da região biogeográfica da Macaronésia (Figura 1.2), juntamente com as restantes do seu arquipélago e as dos arquipélagos dos Açores, Canárias e Cabo Verde (Mata et al., 2015).

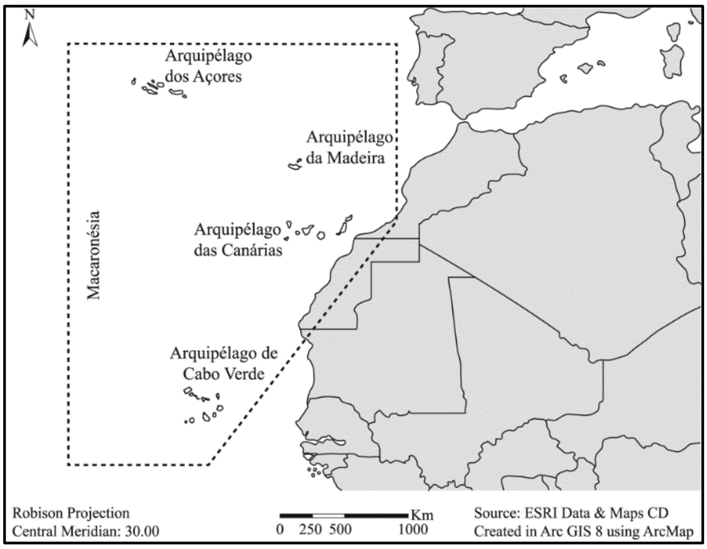

Figura 1.2 Região biogeográfica da Macaronésia: enclave continental do litoral noroeste africano e os arquipélagos da Madeira, Açores, Canárias e Cabo Verde.

O povoamento é disperso e ocorre ao longo da faixa costeira até à média altitude, seguindo o padrão iniciado com a colonização dos portugueses, no princípio do século XV. A distribuição geográfica da população residente, 248 769 habitantes, em 2018 (DREM, 2019), é desigual, com apenas 5,7% a residir no norte da ilha. A principal cidade e capital da Região Autónoma é o Funchal e o seu concelho concentra quase 104 000 habitantes. A população da ilha da Madeira é relativamente homogénea, i.e., não há nenhuma população aborígene que preceda ao seu povoamento pelos portugueses, no início do século XV, embora sejam evidentes traços de pessoas de origem subsariana (Brehm, Pereira, Kivisild, & Amorin, 2003).

A economia da Madeira é, sobretudo, serviços e tem no turismo e nas suas atividades gravitantes as principais fontes de rendimento. Dados de 2018 estimam a entrada de 1,6 milhões de visitantes na RAM (DREM, 2019). Um estudo efetuado, em 2012, aferiu que os atributos 'bom clima' e 'natureza' foram os mais destacados pelos turistas acerca da ilha, a par do seu gosto pessoal por destinos de natureza, seguido de praia/sol/mar e de montanha. Também assinalaram as levadas como o mais importante local de interesse turístico baseado na natureza (Freitas, 2012).

A partir de meados dos anos 80 do século passado, a Região passou de uma economia baseada na produção de subsistência (agricultura e pesca) para uma economia fortemente terciária, muito apoiada no Centro Internacional de Negócios ou Zona Franca da Madeira (Almeida & Correia, 2010), e no desenvolvimento de serviços ligados ao turismo. O rápido crescimento económico foi conseguido, sobretudo, através de fundos estruturais da União Europeia utilizados na construção de estradas, pontes, túneis e aeroporto, na perspetiva de atrair turistas e não limitar os serviços, e outras atividades, à cidade do Funchal. Em 1988, a Madeira era uma das regiões mais pobres da União Europeia (EU), com um produto interno bruto (PIB) *per capita* de apenas 40% da média comunitária a 12 (*European Commission: Regional Policy InfoRegio* 2011). Em 2016, este indicador fixou-se em 74,5 % da média da EU a 28 (DREM: Contas Regionais, 2017-2018Po).

As levadas são pequenos canais de transporte de água, quase sempre ladeados de um trilho de apoio à sua monitorização e manutenção. As suas origens remontam aos primeiros colonos e hoje são cerca de duzentas por toda a ilha, com a impressionante extensão de aproximadamente 1500 km, atravessando e comunicando territórios protegidos, localidades rurais e centros urbanos (Mata et al., 2015; Quintal, 2011; Fernandes, 2010). Delineadas, desde princípio, para a irrigação agrícola e abastecimento de água à população, o seu papel e dimensões foram ampliados com as primeiras centrais hidroelétricas, a partir de meados do século XX (Vieira, 2015). As levadas, juntamente com as veredas e os antigos caminhos pedestres, assumem uma importância cada vez maior na atratividade turística da Madeira, captando milhares de praticantes de caminhada na natureza e de *trail running*. Neste contexto, a DRTM, apoiada no IFCN, IP-RAM, recomenda 30 percursos pedestres (PR), todos rotas curtas, a mais extensa com 15,5 km. Esta lista é atualizada, permanentemente, em termos de recomendações, condicionamentos e encerramentos temporários (IFCN, IP-RAM, 2020). O presente estudo abrange 45 percursos pedestres que passam pela maioria dos recomendados, pela agregação de vários PR num único e por levadas, veredas e antigos caminhos que, por múltiplas razões, não são considerados pelas entidades públicas.

1.5. Objetivos e questões centrais do estudo

O turismo de natureza assume uma grande relevância no desenvolvimento de pequenos territórios insulares e a paisagem parece estar associada ao bem-estar mental, físico e social; contudo, estas associações não estão claramente estabelecidas e pouco é ainda conhecido acerca do 'andar' ou 'caminhar' nas levadas e trilhos da ilha da Madeira. Dado que os espaços verdes naturais parecem aumentar os níveis de atividade física e reduzir o risco de doença, é importante entender a paisagem como um recurso de saúde e conhecer as componentes que são fundamentais ao bem-estar e à qualidade de vida.

O objetivo geral do presente estudo foi explorar a relação entre o turismo de natureza, a paisagem e a saúde. Sobre este, emergem vários objetivos específicos:

1º Rever o conhecimento disponível sobre a associação do turismo de natureza ao bem-estar mental, físico e social do turista;

2º Descrever a paisagem visual das levadas e trilhos da ilha da Madeira, percecionada pelos turistas de natureza;

3º Identificar os sons e cheiros percecionados pelos turistas em caminhadas, nas levadas e trilhos;

4º Investigar a influência dos sons e cheiros na paisagem visual percecionada pelos turistas;

5º Avaliar o padrão dinâmico dos afetos principais ou emoções dos turistas durante a atividade de caminhada de um dia;

6º Explorar a associação de variáveis sociodemográficas dos turistas, de características demográficas dos guias de montanha, do envolvimento, das levadas e trilhos e da qualidade restaurativa percecionada, à mudança nos afetos principais ao longo de uma caminhada de um dia;

7º Investigar se a distância psicológica do dia-a-dia e o envolvimento positivo com a natureza, dois conceitos dos ambientes restaurativos, medeiam a relação entre a paisagem visual percecionada e a mudança nos afetos principais;

8º Descrever as levadas e os trilhos da ilha da Madeira e apresentar a intensidade da atividade física realizada pelos turistas, numa caminhada de um dia;

9º Determinar se a atividade física realizada pelos turistas, nas levadas e trilhos, alcança as diretrizes globais de atividade física;

10º Investigar se a atividade física realizada pelos turistas é suficientemente intensa para promover a melhoria da aptidão física;

11º Identificar os preditores da atividade física moderada-a-vigorosa realizada pelos turistas, nas levadas e trilhos da ilha da Madeira;

12º Investigar se a atividade física habitual medeia a relação entre a atividade realizada nas levadas e trilhos e a aptidão relacionada à saúde.

Os objetivos procuram responder a um conjunto de questões subjacentes a esta investigação: (1) Haverá uma base que nos permita entender a associação entre o turismo de natureza, a paisagem e a saúde? (2) Quais são as características fundamentais do turismo de natureza associadas aos benefícios de saúde e como variam em diferentes segmentos da população? (3) Os sons e os cheiros influenciam a paisagem visual percecionada? (4) Haverá mudanças nos afetos principais ao longo da caminhada? (5) Quais são os preditores da mudança nos afetos principais? (6) A atividade restaurativa é mediadora da relação causal ente a paisagem e a mudança nos afetos principais? (7) A atividade física realizada pelos turistas nas levadas e trilhos alcança as diretrizes globais da atividade? (8) A atividade física nas levadas e trilhos é suficiente para promover um efeito de treino? (9) Quais são os preditores da atividade física moderada-a-vigorosa realizada ao longo das levadas e trilhos? (10) A atividade física global é mediadora da relação entre a atividade física realizada nos trilhos e a aptidão física relacionada à saúde?

1.6. Estrutura da tese

A tese está estruturada de acordo com o modelo escandinavo e integra 8 capítulos. O capítulo 1 é a presente introdução. O capítulo 2 aborda a metodologia geral. O delineamento de pesquisa, a amostragem e participantes, as levadas e trilhos, as variáveis de estudo e instrumentos de avaliação, e os aspetos organizacionais são descritos para uma melhor compreensão dos capítulos seguintes.

Os capítulos 3-6 apresentam quatro artigos originais com uma estrutura similar, nomeadamente, o resumo, a introdução, os métodos, os resultados, a discussão, as conclusões e as referências bibliográficas. À exceção do primeiro artigo, os artigos dois, três e quatro estão em língua inglesa para posterior submissão a revistas da especialidade. O capítulo 3 é um artigo de revisão *scoping* no turismo de natureza e bem-estar mental, físico e social. O segundo artigo (capítulo 4), sob o título *Visual landscape, sounds and smells perceived by nature-based tourists,* aborda a paisagem percecionada pelos turistas numa caminhada, nas levadas e trilhos da ilha da Madeira. O terceiro artigo (capítulo 5), sob o título *Short-term change, prediction and mediation of emotions in nature-based tourism,* analisa os impactes da caminhada no bem-estar mental dos turistas. O quarto artigo (capítulo 6), sob o título *Nature-based tourism and physical health. The case of 'levadas' and trails of Madeira*, investiga a relação entre o turismo de natureza e a saúde física.

O capítulo 7 apresenta as conclusões, as limitações e as perspetivas futuras. A fechar a tese, o capítulo 8 com os anexos.

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Capítulo 2

Metodologia geral

2. Metodologia geral

2.1. Delineamento de pesquisa, amostragem e participantes

O projeto ‘LevMadeira’, acrónimo para ‘O impacto do turismo de natureza e da paisagem na saúde. O caso das levadas na Madeira’, combina dois delineamentos: um transversal e outro longitudinal. A recolha de informação, na maioria das variáveis, foi efetuada apenas uma vez (transversal). As emoções ou afetos principais e os sons e cheiros da paisagem foram recolhidos em dois ou três pontos no tempo (longitudinal). A amostragem foi aleatória e a amostra foi constituída por 1626 turistas, 974 mulheres e 652 homens, com idades compreendidas entre os 5 e os 84 anos. Os turistas visitaram a ilha da Madeira, entre julho de 2016 e outubro de 2017, com o propósito de andar/caminhar nas levadas e trilhos. A dimensão da amostra e as características sociodemográficas dos turistas são apresentadas no Quadro 2.1.

A média de idade dos turistas foi 50,7 (desvio padrão = 14,4) anos. O maior número de turistas integrou os intervalos etários 45-54 anos e 55-64 anos. Os turistas foram oriundos de 29 países e, maioritariamente, franceses, britânicos, alemães, espanhóis, belgas e suíços. Os restantes turistas (n = 73) foram oriundos de 23 países. Uma grande percentagem de turistas possuía formação superior, era casada ou vivia em união de facto e era profissionalmente ativa (Quadro 2.1).

Quadro 2.1 Caraterização sociodemográfica dos turistas.

Variável	Valor	(n = 1626)	%
Sexo	Feminino	974	59,9
	Masculino	652	40,1
Idade, anos	5–14	38	2,3
	15–24	39	2,4
	25–34	155	9,5
	35–44	252	15,5
	45–54	421	25,9
	55–64	439	27,0
	65–74	254	15,6
	75+	28	1,7
País/local de origem	França	1195	73,5
	Reino Unido	116	7,1
	Alemanha	107	6,6
	Espanha	58	3,6
	Bélgica	43	2,6
	Suíça	34	2,1
	Canadá	10	0,6
	Áustria	9	0,6
	Estados Unidos da América	9	0,6
	Polónia	6	0,4
	Portugal	6	0,4
	Eslovénia	5	0,3
	Lituânia	5	0,3
	Países Baixos	4	0,2
	Hong Kong	2	0,1
	Irlanda	2	0,1
	Luxemburgo	2	0,1
	Nova Zelândia	2	0,1
	Argentina	1	0,1
	Brasil	1	0,1
	Bulgária	1	0,1
	Colômbia	1	0,1
	Congo	1	0,1
	Chéquia	1	0,1
	Emirados Árabes Unidos	1	0,1
	Índia	1	0,1
	Itália	1	0,1
	Reunião	1	0,1
	Vietname	1	0,1
Habilitações literárias (n = 1604)	Superior	1188	74,1
	Secundário	359	22,4
	Básico	57	3,6
Estado civil (n = 1603)	Casado/união de facto	737	46,0
	Solteiro	552	34,4
	Separado/divorciado	247	15,4
	Viúvo	67	4,2
Situação profissional (n = 1590)	Trabalho remunerado	1069	67,2
	Reformado/pensionista	389	24,5
	Estudante	68	4,3
	Dona de casa	12	0,8
	Desempregado	11	0,7
	Outras	41	2,6

2.2. Levadas e trilhos

Os turistas foram avaliados em 45 levadas e trilhos da ilha da Madeira. A distribuição espacial das levadas e trilhos é apresentada na Figura 2.1. Os dados de georreferenciação foram obtidos via Polar V800 com GPS. Os Quadros 2.2 e 2.3 apresentam a distribuição dos turistas por área geográfica e levadas e trilhos.

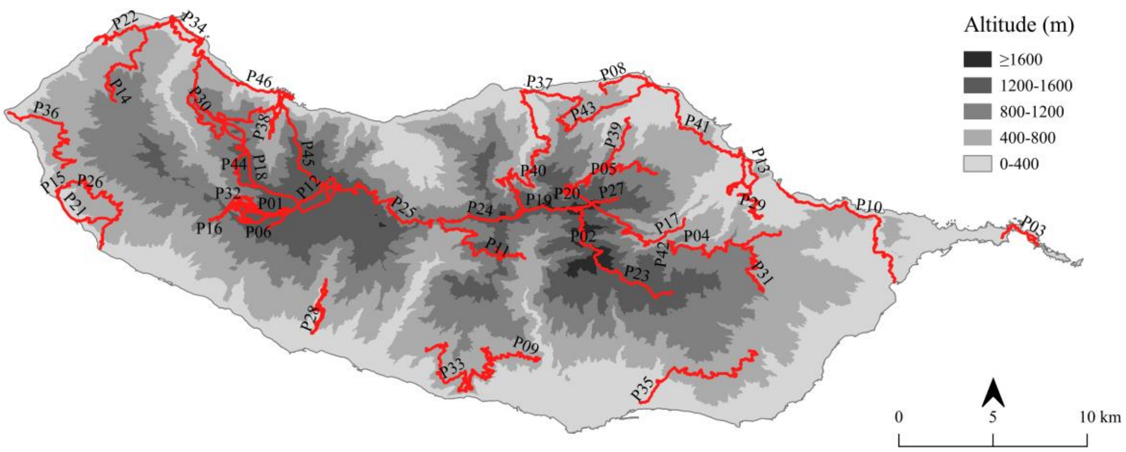

Figura 2.1 Localização das 45 levadas e trilhos na ilha da Madeira[†]. Fonte: Direção de Serviços de Informação Geográfica e Cadastro.

[†]P01, 25 Fontes (Rabaçal ou 'Garagem'); P02, Pico Ruivo (Pico Areeiro ou Achada do Teixeira); P03, Ponta de S. Lourenço (Cais do Sardinha); P04, Ribeiro Frio – Portela; P05, Caldeirão Verde (Queimadas ou Pico das Pedras); P06, Levada do Alecrim (Lagoa D. Beja); P07, Levada do Rei; P08, Arco de S. Jorge – Quinta do Furão; P09, Levada do Norte (Estreito de Cª de Lobos – Cabo Girão); P10, Larano (Porto da Cruz – Machico); P11, Pico Grande (Encumeada – Pico Grande – Curral das Freiras); P12, Estanquinhos – Levada do Pico da Urze – Levada do Alecrim; P13, S. Roque do Faial – Penha d'Águia – S. Roque do Faial ou Santana; P14, Levada do Moinho (Porto Moniz); P15, Levada Nova (Calheta) – Paul do Mar ou Jardim do Mar; P16, Risco – Lagos (Lagoas do Vento e D. Beja) – Paul da Serra; P17, Fajã da Nogueira – Caldeirão do Inferno – Caldeirão Verde – Queimadas; P18, Estanquinhos – Pico Ruivo do Paul – Levada dos Cedros – Ribeira da Janela; P19, Encumeada – Pico Ruivo – Achada do Teixeira; P20, Ilha – Caldeirão Verde – Caldeirão do Inferno – Queimadas; P21, Jardim do Mar – Prazeres – Paul do Mar (caminhos reais); P22, Achadas da Cruz – Pombais – Pico – Porto Moniz; P23, Achada do Teixeira – Pico Areeiro – Poiso; P24, Boaventura – Encumeada (Picos); P25, Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos ou Feiteiras; P26, Maloeira – Prazeres – Paul do Mar; P27, Achada do Teixeira – Pico Ruivo – Achada do Teixeira; P28, Levada Nova – Levada do Moinho (Ponta do Sol); P29, Referta – Terra Baptista; P30, Levada dos Cedros; P31, Levada da Serra do Faial (Santo da Serra – Portela); P32, Levada Velha – 25 Fontes – Levada do Alecrim – Lagoa D. Beja – Rabaçal; P33, Levada do Norte (Campanário – Quinta Grande); P34, Seixal (Cais) – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela; P35, Levada da Serra do Faial (Vale Paraíso) – Choupana – Funchal; P36, Levada Nova da Calheta (Prazeres) – Farol da Ponta do Pargo; P37, Boaventura – S. Jorge; P38, Seixal – Chão da Ribeira – Seixal; P39, Pico das Pedras – Caldeirão Verde – Ilha; P40, Levada dos Tornos (Boaventura) – Pousada da Boaventura; P41, Santana – Faial – S. Roque do Faial; P42, Balcões; P43, Arco de S. Jorge – S. Jorge – Praia de S. Jorge; P44, Estanquinhos – Paul da Serra – Seixal; P45, Encumeada – Estanquinhos – Paul da Serra – Chão da Ribeira – Seixal; P46, Seixal – Ribeira Funda – Ribeira da Janela – Lamaceiros – Porto Moniz.

A vertente Norte da ilha incluiu o maior número de levadas e trilhos, seguida do Maciço Montanhoso e vertente Sul. A junção das vertentes Sul e Norte e a junção do Maciço Montanhoso à vertente Norte, apresentaram um número mais reduzido de levadas e trilhos (Quadro 2.2). As seis levadas e trilhos em que foram avaliados mais turistas foram: (1) Pico Ruivo, (2) Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos ou Feiteiras, (3) Jardim do Mar – Prazeres – Paul do Mar, (4) 25 Fontes, (5) Levada do Moinho e (6) São Roque do Faial – Penha d'Águia – São Roque do Faial (Quadro 2.3).

Quadro 2.2 Distribuição dos turistas por área geográfica e levadas e trilhos.

Área geográfica†	Levadas e trilhos		Turistas	
	n	%	n	%
Vertente Sul				
P03, P09, P15, P21, P26, P28, P33, P35, P36	9	20,0	325	20,0
Maciço Montanhoso				
P01, P02, P04, P06, P11, P12, P16, P19, P23, P25, P27, P31, P32, P42	14	31,1	609	37,5
Vertente Norte				
P05, P08, P13, P14, P17, P20, P22, P29, P30, P34, P37, P38, P39, P40, P41, P43, P46	17	37,8	577	35,5
Vertentes Sul e Norte				
P10	1	2,2	75	2,5
Maciço Montanhoso e vertente Norte				
P18, P24, P44, P45	4	8,9	40	4,6

†P, percurso. Vertente Sul: P03, Ponta de S. Lourenço (Cais do Sardinha); P09, Levada do Norte (Estreito de Cª de Lobos – Cabo Girão); P15, Levada Nova (Calheta) – Paul do Mar ou Jardim do Mar; P21, Jardim do Mar – Prazeres – Paul do Mar (caminhos reais); P26, Maloeira – Prazeres – Paul do Mar; P28, Levada Nova – Levada do Moinho (Ponta do Sol); P33, Levada do Norte (Campanário – Quinta Grande); P35, Levada da Serra do Faial (Vale Paraíso) – Choupana – Funchal; P36, Levada Nova da Calheta (Prazeres) – Farol da Ponta do Pargo.

Maciço Montanhoso: P01, 25 Fontes (Rabaçal ou 'Garagem'); P02, Pico Ruivo (Pico Areeiro ou Achada do Teixeira); P04, Ribeiro Frio – Portela; P06, Levada do Alecrim (Lagoa D. Beja); P11, Pico Grande (Encumeada – Pico Grande – Curral das Freiras); P12, Estanquinhos – Levada do Pico da Urze – Levada do Alecrim; P16, Risco – Lagos (Lagoas do Vento e D. Beja) – Paul da Serra; P19, Encumeada – Pico Ruivo – Achada do Teixeira; P23, Achada do Teixeira – Pico Areeiro – Poiso; P25, Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos ou Feiteiras; P27, Achada do Teixeira – Pico Ruivo – Achada do Teixeira; P31, Levada da Serra do Faial (Santo da Serra – Portela); P32, Levada Velha – 25 Fontes – Levada do Alecrim – Lagoa D. Beja – Rabaçal; P42, Balcões.

Vertente Norte: P05, Caldeirão Verde (Queimadas ou Pico das Pedras); P08, Arco de S. Jorge – Quinta do Furão; P13, S. Roque do Faial – Penha d'Águia – S. Roque do Faial ou Santana; P14, Levada do Moinho (Porto Moniz); P17, Fajã da Nogueira – Caldeirão do Inferno – Caldeirão Verde – Queimadas; P20, Ilha – Caldeirão Verde – Caldeirão do Inferno – Queimadas; P22, Achadas da Cruz – Pombais – Pico – Porto Moniz; P29, Referta – Terra Baptista; P30, Levada dos Cedros; P34, Seixal (Cais) – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela; P37, Boaventura – S. Jorge; P38, Seixal – Chão da Ribeira – Seixal; P39, Pico das Pedras – Caldeirão Verde – Ilha; P40, Levada dos Tornos (Boaventura) – Pousada da Boaventura; P41, Santana – Faial – S. Roque do Faial; P43, Arco de S. Jorge – S. Jorge – Praia de S. Jorge; P46, Seixal – Ribeira Funda – Ribeira da Janela – Lamaceiros –Porto Moniz.

Vertentes Sul e Norte: P10, Larano (Porto da Cruz – Machico).

Maciço Montanhoso e vertente Norte: P18, Estanquinhos – Pico Ruivo do Paul – Levada dos Cedros – Ribeira da Janela; P24, Boaventura – Encumeada (Picos); P44, Estanquinhos – Paul da Serra – Seixal; P45, Encumeada – Estanquinhos – Paul da Serra – Chão da Ribeira – Seixal.

Quadro 2.3 Distribuição dos turistas por levada e trilho.

Código[†]	Levadas e trilhos	Turistas	
		n	%
P01	25 Fontes (Rabaçal ou ‘Garagem’)	123	7,6
P02	Pico Ruivo (Pico Areeiro ou Achada do Teixeira)	160	9,8
P03	Ponta de S. Lourenço (Cais do Sardinha)	60	3,7
P04	Ribeiro Frio – Portela	34	2,1
P05	Caldeirão Verde (Queimadas ou Pico das Pedras)	59	3,6
P06	Levada do Alecrim (Lagoa D. Beja)	26	1,6
P07	Levada do Rei[††]	-	-
P08	Arco de S. Jorge – Quinta do Furão	88	5,4
P09	Levada do Norte (Estreito de Cª de Lobos – Cabo Girão)	33	2,0
P10	Larano (Porto da Cruz – Machico)	75	4,6
P11	Pico Grande (Encumeada – Pico Grande – Curral das Freiras)	13	0,8
P12	Estanquinhos – Levada do Pico da Urze – Levada do Alecrim	10	0,6
P13	S. Roque do Faial – Penha d’Águia – S. Roque do Faial ou Santana	105	6,5
P14	Levada do Moinho (Porto Moniz)	119	7,3
P15	Levada Nova (Calheta) – Paul do Mar ou Jardim do Mar	38	2,3
P16	Risco – Lagos (Lagoas do Vento e D. Beja) – Paul da Serra	10	0,6
P17	Fajã da Nogueira – Caldeirão do Inferno – Caldeirão Verde – Queimadas	17	1,0
P18	Estanquinhos – Pico Ruivo do Paul – Levada dos Cedros – Ribeira da Janela	14	0,9
P19	Encumeada – Pico Ruivo – Achada do Teixeira	36	2,2
P20	Ilha – Caldeirão Verde – Caldeirão do Inferno – Queimadas	10	0,6
P21	Jardim do Mar – Prazeres – Paul do Mar (caminhos reais)	136	8,4
P22	Achadas da Cruz – Pombais – Pico – Porto Moniz	14	0,9
P23	Achada do Teixeira – Pico Areeiro – Poiso	11	0,7
P24	Boaventura – Encumeada (Picos)	8	0,5
P25	Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos ou Feiteiras	143	8,8
P26	Maloeira – Prazeres – Paul do Mar	17	1,0
P27	Achada do Teixeira – Pico Ruivo – Achada do Teixeira	25	1,5
P28	Levada Nova – Levada do Moinho (Ponta do Sol)	11	0,7
P29	Referta – Terra Baptista	9	0,6
P30	Levada dos Cedros	2	0,1
P31	Levada da Serra do Faial (Santo da Serra – Portela)	3	0,2
P32	Levada Velha – 25 Fontes – Levada do Alecrim – Lagoa D. Beja – Rabaçal	13	0,8
P33	Levada do Norte (Campanário – Quinta Grande)	14	0,9
P34	Seixal (Cais) – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela	53	3,3
P35	Levada da Serra do Faial (Vale Paraíso) – Choupana – Funchal	7	0,4
P36	Levada Nova da Calheta (Prazeres) – Farol da Ponta do Pargo	9	0,6
P37	Boaventura – S. Jorge	6	0,4
P38	Seixal – Chão da Ribeira – Seixal	5	0,3
P39	Pico das Pedras – Caldeirão Verde – Ilha	43	2,6
P40	Levada dos Tornos (Boaventura) – Pousada da Boaventura	25	1,5
P41	Santana – Faial – S. Roque do Faial	10	0,6
P42	Balcões	2	0,1
P43	Arco de S. Jorge – S. Jorge – Praia de S. Jorge	8	0,5
P44	Estanquinhos – Paul da Serra – Seixal	6	0,4
P45	Encumeada – Estanquinhos – Paul da Serra – Chão da Ribeira – Seixal	12	0,7
P46	Seixal – Ribeira Funda – Ribeira da Janela – Lamaceiros – Porto Moniz	4	0,2
Total		1626	100

[†]P, percurso. [††]Anulado por desistência dos participantes.

2.3. Variáveis de estudo e instrumentos de avaliação

As características sociodemográficas, o comportamento/estilo de vida, o bem-estar físico, o bem-estar mental, o bem-estar social, o turismo de natureza, os afetos principais, as características das levadas e trilhos, a paisagem visual, a paisagem sonora, a paisagem olfativa e a atividade turística foram as variáveis investigadas no estudo LevMadeira.

O questionário foi estruturado em quatro partes. A primeira, aplicada no local de acomodação, incluiu a descrição do projeto de investigação, o consentimento informado, as fichas de registo do bem-estar físico e os afetos principais (Anexo 1.1). A segunda, aplicada no meio das levadas e trilhos, incluiu o bem-estar mental, mais especificamente, a qualidade restaurativa percecionada, a paisagem sonora e a paisagem olfativa (Anexo 1.2). A terceira, aplicada no fim das levadas e trilhos, incluiu a perceção da paisagem visual, o bem-estar social e a atividade turística (Anexo 1.3). A última, aplicada no regresso ao local de acomodação, incluiu as características sociodemográficas, o comportamento/estilo de vida, o bem-estar físico e o turismo de natureza (Anexo 1.4).

Os afetos principais, a paisagem sonora e a paisagem olfativa integraram a primeira e/ou a segunda e terceira partes do questionário. As variáveis investigadas na presente tese e os instrumentos/protocolos de avaliação são descritos nos itens seguintes.

2.3.1. Características sociodemográficas e comportamento/estilo de vida

As variáveis sociodemográficas incluem a idade, o sexo, o país de origem, o local de residência, as habilitações literárias, a profissão, a situação profissional e o estado civil (Anexo 1.4, item 1). As variáveis foram retiradas dos questionários individual e de família dos Censos 2011 [Instituto Nacional de Estatística (INE), 2009-2014]. O comportamento/estilo de vida inclui questões relativas à visão, à audição, ao cheiro, à memória e à autonomia na deslocação) (Anexo 1.4, item 2). As questões foram extraídas da literatura (Thompson, 2011; Annersted et al., 2010; Korpela, Ylen, Tyrvainen, & Silvennoinen, 2010; Bird, 2004; Humpel, Owen, Iverson, Leslie, & Bauman, 2004).

2.3.2. Paisagem visual

A perceção da paisagem visual foi aferida a partir dos aspetos físicos, biológicos, sensoriais e estéticos. O tipo de paisagem e a sua luminosidade foram avaliados através de escalas de diferencial semântico contínuo, adaptadas de Kaplan (1985). A cor ou cores dominantes foram identificadas a partir de uma escala tipo arco-íris derivada de Küller, Mikellides e Janssens (2009). Uma lista de 20 elementos da paisagem permitiu ao turista assinalar os elementos que foram dominantes na sua perceção visual. Os elementos perturbadores da paisagem (ex., congestionamento dos trilhos) e os riscos (ex., bermas desprotegidas) foram avaliados numa escala ordinal com 5 categorias (Anexo 1.3, item 13).

2.3.3. Paisagem sonora

As fontes acústicas ou sonoras foram adaptadas do *Swedish Soundscape-Quality Protocol* (Axelsson, Nilsson, Hellström, & Lundén, 2014; Nilsson & Berglund, 2006). Os sons foram divididos em 5 tipos: (1) ruído de tráfego (ex., carros), (2) outros ruídos (ex., construção civil), (3) sons humanos (ex., conversa entre pessoas), (4) sons naturais (ex., canto dos pássaros) e sons de água (ex., cursos de água). O som global do envolvimento e o envolvimento visual foram, também, alvo de avaliação. O formato de resposta foi uma escala ordinal com 5 categorias (Anexo 1.2, item 7; Anexo 1.3, item 11).

2.3.4. Paisagem olfativa

Os tipos de cheiros (fragância e odores) foram extraídos de Henshaw (2014) e Porteous (1985) e dos cheiros identificados em visitas anteriores às levadas e trilhos, no pré-teste e nos estudos piloto. Os tipos de cheiros foram agrupados em cinco categorias: (1) resíduos (ex., lixo), (2) pessoas (ex., odor corporal), (3) animais (ex., fezes), (4) natureza (ex., ar fresco) e (5) outros (ex., gases de escape). O turista foi questionado sobre a perceção do cheiro global do envolvimento e a forma como experimentou o cheiro do envolvimento. Os tipos de cheiros foram respondidos numa escala ordinal com cinco categorias, sendo a 1, não cheiro nada e a 5, domina completamente. Na última questão, os turistas formulavam a sua resposta numa escala ordinal com 5 categorias (1, concordo completamente a 5, discordo completamente) (Anexo 1.2, item 8; Anexo 1.3, item 12).

2.3.5. Afetos principais

Os afetos principais foram avaliados através da *Swedish Core Affect Scale* (SCAS) (Västfjäll & Gärling, 2007; Västfjäll, Friman, Gärling, & Kleiner, 2002). A SCAS inclui 12 pares de adjetivos bipolares que exploram quatro dimensões dos afetos principais: (1) *valence*, (2) *activation*, (3) *pleasant activation–unpleasant deactivation* e (4) *unpleasant activation-pleasant deactivation*. Os pares de adjetivos que definem a *valence* são: 'descontente-contente', 'triste-alegre' e 'deprimido-feliz'; aqueles que definem a *activation* são: 'sonolento-vígil', 'apático-enérgico' e 'passivo-ativo'; aqueles que definem a *pleasant activation-unpleasant deactivation* são: 'desinteressado-interessado', 'indiferente-envolvido' e 'pessimista-otimista'; e aqueles que definem a *unpleasant activation–pleasant deactivation* são: 'tenso-sereno', 'ansioso-calmo' e 'nervoso-relaxado' (Anexo 1.1, item 5; Anexo 1.2, item 9; Anexo 1.3, item 10).

Os turistas foram instruídos para descrever como se sentiam, naquele preciso momento. Os adjetivos bipolares foram representados numa escala horizontal. O valor mais baixo (1, à esquerda) reflete os afetos não desejados e o valor mais elevado (9, à direita) reflete os afetos desejáveis. O valor 5 é um valor neutro. A fiabilidade da SCAS no estudo LevMadeira foi elevada e similar à fiabilidade reportada por Västfjäll et al. (2002). O alfa de Cronbach estava compreendido entre 0,86 a 0,91 para a *valence*; entre 0,80 a 0,88 para a *activation*; entre 0,71 to 0,76 para a *pleasant activation-unpleasant deactivation*; e entre 0,83 to 0,86 para a *unpleasant activation-pleasant deactivation*.

2.3.6. Qualidade restaurativa percecionada

A *Perceived Restorativeness Scale* (PRS) (Hartig, Korpela, Evans, & Gärling, 1997) foi usada para capturar a experiência restaurativa dos turistas. A PRS apresenta as subescalas *being away*, *fascination*, *coherence* (*extent*) e *compatibility*. As subescalas *coherence* e *compatibility* não foram incluídas no estudo LevMadeira, à semelhança dos estudos desenvolvidos por Dahlkvist et al. (2016) e Lindal e Hartig (2013), que consideraram o *being away* e a *fascination* as características centrais da experiência restaurativa.

A subescala *being away* consiste em 5 itens (ex., 'este lugar é um refúgio de distrações indesejadas'; 'este é um lugar para ficar longe das coisas que normalmente exigem a minha atenção'). A subescala *fascination* consiste, também, em 5 itens (ex., 'este lugar desperta a minha curiosidade'; 'há muito a explorar e a descobrir aqui'). A totalidade dos itens foi codificada numa escala ordinal de 11 pontos, com início no zero (de modo nenhum ou nunca) e término no 10 (completamente) (Anexo 1.2, item 6).

A consistência interna nas subescalas *being away* e *fascination* foi 0,59 e 0,92, respetivamente. Para a subescala *being away*, o coeficiente de fiabilidade não alcançou o valor convencional de 0,70 (Nunnally, 1978). Contudo, o alfa de Cronbach aumentou para 0,72 se o item 'este lugar é um refúgio de distrações indesejadas' fosse eliminado da análise. Para verificar se as análises realizadas com a versão de 4 itens produziam correlações similares às obtidas com a versão de 5 itens, calculamos as correlações entre o *being away* e as subescalas SCAS, usando a versão de 4 itens. As correlações obtidas com a versão 4 itens diferiram muito pouco das correlações obtidas com a versão de 5 itens. Assim, decidimos usar a versão 5 itens, em conformidade com estudos anteriores que aferiram a validade da escala (ex., Dahlkvist et al., 2016; Dzhambov, Markevych, & Lercher, 2018).

2.3.7. Atividade física e características das levadas e trilhos

A atividade física realizada pelos turistas nas levadas e trilhos foi avaliada, de forma objetiva, através de dois monitores: o acelerómetro ActiGraph, modelo GT3X (ActiGraph, LLC. Pensacola, FL, USA) e o Polar V800 com GPS integrado (Polar Electro OY, Kempele, Finland). O monitor de atividade Polar V800 estava emparelhado a dois acessórios: o sensor de frequência cardíaca (H7 Heart Rate Sensor) e o sensor de passada (Polar Stride Sensor *Bluetooth*® Smart) (Polar Electro OY, Kempele, Finland).

Os três equipamentos eletrónicos permitiram, ainda, recolher informação relativa à cadência (número de vezes por minuto que o pé que tinha o sensor de passada tocava o solo), ao comprimento da passada (distância entre os pontos de contacto dos pés direito e esquerdo, no solo), aos desníveis acumulados positivo (subida) e negativo (descida), à distância, à duração, à frequência cardíaca e zonas, ao número de passos e à velocidade.

2.3.7.1. Acelerómetro ActiGraph, modelo GT3X

O acelerómetro ActiGraph, modelo GT3X (3,8 cm × 3,7 cm × 1,8 cm; 27,0 g) mede e regista a aceleração corporal produzida nos eixos sagital, longitudinal e transversal. A aceleração é amostrada através de um conversor analógico digital, com uma taxa definida pelo utilizador e que pode variar entre os 30 Hz e os 100 Hz. Os registos de aceleração são armazenados em unidades de aceleração da gravidade (G's), de forma não processada e não filtrada (ActiGraph, 2013). Os dados são gravados diretamente numa memória não-volátil. Os registos brutos são processados e filtrados no *software* ActLife 6 (ActiGraph, Pensacola, FL, USA) e convertidos em 'counts' de atividade ou 'unidade de movimento'.

A quantificação da atividade física realizada pelo turista nas levadas e trilhos envolveu quatro etapas: a definição dos parâmetros, a introdução dos dados individuais, a colocação dos acelerómetros e o *download* ou transferência dos dados. Na primeira, definimos a taxa ou frequência de amostragem em 80 Hz, a data de início da recolha dos dados, a 'epoch' (intervalo de registo) em 60s, os 3 eixos e o filtro 'normal'. Na segunda, introduzimos o nome/código, o sexo, a altura, o peso e a data de nascimento do turista. Na terceira, colocamos o acelerómetro sobre a crista ilíaca ântero-superior direita do turista, no prolongamento da linha midaxilar, com um cinto elástico ajustável. Na última, transferimos os dados do acelerómetro para o Excel, através de um cabo de interface universal. Na construção do ficheiro definimos a 'epoch length' de 1s, os três eixos e selecionamos os pontos de corte propostos por Troiano et al. (2007) para classificar a intensidade de atividade física em sedentária (0 – 99 counts·min^{-1}), leve (100 – 2019 counts·min^{-1}), moderada (2020 – 5998 counts·min^{-1}) e vigorosa (≥ 5999 counts·min^{-1}).

2.3.7.2. Polar V800 e equipamentos associados

A primeira tarefa associada ao uso do Polar V800 consistiu em registá-lo no serviço *web Polar Flow*. De seguida, selecionamos o perfil de desporto (pedestrianismo) e destacamos os parâmetros a mostrar no visor (altitude, distância, frequência cardíaca e horas). O passo seguinte consistiu em instalar o *software* Polar Flowsync e proceder à sincronização do H7 *Heart Rate Sensor* e do Polar *Stride Sensor Bluetooth® Smart*, ao Polar V800. Por fim, verificamos, no *web* Polar Flow, se os equipamentos estavam conectados.

O monitor de atividade Polar V800 com GPS integrado (42 mm × 40 mm × 12 mm; 80,6 g) foi colocado no punho esquerdo do turista.

O 'H7 Heart Rate Sensor' (63 mm × 37 mm × 11 mm; 26,0 g) foi acoplado a uma banda elástica 'Polar Soft Strap M-XXL' e colocada à volta do peito, em conformidade com as instruções do manual (Polar, 2016). Mais especificamente: (1) o elétrodo da banda elástica foi humedecido com água, (2) a banda elástica foi ajustada ao peito, logo abaixo do grande peitoral, em contacto com a pele, firme, mas com uma tensão confortável, e (3) o 'H7 Heart Rate Sensor' foi colocado ao centro do peito e na posição horizontal.

O 'Polar Stride Sensor *Bluetooth®* Smart' (56 mm × 40 mm × 12 mm; 24,0 g) foi aplicado ao sapato, do pé direito do turista, através de um 'garfo' Polar. A aplicação do sensor de passada cumpriu três etapas. A primeira, na introdução do 'garfo' entre os atacadores e a lingueta do sapato. A segunda, no encaixe do sensor no 'garfo' e fixação à aba. A última, na fixação do 'garfo' e do sensor ao sapato através de uma braçadeira plástica. O sensor ficava alinhado com o sapato e bem fixo de forma a evitar oscilações.

O Polar V800 e os sensores de frequência cardíaca e de passada foram colocados, no turista, no local de acomodação e ativados e desligados no início e final das levadas e trilhos, respetivamente. O *download* da informação foi efetuado via *software* FlowSync em ficheiros gpx (formato de intercâmbio GPS) e csv (valores separados por vírgulas).

2.3.8. Aptidão física relacionada à saúde

2.3.8.1. Antropometria e composição corporal

A altura, o peso corporal e as pregas de adiposidade subcutânea foram medidos de acordo com o protocolo do 'American College of Sports Medicine (ACSM)' (2018). A altura foi medida com um estadiómetro portátil (Siber-Hegner, GPM) e arredondada ao milímetro. O peso corporal foi medido com uma balança portátil com aproximação de valores até 100 g (Seca Optima 760). As pregas de adiposidade abdominal, peitoral, subescapular, suprailíaca e tricipital foram medidas com um adipómetro (Holtain, LTD).

Na estimação da densidade corporal utilizamos três pregas de adiposidade subcutânea: peitoral, tricipital e subescapular para os homens e tricipital, suprailíaca e abdominal para as mulheres. Na conversão da densidade em percentagem de gordura utilizamos as fórmulas específicas por idade e sexo fornecidas pelo ACSM (2018, p. 78).

2.3.8.2. Aptidão física e aptidão funcional

O 'YMCA 3-minute step test' (Golding, 2000) foi utilizado na avaliação da aptidão física dos participantes com idades compreendidas entre os 18 e os 59 anos. O teste '6-minute walk' da 'Senior Fitness Test' (Rikli & Jones, 1999) foi utilizado na avaliação da aptidão funcional do adulto idoso (60+ anos).

2.4. Aspetos organizativos gerais

O projeto de investigação 'O impacto do turismo de natureza e da paisagem na saúde. O caso das levadas na Madeira' foi aprovado pelo Conselho Científico da Faculdade de Ciências Sociais e Humanas – FCSH/NOVA a 27 de novembro de 2014 e teve a participação da Faculdade de Ciências Sociais da Universidade da Madeira, da Faculdade de Desporto da Universidade do Porto e do Governo da Região Autónoma da Madeira, via Secretaria Regional de Educação, Ciência e Tecnologia.

2.4.1. Questionários e equipamentos eletrónicos

Os questionários e os equipamentos eletrónicos foram aperfeiçoados e introduzidos, no terreno, através de um pré-teste e dois estudos piloto.

O pré-teste realizou-se nos dias 17 e 18 de maio de 2014, em dois percursos recomendados pelo 'Turismo da Madeira': a vereda da Ponta de S. Lourenço e a Levada das 25 Fontes. O questionário foi aplicado a oito turistas e a um elemento da equipa de investigação, residente em Portugal Continental, e em visita à ilha da Madeira (n = 9). Nesta primeira aplicação, detetamos dificuldades dos participantes na interpretação de algumas questões e identificamos fragilidades na estrutura do questionário. Face a estas lacunas, substituímos alguns termos, alteramos a ordem das questões e introduzimos a qualidade restaurativa, o estado de saúde, a qualidade do som da paisagem, a experiência do turista e o risco e grau de dificuldade das levadas e trilhos. Optamos, também, por avaliar os afetos principais no meio e fim das levadas e trilhos e equipar os participantes com monitores de atividade física.

O primeiro estudo piloto, com aplicação teste-reteste, realizou-se a 8 e a 15 de novembro de 2014, na Vereda da Ponta de S. Lourenço. A amostra foi constituída por 18 participantes, entre familiares, amigos e colegas de profissão. Os participantes foram equipados com um acelerómetro ActiGraph, modelo GT3X (ActiGraph, LLC. Pensacola, FL, USA) e um pedómetro, modelo HJ720 (Omron Electronics Ibéria, S.A., Portugal). As alterações efetuadas no pré-teste tornaram o questionário mais acessível e robusto. No entanto, decidimos incluir um novo item relativo à qualidade do cheiro da paisagem e munir os participantes de sensores de frequência cardíaca e monitores de atividade, com GPS integrado, de forma a registar a posição do turista e a intensidade e 'timing' da atividade física. O questionário foi dividido em quatro partes a ser aplicadas no local de acomodação e no início, meio e fim das levadas e trilhos. Os afetos principais foram avaliados no início, meio e fim das levadas e trilhos, e os sons e cheiros, no meio e fim.

O segundo estudo piloto ocorreu entre 25 de junho de 2016 e 9 de julho de 2016, também, na Vereda da Ponta de S. Lourenço. O distanciamento, de cerca de dois anos e meio, entre os dois estudos piloto, deveu-se ao facto de aguardarmos por uma fonte de financiamento e pelo meu destacamento para o projeto, via Secretaria Regional de Educação, Ciência e Tecnologia do Governo Regional da Madeira. O estudo piloto foi desenvolvido em dois grupos distintos. O primeiro grupo, constituído por familiares, amigos e colegas de profissão (n = 16) foi avaliado nos dias 25 de junho (teste) e 1 de julho (reteste) de 2016. O segundo grupo, constituído por elementos do 'Clube Pés Livres', uma associação de montanhismo da Madeira (n = 21), foi avaliado nos dias 1 (teste) e 9 de julho (reteste) de 2016. Os questionários incluíam todas as alterações previamente sugeridas e os participantes estavam equipados com monitores de atividade física, sensores de frequência cardíaca e sensores de passada. Neste último momento, emergiu, ainda, a necessidade de incluir uma questão relativa ao rastreio da visão, audição, cognição e deslocação autónoma, no questionário.

Alcançada a versão final, em língua portuguesa, o questionário foi traduzido para a língua francesa, alemã e espanhola, por docentes de língua nativa da Faculdade de Artes e Humanidades da Universidade da Madeira. Numa segunda etapa, outros docentes da Faculdade de Artes e Humanidades da Universidade da Madeira procederam à tradução dos questionários para a língua portuguesa, de forma a validar as versões. As escalas em inglês foram mantidas no seu texto original.

2.4.2. Procedimentos utilizados na recolha de dados

Uma equipa composta por 10 investigadores experientes, com formação em Geografia, Ciências do Desporto e Enfermagem, procedeu à recolha de dados, no período compreendido entre 14 de julho de 2016 e 12 de outubro de 2017.

A amostra incidiu sobre 'grupos fechados', i.e., turistas que se deslocam à ilha da Madeira, em grupo, para andar nas levadas e trilhos, por um período de 8-10 dias, e que são conduzidos por um guia de montanha. Na aproximação aos turistas, começamos por convidar as agências de viagens e empresas de animação turística. Dos 26 convites, 7 (26,9%) recusaram participar no estudo 'LevMadeira'. Entre as razões para a recusa, realce para o 'distúrbio' da atividade causado pela aplicação dos questionários, os horários apertados dos condutores e a não autorização na origem, sobretudo de operadores turísticos sediados na Alemanha, Áustria, Holanda e Reino Unido. Num segundo passo, um elemento da equipa de investigação contactou os guias de montanha (n = 53) das agências de viagens e empresas de animação turística que colaboraram no estudo. Após apresentar o estudo e obtida a autorização e vontade do guia de montanha em colaborar com a presente investigação, foi definida uma reunião com os turistas, no local de acomodação. Na reunião, efetuamos uma breve descrição do projeto, incluindo as instituições participantes, os objetivos, a amostra, as variáveis de estudo, os procedimentos de avaliação e o relatório individual da aptidão física relacionada com a saúde. Os turistas foram convidados a participar numa base voluntária e poderiam abandonar o estudo a qualquer momento. Uma vez definido o dia de avaliação, a equipa de investigação/campo chegava ao local de acomodação antes do pequeno-almoço, geralmente entre as 8h00 e as 8h30. Os turistas começavam por assinar o consentimento informado e preenchiam o questionário relativo aos afetos principais (T1). Os turistas eram, posteriormente, equipados com os monitores de atividade física e sensores de frequência cardíaca.

Cada turista participou apenas uma vez e num único dia, no estudo. A avaliação foi conduzida em 45 levadas e trilhos da ilha da Madeira. Dependendo do tamanho do grupo, um ou mais membros da equipa de investigação/campo deslocava(m)-se ao início das levadas e trilhos para 'ligar' os equipamentos eletrónicos. Na totalidade das avaliações (n = 218), um membro do estudo 'LevMadeira' acompanhou os turistas e os guias de montanha. Os objetivos eram vários: (1) resolver os problemas que pudessem surgir com os dispositivos eletrónicos, (2) levar e distribuir os questionários no meio e fim das levadas e trilhos, (3) retirar alguma dúvida no preenchimento dos questionários e (4) 'desligar' os dispositivos eletrónicos, no final das levadas e trilhos. O questionário no meio das levadas e trilhos, geralmente aplicado num momento de descanso ou o 'alvo' da caminhada, incluía questões relativas à qualidade restaurativa percecionada, à qualidade dos sons e cheiros da paisagem e aos afetos principais. No final das levadas e trilhos, os turistas preenchiam um questionário com itens relativos aos afetos principais (T3), à qualidade dos sons e cheiros da paisagem (T2), à perceção da paisagem, ao bem-estar social e à atividade turística.

Na chegada ao local de acomodação, o turista preencheu o questionário relativo às características sociodemográficas, comportamento/estilo de vida, estado de saúde, atividade física habitual e turismo de natureza. Os participantes foram, ainda, alvo de uma avaliação morfológica e funcional e foi-lhes entregue um relatório de aptidão física relacionado à saúde. No final de cada avaliação, a equipa de investigação/campo promoveu um pequeno convívio com os turistas e guias de montanha, no qual foi oferecido um 'Madeira de Honra', i.e., um cálice de vinho Madeira e bolo de mel da Região. Os dados pessoais relativos à atividade física e à frequência cardíaca, recolhidos durante a caminhada nas levadas e trilhos, foram posteriormente enviados aos participantes por correio eletrónico.

A avaliação dos turistas foi efetuada aos dias úteis da semana e ao sábado, entre as 8h00 e as 20h00. O mínimo de turistas e guias de montanha avaliados, por grupo, foi de 1 e o máximo de 16 (média = 7,53). O número de turistas avaliados é representado graficamente na Figura 2.2.

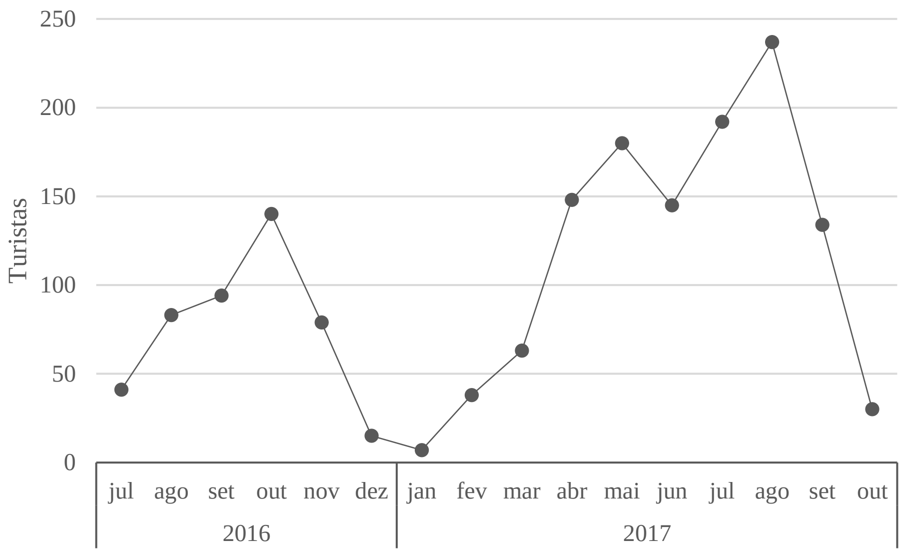

Figura 2.2 Turistas avaliados no estudo LevMadeira, em função do mês e ano.

É de realçar a presença de três picos: outubro de 2016 (n = 140), maio de 2017 (n = 180) e agosto de 2017 (n = 237). Estes meses são coincidentes com a época alta para o turismo de natureza e num ano excecionalmente bom, segundo indicação dos guias de montanha, agências de viagens e empresas de animação turística.

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Capítulo 3

Turismo de natureza e bem-estar mental, físico e social: uma revisão *scoping*

3. Turismo de natureza e bem-estar mental, físico e social: uma revisão *scoping*

Resumo

O impacto do turismo de natureza na saúde é resultante da influência do ambiente, do turista e da atividade. O objetivo do presente estudo foi rever a literatura disponível sobre a associação do turismo de natureza ao bem-estar mental, físico e social do turista.

Um total de 35 artigos foi incluído numa revisão *scoping*. A revisão foi estruturada em 5 passos: identificar a questão de pesquisa, identificar os estudos relevantes, selecionar a literatura, mapear os dados, e agrupar, resumir e apresentar os resultados.

O turismo de natureza estava associado ao bem-estar mental, via restauração da atenção, promoção de afetos positivos e redução do stress. A 'bipolaridade de sentimentos', o 'pico emocional', o *flow* e o *rush* emergiram de uma amálgama de emoções. A dificuldade dos trilhos, as más condições atmosféricas e a preocupação com as doenças autóctones geraram emoções negativas. O turismo de natureza estava associado ao bem-estar físico através do aumento dos níveis de atividade e aptidão física, melhoria dos estilos e qualidade de vida e uma dieta saudável. A associação entre o turismo de natureza e bem-estar social foi materializada no reforço dos laços familiares e amizade. Os estudos revistos utilizaram, na sua maioria, o questionário autoadministrado e/ou entrevista; a quase totalidade dos artigos apresentou um delineamento transversal.

O turismo de natureza é benéfico ao bem-estar mental, físico e social. Os resultados serão úteis, entre outros, aos académicos, setores do turismo e viagens, responsáveis pela saúde pública, gestores da paisagem, companhias de seguros e ambientalistas.

Palavras-chave: turismo de natureza, saúde e bem-estar, atividade, *scoping*

3.1. Introdução

A natureza atrai os visitantes e o retorno parece ser 'mais' e 'melhor saúde'. É assim há muitos anos, mas, recentemente, as novas motivações para o turismo de natureza materializaram-se numa procura atrevida dos visitantes e de uma ampla oferta do lugar

(Turismo de Portugal, 2013). Tal ‘acoplagem’ parece emergir de preocupações com o aumento da obesidade, diabetes tipo 2, doença cardiovascular, cancro e doença mental, e dos custos associados à doença (Thompson, 2013; Mytton, Townsend, Rutter, & Foster, 2012).

A paisagem tem sido descrita como um recurso de saúde física, mental e social. Num estudo de revisão, Abraham, Sommerhalder e Abel (2010) reportaram que a paisagem foi promotora do bem-estar mental através da restauração da atenção, redução do stress e evocação de emoções positivas; do bem-estar físico, através da promoção da atividade física diária e ambientes facilitadores para andar a pé; e do bem-estar social, através da reintegração, envolvimento e apoio social. A relação entre a natureza e a saúde foi igualmente revista por Hartig, Mitchell, de Vries e Frumkin (2014). A natureza teve um efeito positivo na saúde via qualidade do ar, atividade física, coesão social e redução do stress. Mais recentemente, Andkjær e Arvidsen (2015) investigaram a relação entre o ambiente natural e a atividade recreativa. O ambiente natural teve um grande impacto sobre a atividade física. As pessoas alcançaram várias experiências e demonstraram preferenciais distintos pelos ambientes naturais.

As revisões anteriores centraram a sua atenção no ambiente em que decorreu a atividade, por exemplo, florestas, montanhas, áreas costeiras, espaços rurais e parques, espaços verdes, hortas comunitárias e jardins urbanos, em detrimento da atividade turística, i.e., as características, as ações e os comportamentos dos visitantes (Cunha & Abrantes, 2013). As amostras incluíram turistas, população residente nas áreas urbanas, estudantes universitários, pacientes hospitalizados, entre outros. Urge, pois, a necessidade de rever a investigação efetuada em ambientes naturais não urbanos e focalizada unicamente no turista. Os turistas aliviados da rotina diária podem interagir mais com a natureza e procurar certos destinos, os quais, por sua vez, podem moldar a experiência do visitante (Willis, 2015). Por outras palavras, não é claro se a associação positiva entre a natureza e a saúde é desencadeada pelo ambiente ou pelo visitante (White, Pahl, Ashbullby, Herbert, & Depledge, 2013). Assim, o objetivo principal do presente estudo foi rever o conhecimento disponível sobre a associação do turismo de natureza ao bem-estar mental, físico e social do turista. Os artigos foram descritos e explorados em função do tipo e segmento/nicho, atividade turística, principais resultados e metodologias de investigação/instrumentos de pesquisa.

3.2. Métodos

3.2.1. Revisão *scoping*

A presente revisão utiliza a metodologia *scoping*. Um estudo de *scoping* faz um mapeamento da literatura sobre um tópico específico e procede à reinterpretação analítica (Armstrong, Hall, Doyle, & Waters, 2011; Levac, Colquhoun, & O'Brien, 2010). O objetivo é alcançar uma maior clareza sobre um campo de evidência (Davis, Drey, & Gould, 2009). A estrutura metodológica da atual revisão segue os passos sugeridos por Arksey e O'Malley (2005), mais especificamente, identificar a questão de pesquisa, identificar os estudos relevantes, selecionar a literatura, mapear os dados, e agrupar, resumir e apresentar os resultados.

3.3. Questões de pesquisa

Na definição das questões de pesquisa foram consultados 18 artigos de revisão. As questões, abrangentes e consensuais, foram as seguintes: (1) haverá uma base teórica que nos permita entender a associação entre o turismo de natureza e a saúde? (2) quais são as características fundamentais do turismo de natureza associadas aos benefícios de saúde, e como é que essas características variam em diferentes segmentos da população?

3.3.1. Identificação dos estudos relevantes: critérios de pesquisa

O inventário das publicações académicas para a análise bibliográfica foi elaborado pela autora, a partir de bases de dados internacionais disponibilizadas pela Biblioteca Digital da Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa, nomeadamente: *b-on*, Academia.edu, *Google Scholar*, *SciELO-Scientific Electronic Library Online*, *Latindex* e *OAPEN Library*. A *Scopus*, a *EBSCO*, a *Science Direct* e a *PubMed*, entre outras, foram consultadas via Universidade da Madeira, Universidade do Porto, *University of Essex*, *University of Michigan* e *Michigan State University*. A diversidade das fontes de pesquisa permitiu alcançar o maior número de revistas da especialidade, evitar a exclusividade geográfica de documentos ocidentais e a hegemonia dos EUA e/ou países anglo-saxónicos. Os artigos de revisão e a lista de referências foram exaustivamente analisados. Os trabalhos em falta foram introduzidos, um a um, nos motores de busca ou diretamente nos sítios eletrónicos. Alguns repositórios universitários e o *curriculum vitae* de vários autores foram consultados.

Os dois focos centrais da pesquisa foram o turismo de natureza e a saúde e bem-estar físico, mental e social. Para o primeiro, o turismo de aventura, o ecoturismo, o turismo de observação de vida selvagem, o *birdwatching*, o turismo ativo, o turismo em espaço rural, o turismo de bem-estar, o *trekking*, o *hiking* e o 'lazer sério' foram considerados segmentos ou derivações daquele produto turístico e, todos, na língua inglesa. A pesquisa básica utilizando a expressão *nature-based tourism* foi limitada ao período 2001-2015 e gerou cerca de 9000 resultados. Nos casos possíveis, uma pesquisa avançada foi feita, acrescida dos limitadores 'tipos de fonte', 'texto integral' e 'idiomas'. A saúde e o bem-estar foram, também, introduzidos como termos de combinação através do operador booleano 'AND'. O título, as palavras-chave e/ou o resumo determinaram a seleção de cada artigo na língua inglesa, espanhola e portuguesa. Para colmatar as falhas de entrada, nas bases de dados, as mesmas combinações foram introduzidas, uma a uma, em 69 revistas científicas listadas na *b-on* com 'turismo' ou 'ecoturismo' na sua denominação. Os critérios de pesquisa e os resultados estão sintetizados no Quadro 3.1. Um total de 1025 potenciais estudos foi identificado.

Quadro 3.1 Critérios de pesquisa e resultados.

Sequência de abordagem
1. Palavra-chave ‘turismo de natureza’
2. Data de publicação: 2001-2015
Resultado global: 9178
Pesquisa avançada (filtragem):
3. Palavras-chave:
Turismo de natureza
Ecoturismo
Turismo de aventura
Turismo ativo
Turismo de observação de vida selvagem
Turismo de observação de aves
Turismo em espaço rural
Trekking
Hiking
‘Lazer sério’
Combinação (AND): saúde; bem-estar; bem-estar mental; bem-estar físico; bem-estar social; ambiente saudável; emoção; ambiente restaurativo; paisagem terapêutica; psicologia ambiental; restauração da atenção; stress; doença; acidentes.
4. Texto integral
5. Tipos de fontes:
Revistas académicas (*peer reviewed*); revistas; dissertações/teses; resenhas; relatórios; materiais de conferências; livros.
6. Artigos em língua inglesa, espanhola e portuguesa
Resultado final: 1025 publicações

3.3.2. Seleção da literatura: critérios de inclusão/exclusão

O fluxograma das várias etapas percorridas no processo de inclusão e exclusão dos potenciais estudos é apresentado na Figura 3.1. Os critérios de inclusão e exclusão *post-hoc* foram sequenciais à tomada de conhecimento dos recursos. Nenhum dos 1025 estudos foi invalidado em função da sua origem ou tipologia. Os estudos sobre atividades ao ar livre, em parques e áreas protegidas, e respetivos efeitos na saúde e bem-estar humanos (n = 52) foram eliminados quando não se referiam a produtos turísticos. Na segunda etapa, 266 trabalhos foram excluídos porque abordavam o turismo de saúde (tratamentos médicos, cirurgias, etc.), o turismo religioso (peregrinações a santuários, celebrações, etc.), o turismo *wellness* (*spas*, termas, ioga, tratamentos alternativos, etc.), o turismo desportivo (eventos desportivos) e o turismo de lazer (praia, festivais, parques temáticos, etc.). A terceira filtragem ocorreu como consequência da leitura integral dos estudos. A maioria das publicações (n = 640) foi excluída porque incidia sobre a associação do turismo de natureza à saúde, numa perspetiva única e exclusiva de satisfação com os serviços e infraestruturas, expectativas sobre cenários/paisagens, oferta de serviços espacializados, inclusão de participantes que não turistas (p. ex., guias, operadores turísticos e empresários) e estudos desenvolvidos em paisagens predominantemente culturais. Também, neste conjunto, foram incluídos os estudos associados ao bem-estar da vida selvagem, os dos residentes/populações locais e os que avaliavam os impactos de comportamentos e atitudes na qualidade ambiental. Ainda nesta etapa, 27 estudos foram selecionados para uma segunda análise e debate entre os membros da equipa, porque suscitavam dúvidas relativas aos critérios de inclusão. A última fase incidiu sobre 67 estudos.

Os registos de conferências e *research notes* foram eliminados. Dos 27 estudos em dúvida, 19 não obtiveram consenso entre os elementos da equipa e foram excluídos. Entre os 40 estudos a confirmar, 9 não cumpriam com os critérios de seleção. Os restantes estudos, na sua totalidade artigos científicos e capítulos de livros, revistos por pares, foram rastreados em função dos itens de inclusão, mais especificamente, (1) turismo de natureza e respetivos segmentos/nichos, associado à saúde e/ou bem-estar dos turistas; (2) impacto de atividades ao ar livre, típicas de turismo de natureza, na saúde e/ou bem-estar dos turistas; (3) motivação dos turistas baseados na natureza pela procura de saúde e/ou bem-estar; (4) riscos e acidentes que ocorrem no turismo de natureza; (5) turismo *wellness* associado a experiências e/ou atividades na natureza; (6) espiritualidade e/ou misticismos associados a afetos principais, em contexto de turismo baseado na natureza; e (7) estudos de mercado/opinião com turistas sobre produtos/lugares na natureza e potencialidades para a saúde e/ou bem-estar. Um total de 35 estudos foi considerado relevante para esta revisão.

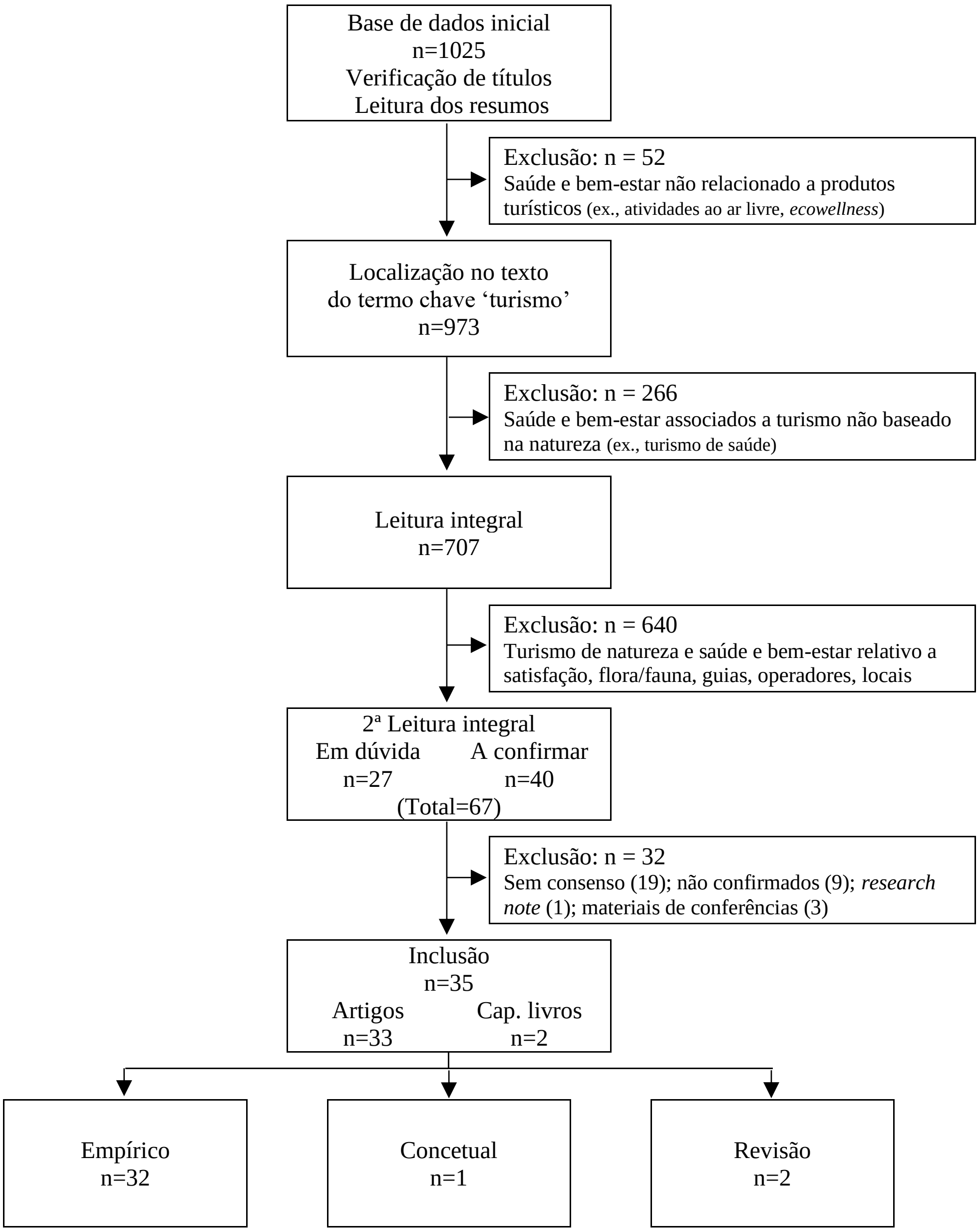

Figura 3.1 Sequência operacional no processo de inclusão e exclusão dos estudos.

3.3.3. Mapeamento dos dados

Os recursos incluídos na revisão, em função do período de publicação, são apresentados no Quadro 3.2. O maior número de artigos e capítulos de livros foi publicado nos últimos 5 anos. O *Annals of Tourism Research*, o *Journal of Sustainable Tourism* e o *Tourism Management* foram os jornais da especialidade mais representados com 4 ou mais publicações. As editoras dominantes foram a *Elsevier* e a *Routledge-Taylor & Francis Group* (dados não apresentados).

Quadro 3.2 Recursos incluídos na revisão, em função do período de publicação: 2001-2005, 2006-2010 e 2011-2015.

	Artigo científico			Capítulo de livro		
Período	Empírico	Concetual	Revisão	Empírico	Revisão	Total
2001-2005	5	-	-	-	-	5 (14,3)†
2006-2010	9	-	-	1	-	10 (28,6)
2011-2015	17	1	1	-	1	20 (57,1)
Total	31 (88,6)	1 (2,9)	1 (2,9)	1 (2,9)	1 (2,9)	35 (100)

†Frequência relativa entre parêntesis.

A distribuição dos artigos retidos para análise, em função do país onde foram desenvolvidos, é apresentada na Figura 3.2. O maior número de artigos foi observado na Austrália (n = 4), seguido pela China, Nova Zelândia e Reino Unido, com 3 artigos. O Canadá, os Estados Unidos da América, a Finlândia, a Malásia e a Noruega foram alvo de dois artigos, cada um. A França, a Islândia, Israel, o Nepal, Portugal e a República da Coreia foram representados por 1 artigo cada. Quatro trabalhos foram realizados sobre uma mescla de países e dois foram de natureza concetual ou de revisão. Um pouco mais de metade dos estudos (51,4%) foi proveniente da área do turismo; os restantes foram distribuídos pela geografia, ciências naturais/ambientais, economia, gestão, ciências do desporto, psicologia e sociologia (dados não apresentados).

O mapeamento dos artigos foi efetuado em várias grelhas compostas pelos itens seguintes: autor/ano de publicação, área de especialidade; fonte de pesquisa, título, palavras-chave; questões e tópicos de pesquisa, objetivos, métodos, amostra, turista, local da pesquisa e resultados. A partir destas grelhas foram construídas as matrizes de síntese que permitiram aferir os resultados e a consequente discussão.

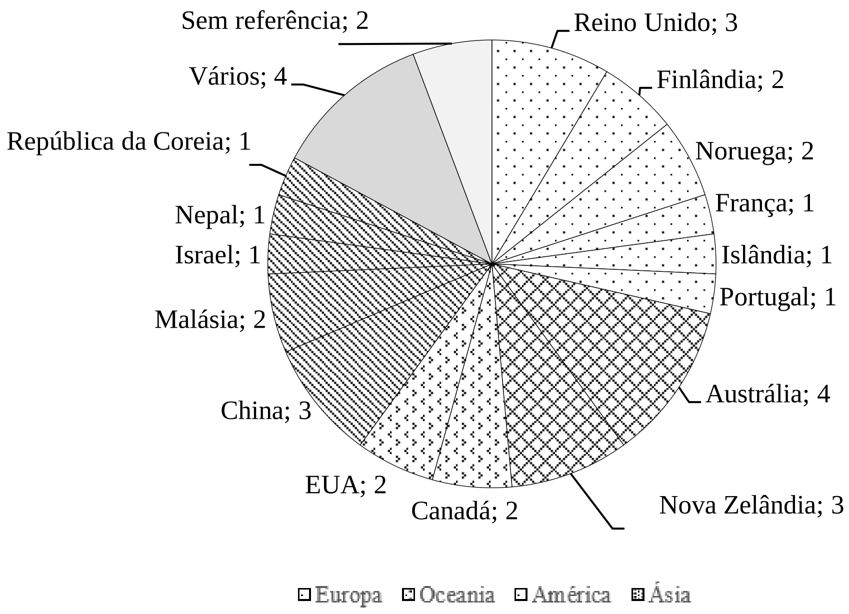

Figura 3.2 Distribuição dos artigos retidos para análise em função do país onde foram desenvolvidos.

3.4. Resultados

3.4.1. Tipos, segmentos/nichos e atividades de turismo de natureza

Os tipos, segmentos/nichos e atividades de turismo de natureza concetualizados a partir dos trabalhos revistos são apresentados na Figura 3.3. O turismo de natureza é a expressão mais frequente, seguido do turismo de aventura, turismo *wellness*, ecoturismo, turismo *wildlife* e turismo rural. A caminhada é a atividade mais realizada no turismo de aventura, turismo *wellness*, ecoturismo e turismo rural. Outras atividades realizadas com frequência são a escalada/alpinismo/montanhismo, o campismo, o *canyoning/rafting*, a observação de vida selvagem (aves, cetáceos, tubarões, gorilas, etc.) e o *surf*.

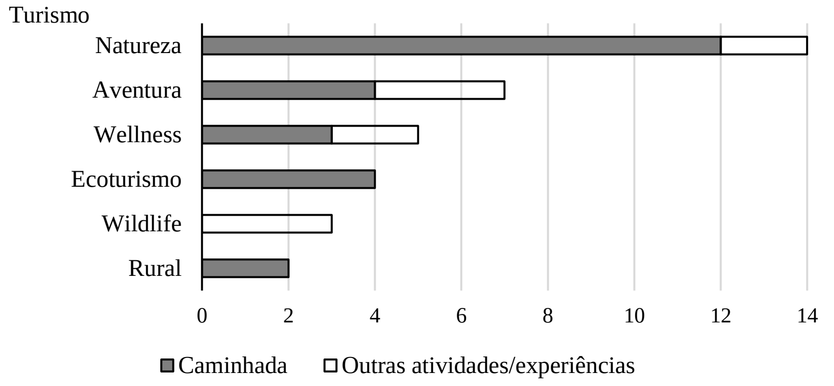

Figura 3.3 Caminhada em função das atividades/experiências ao ar livre por tipo ou segmento de turismo baseado na natureza, nas publicações revistas.

3.4.2. Turismo de natureza e saúde

O mapeamento dos artigos revistos sobre a associação do turismo de natureza à saúde é apresentado no Quadro 3.3. Os artigos incidem sobre a avaliação/análise de quadros emocionais e experiências sensoriais, os contextos e/ou significados de risco/perigo, os acidentes e/ou doenças, e as motivações para o turismo de natureza. A associação do turismo de natureza ao bem-estar mental é investigada na quase totalidade dos artigos; uma única exceção é observada no estudo desenvolvido por Musa, Hall e Higham (2004), que explorou o efeito da altitude na saúde dos turistas. O bem-estar físico e social são explorados em 20 e 11 artigos, respetivamente.

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Quadro 3.3 Mapeamento dos artigos incluídos na revisão: turismo baseado na natureza e saúde e bem-estar

		Turismo		
	Autor /ano de publicação	Tipo†	Atividade	Principais resultados
1	Bentley e Page (2001)	Aventura	Variadas	Registo incorreto dos acidentes com turistas estrangeiros, pelas agências de atividades de aventura; os acidentes são a principal causa de lesões e morte entre os turistas (excluindo morte por doença cardiovascular). Perspetiva baseada no bem-estar do turista.
2	Buckley (2012)	Aventura	Radicais	*Rush* como combinação de emoções e 'estado de fluxo' (*flow*) conseguido no auge de atividades radicais (*snowboarding*, *whitewater kayaking*, *surf*, vela e *kitesurf*); experiência psicológica unificadora, intensa e emocional; associado a elevados níveis de adrenalina pelas emoções que estimulam os músculos e todos os sentidos à máxima capacidade, ao mesmo tempo que são necessários controlo e calma sobre os movimentos e ações; risco de lesão existe e é inevitável, mas a motivação é o *rush*, num processo de procura de elevados níveis de satisfação.
3	Cater (2006)	Aventura	Não identificada	O risco é fundamental na experiência de aventura. Atrações para os turistas de aventura: situações inusitadas e o sucesso de completar a atividade; falta de notificação dos acidentes; risco de lesão grave/perda de vida muito raro; risco real (estatístico; probabilidade de ocorrência de um evento) influi no risco percecionado (qualitativo); principais motivações: emoção e entusiasmo; procura pelo medo e não pelo risco.
4	Chan e Baum (2007)	Ecoturismo	Caminhada	Benefícios psicológicos das caminhadas na natureza; aspetos emocionais/afetivos derivados das experiências ecoturísticas (vida selvagem, ambiente natural, atividades, como, por ex., a caminhada). Guias: interações positivas e sensação de segurança.
5	Chang (2014)	Natureza	Caminhada	A frequência da atividade de turismo de natureza está significativamente associada ao stress e à função do sistema nervoso autónomo, no turista nacional; fraca relação para os turistas internacionais. Participação benéfica a dois níveis: atividade física (caminhada e dança) e alívio do stress; mais importante nos adultos idosos que parecem ter ajuda efetiva para manterem a função do sistema nervoso autónomo; benefícios de saúde mais elevados do turismo de natureza comparativamente à atividade física nos tempos livres.
6	Chhetri et al. (2004)	Natureza	Caminhada	Mapeamento das experiências (emoções, humor e sentimentos) dos visitantes nas caminhadas; os estímulos geográficos afetam as experiências dos participantes; bipolaridade de sentimentos, i.e., positivos e negativos.
7	Curtin (2009)	*Wildlife*	Observação vida selvagem	Resposta emocional da observação de vida selvagem: admiração e assombro pela beleza do espetáculo. Experiência de pico catártica: vida selvagem evoca sentimentos de profunda felicidade, com todos os elementos do pico emocional (intenção, reciprocidade, ligação, vivacidade e harmonia). 'Estado de fluxo' (*flow*): total absorção pela atividade, perda do sentimento de autoconsciência, epifania de autorrealização e passagem do tempo distorcida. Profunda sensação de bem-estar com benefícios para a saúde psicológica.
8	Curtin e Kragh (2014)	*Wildlife*	Observação vida selvagem	A necessidade de repouso/refúgio explica a procura por ambientes naturais. A exposição aos animais e à natureza diminui a agressividade, a ansiedade, a depressão e as doenças negativas; aumenta o afeto, a capacidade cognitiva e a saúde. 'Estado de fluxo' (*flow*) e experiência de pico. Perda de noção do tempo. Profunda admiração e vínculo com o mundo natural. Sentimento de espanto, admiração e aliciamento. Natureza: componente importante do bem-estar. 'Magia' perdida nas experiências turísticas fortemente mediadas e controladas pelo uso de trilhos, jipes, vedações e limites.

†Tipo e segmento/nicho de turismo de natureza.

Quadro 3.3 Mapeamento dos artigos incluídos na revisão: turismo baseado na natureza e saúde e bem-estar. (Continuação)

Autor /ano de publicação		Turismo		Principais resultados
		Tipo	Atividade	
9	Ellard et al. (2009)	Natureza	Não identificada	Forte reação emocional à natureza e à paisagem. Dimensão espiritual em 4 perspetivas: (1) criação, (2) natureza, (3) tranquilidade e transcendência, e (4) 'recentrar'. Sensação de paz e serenidade. Sentimento de ser abençoado. Experiência transcendente.
10	Farber e Hall (2007)	*Wildlife*	Observação	Emoções de assombro, excitação e prazer. Níveis elevados de afetos positivos: atividade recreativa e em grupo.
11	Gyimóthy e Mykletun (2004)	Aventura	Caminhada	Desafio, competição e emoções inerentes às atividades lúdicas (caminhada) com dois rivais: a natureza e os participantes. Procuram risco, desafios e enfrentar o perigo. 'Experiência de fluxo' (*flow*). A luta pela vida no meio de perigos, como, por exemplo, as fendas no gelo, as temperaturas muito baixas e os ursos polares, estimula uma infinidade de sentidos, provoca intenso alerta e exalta o humor.
12	Hassell et al. (2015)	Natureza	Caminhada; outras	Motivações para acampar: beleza visual e auditiva da natureza e atividades como a caminhada, a pesca, o caiaque e a observação. Experiências de admiração, aventura, orgulho (superação de desafios), descanso, relaxamento, diversão, reforço dos laços familiares e das amizades. Alguns sentimentos de temor pelo potencial destruidor da natureza. Restabelecimento do vínculo com a natureza, família e amigos através da simplificação da vida (ausência de televisão, telefones e emprego).
13	Hill et al. (2014)	Natureza	Caminhada; observação vida selvagem	Resposta emocional/afetiva dos turistas: admiração/assombro e reverência. 'Momentos de fluxo' (*flow*) ou absorção e preenchimento espiritual mais frequente/evidente nos turistas da floresta tropical; extrema imersão multissensorial até à alienação individual nas experiências a pé (caminhadas) na floresta; menos no turista passivo de observação de vida selvagem. Sentimentos de segurança expresso por 'belo', 'calmo' e 'tranquilo' pelos turistas da floresta tropical, mas vulnerabilidade relacionada com a presença de vida selvagem e caminhos escorregadios. Ausência de medo e vulnerabilidade expressa nos encontros com espécies raras e ameaçadas de extinção, nos turistas de observação de vida selvagem.
14	Huang e Xu (2014)	*Wellness*	Caminhada; outras	Principais comportamentos dos turistas de bem-estar: estar na natureza, fazer exercício físico moderado na natureza (caminhada, dança e outros) e dieta adequada (alimentação saudável e em sintonia com a estação do ano). Recuperação da saúde. A longevidade dos residentes locais contribui para os comportamentos dos turistas.
15	Jepson e Sharpley (2015)	Rural	Caminhada; outras	Independente do grau de religiosidade dos turistas: esforço da escalada, combinado com a recompensa da vista, suscitou poderosas emoções. Importância da natureza para o bem-estar geral. O envolvimento ativo (caminhada) no ambiente natural melhorou a experiência emocional (bem-estar emocional). O desfrutar da solidão/silêncio conduz ao estado espiritual. Estar e envolver-se com a paisagem, especialmente através da atividade física, é fundamental para respostas emocionais, como, por exemplo, ao alívio do stress e à saúde mental.
16	Kil et al. (2012)	Natureza	Caminhada; outras	Atividades contempladas: caminhadas, canoagem, desportos náuticos em águas interiores, campismo e passeios em veículos todo-o-terreno. Importantes preditores do vínculo ao lugar e intenções comportamentais: melhorar a aptidão física, explorar a natureza, escapar à pressão e nostalgia. Benefícios alcançados coincidentes com benefícios desejados.

Quadro 3.3 Mapeamento dos artigos incluídos na revisão: turismo baseado na natureza e saúde e bem-estar. (Continuação)

		Turismo		
	Autor /ano de publicação	Tipo	Atividade	Principais resultados
17	Kim et al. (2015)	Natureza	Caminhada	Motivações para o bem-estar subjetivo: desfrutar da natureza e escapar à vida quotidiana, procura de vida saudável, procura de intimidade, melhoria da aptidão física e reforço dos laços familiares e de amizades. A busca pelo rejuvenescimento, através da recuperação dos estados físico e mental, encoraja os turistas a revisitarem os trilhos. Sentir-se saudável física e mentalmente, depois da caminhada.
18	Konu (2015)	*Wellbeing*	Caminhada	Caminhada na floresta finlandesa mais fácil do que no Japão e, assim, mais fácil de relaxar. Exercícios focados para 'estar no momento', experimentar a natureza sem pressa e em silêncio. Forte experiência emocional relacionada com as caminhadas, caiaque e visitas guiadas, incluindo 'passeios em silêncio' e 'natureza e vigor'. Experiências emocionais mais fortes e positivas nas atividades guiadas. Serviço de um produto de turismo de bem-estar baseado na floresta.
19	Kulczycki e Lück (2009)	Aventura	Caminhada; outras	O turismo de aventura, nas mais variadas atividades radicais (incluindo a caminhada em ambientes e condições difíceis), contribui para o bem-estar físico, mental e social. 'Experiência de fluxo' (*flow*) pelo risco/perigo (calculado), enquanto interagem com o ambiente natural. Os vários componentes da experiência do turismo de aventura (vínculo ao lugar, risco calculado, conquista/realização e interação social) contribuem ativamente para a saúde e bem-estar.
20	Markwell (2001)	Natureza	Caminhada	Desafios da escalada, caminhadas e observação de vida selvagem: o menor controlo sobre a experiência turística aumenta o stress, tensão e pressão sobre o corpo. Stress e dor física superados (temporariamente) pelo aparecimento de animal ou de uma 'vista' espetacular. Sensação de admiração e de realização como recompensa por atingir o cume. Desconforto corporal resultante das más condições meteorológicas e com impacto no desfrute do lugar. 'Estar no meio da selva' representa um maior envolvimento com o lugar. Acampamento: stress menos severo e, no limite, paz e relaxamento. Potenciais ameaças à integridade física: picadas de mosquitos e doenças tropicais, sobretudo malária. Retomar as caminhadas causou stress, mau humor e impaciência. Turismo de natureza, mais do que uma atividade visual, é uma experiência sensorial integral.
21	Moscardo (2011)	*Wellness*	Não identificada	Estudo longitudinal: crescente interesse dos turistas por viagens para restaurar/manter a saúde e bem-estar. Motivações a ganhar importância: escapar às rotinas quotidianas, descansar e relaxar e fazer atividade física. Motivação 'estar perto da família e amigos' a perder interesse. Início do período de estudo: turistas mais empenhados no ambiente, em si, como novidade e emoções associadas. Atualmente, duas expressões diferentes de interesse no bem-estar: (1) aspetos sociais da experiência, mais propensos a utilizar serviços estruturados; (2) o grupo da 'solidão', à procura de oportunidades independentes e auto-organizadas em ambientes naturais de elevada qualidade.
22	Musa et al. (2004)	Ecoturismo	Caminhada em montanha	Problemas de saúde aguardados por turistas de alpinismo: lesões nos tecidos moles e diarreias. Maioria experimentou um ou mais problemas de saúde; mais jovens com mais dores de cabeça. Fadiga, insónia, perda de apetite e vertigens em alguns. O risco não foi motivação importante, assim como 'razões espirituais', 'estar mais perto de Deus' ou 'estar só'.
23	Olafsdottir (2013)	Natureza	Caminhada	As emoções e a terapia afetiva estão relacionadas: dependem do desempenho da natureza e do contributo do turista. Experimentar configurações de serenidade e tranquilidade. A caminhada percebida como oportunidade de 'ficar longe'. Crença romântica no poder terapêutico da natureza.

Quadro 3.3 Mapeamento dos artigos incluídos na revisão: turismo baseado na natureza e saúde e bem-estar. (Continuação).

		Turismo		
	Autor /ano de publicação	Tipo	Atividade	Principais resultados
24	Pan e Ryan (2007)	Ecoturismo	Caminhada	Caminhadas regulares, mesmo em trilhos difíceis: fonte de relaxamento físico e mental. Motivação mais importante: relaxar mentalmente; outras motivações: contemplação/inspiração, descanso mental e 'manter o corpo saudável'.
25	Pesonen e Komppula (2010)	*Wellness*	Não identificada	Distinto segmento de bem-estar, entre turistas finlandeses em espaço rural: paz e tranquilidade, em simultâneo com tempo passado na natureza. Motivações: relaxar longe do habitual, férias sem preocupações, recuperar as forças, sensação de conforto e oportunidade para descanso físico.
26	Pomfret (2012)	Aventura	Caminhada em montanha	Participação nas atividades de alpinismo: a maioria dos turistas não percecionava qualquer grau de risco e os guias são protetores de eventuais riscos. Desafio como parte mais significativa das experiências de risco. Emoções experimentadas: euforia e profunda satisfação pela natureza fisicamente exigente do alpinismo; sentimentos positivos e negativos. 'Estado de fluxo' (*flow)* ou similar: completa absorção, escape da realidade, concentração e foco nas tarefas e perda de noção do tempo. Paisagem montanhosa com impactos no bem-estar psicológico.
27	Prazeres e Donohoe (2014)	Natureza	Caminhada	Experiência sensorial necessária à satisfação: experimentar o ambiente natural através dos sentidos (visão, audição, olfato e tato). A dimensão sensorial 'cheiro' notada apenas pelo sexo feminino. As condições meteorológicas influenciam o humor.
28	Rodrigues et al. (2010)	*Wellness*	Caminhada	Potencial proximidade entre a caminhada e o interesse por turismo de bem-estar. Principais motivações das caminhadas associadas a 'cura' por experiência na natureza: observar e apreciar a beleza da paisagem, respirar ar puro e conhecer e interpretar a natureza de forma envolvida. Sentimentos positivos na natureza: serenidade, tranquilidade, relaxamento e divertimento. Para alguns, enigma, tensão e medo. Potencial obstáculo: insegurança relacionada a lugares perigosos, desorientação e dificuldade de assistência, em caso de acidente.
29	Saunders et al. (2013)	Natureza	Caminhada	Terapia: resolução/alívio/mitigação de problemas crónicos como a depressão e o medo das alturas. Desafio e término com sucesso: realização e ganho de confiança. Capacitação, coragem, força e determinação. Benefícios sociais (relacionamentos e pertença, com importante papel do guia) e de saúde das caminhadas. Caminhadas na natureza podem gerar sentimento de consciência espiritual e de conexão com o infinito. Mudanças duradoiras aumentam o bem-estar.
30	Schwarz (2013)	Natureza	Caminhada	Preferências conflituosas sobre a paisagem sonora, adequada e desejada, nas caminhadas. Natureza absorvente: pode curar; experiência de tranquilidade interior ou relaxamento, sublimação ou espiritualidade e liberdade. Sons não-naturais perturbadores. A natureza como mediadora da introspeção e autoexame, isolamento do quotidiano. Natureza como estágio social, palco de socialização, nem sempre automática; silêncio difícil em viagens de grupo. Natureza como conjunto de adereços para a atividade física, o desafio que representa para a 'utilização' do corpo; excitação causada pelo exercício com expressões sonoras desenfreadas. Maioria evita a música em sítios naturais; uma pequena percentagem acredita intensificar as imagens visuais da natureza com a adição de uma 'banda sonora'.
31	Sharpley e Jepson (2011)	Rural	Caminhada; outras	Atividades na natureza como o BTT, as caminhadas e a escalada. Expressões idênticas para conceitos de espiritualidade e de conectividade, unidade e bem-estar interior entre turistas (maioria sem afiliação religiosa). Experimentar lugares naturais proporciona um envolvimento físico e emocional mais profundo. Sentido de comunidade. Sentimento de ser abençoado. Sensação de renovação.

Quadro 3.3 Mapeamento dos artigos incluídos na revisão: turismo baseado na natureza e saúde e bem-estar. (Continuação)

	Turismo		
Autor /ano de publicação	Tipo	Atividade	Principais resultados
32 Svarstad (2010)	Ecoturismo	Caminhada	Significado das caminhadas. Importante em duas categorias identificadas nos turistas: (1) recreação - aspetos de saúde física saúde mental, felicidade, tranquilidade e paz interior; (2) pertença - alienação reduzida pelos vínculos de pertença à natureza, à 'vida original', à criação de sentido de continuidade e de pertença à sua própria vida e família. Caminhada: contribuinte fundamental para o bem-estar.
33 Tsaur et al. (2013)	Aventura	Caminhada em montanha	Experiência transcendente estimulada pela natureza e vida selvagem. Experiência transcendente e positivamente relacionada com a felicidade, sentimento interior que gera afetos positivos. Os alpinistas perceberam a experiência transcendente mais suscetível de 'fluxo' (*flow*) e felicidade. O 'fluxo' afeta positivamente a felicidade e tem papel mediador entre a experiência transcendente e a felicidade. O alpinismo conduz à melhoria física, psicológica e espiritual.
34 Willis (2015)	Natureza	Não identificada	Lugar de experiência com profundo significado. Linguagem emocional nas expressões sobre o litoral. Benefícios associados ao sentido de pertença ao lugar, apreciação estética, lazer, relaxamento, de escapar, revigorar e experiência espiritual e edificante (elevação moral). A paisagem física e as atividades realizadas influenciam o bem-estar psicológico.
35 Wolf et al. (2014)	Natureza	Caminhada	Caminhadas: desenvolvimento de laços sociais e melhorias significativas na saúde, bem-estar e competências. Melhoria generalizada na saúde física, pelo aumento da resistência cardiorrespiratória. Influência positiva na realização, satisfação, conforto, alegria, autoestima e respeito por si. Turistas repetentes com melhores resultados. Guias entendidos como essenciais para a segurança e interações sociais.

O turismo de natureza está positivamente associado ao bem-estar mental através da restauração da atenção, promoção de afetos positivos e redução do stress, em 33 dos 35 estudos revistos. A admiração e o assombro, o aliciamento, a boa disposição/diversão, a conexão ao lugar e à natureza, a confiança, a coragem, a determinação, a força, a excitação, o entusiasmo, a euforia, a felicidade, a intimidade, a introspeção e autoexame, a autoestima, o orgulho, a realização, o relaxamento, a satisfação, a tranquilidade e serenidade, e a paz são os 'sentimentos' extraídos dos estudos revistos. A combinação de várias emoções, como, por exemplo, a 'bipolaridade de sentimentos', o 'pico emocional', o 'estado de fluxo' (*flow*) e o *rush* emergem, do mesmo modo, do turismo de natureza. O 'pico emocional' integra a intenção, a reciprocidade, a ligação, a vivacidade e a harmonia. O 'estado de fluxo' reúne a absorção, a alienação, a concentração, o escape da autoconsciência, a epifania da autorrealização e a distorção do tempo. O *rush* combina ambos, o 'pico emocional' e o 'estado de fluxo'.

A dificuldade dos trilhos, as más condições atmosféricas e a preocupação com as doenças autóctones geraram, também, emoções negativas, como, por exemplo, a impaciência, o medo/terror, o mau humor, a ansiedade/tensão, o stress/pressão, a infelicidade/miséria e a alienação. A espiritualidade está, também, associada ao bem-estar mental, através da edificação, do abençoado, da transcendência e da sublimação.

As atividades de turismo de natureza estão associadas ao bem-estar físico, através da promoção da atividade física e do poder terapêutico. Os estudos revistos realçam o aumento da aptidão física, a cura/redução da doença, a melhoria da qualidade de vida, o rejuvenescimento, a longevidade e o melhor desempenho do sistema nervoso autónomo. Os aspetos negativos do turismo de natureza, no bem-estar físico, são quantificados pelo risco de acidente e/ou doença que ocorre com a atividade, como, por exemplo as quedas, a lesão músculo-esquelética, as infeções respiratórias, as diarreias, as insónias, as vertigens, a perda de apetite, a fadiga e as doenças autóctones.

A associação do turismo de natureza ao bem-estar social é explorada em 11 artigos. As experiências na natureza são conducentes ao reforço dos laços familiares e ao incremento das relações de amizade entre os elementos do grupo. O guia é importante para quebrar a barreira entre o grupo e o lugar, mormente no aumento da sensação de segurança e socialização.

3.4.3. Metodologias de investigação

A quase totalidade dos artigos revistos (n = 32) é de natureza empírica. Os métodos descritivos, como, por exemplo, os questionários, as entrevistas, os diários, as notas de campo, o estudo de caso e a observação são utilizados nestes artigos. A investigação qualitativa é observada em 21 artigos. A investigação mista é observada em 6 artigos revistos. Em relação aos delineamentos de pesquisa, apenas Cater (2006) e Chhetri, Arrowsmith e Jackson (2004) avaliam os turistas em dois ou mais pontos no tempo. Os restantes estudos empíricos são de natureza transversal, i.e., os turistas são inquiridos/avaliados apenas uma vez na atividade e, preferencialmente, no fim.

3.5. Discussão

3.5.1. Quais são os tipos, segmentos/nichos e atividades de turismo de natureza?

O turismo de natureza apresentou como tipos e segmentos/nichos o turismo de aventura, o turismo *wellness*, o ecoturismo, o turismo *wildlife* e o turismo rural. Tal diversidade parece refletir a dificuldade concetual inerente à expressão ‘turismo de natureza’. O turismo de natureza é definido como uma ‘atividade em que o turista explora e aprecia a natureza e os recursos naturais’ (Tangeland, Vennesland, & Nybakk, 2013); uma ‘interação construída e mediada entre o turista e a natureza’ (Markwell, 2001); um conjunto de atividades centradas no desfrute de atrações naturais pelos turistas (Chang, 2014). Outros associam ao turismo de natureza uma experiência que une o indivíduo à natureza (Willis, 2015; Hill, Curtin, & Gough, 2014) ou um ideal romântico para ‘recarregar baterias’ (Olafsdottir, 2013).

As atividades inerentes ao turismo de natureza foram diversas e resultaram do ambiente/local geográfico onde se desenvolveram e da própria inovação, como, por exemplo, o *climbing* e o *rafting*. A caminhada foi a atividade mais comum (Hassell, Moore, & Macbeth, 2015; Kim, Lee, Uysal, Kim, & Ahn, 2015; Saunders, Laing, & Weiler, 2013) e estava intimamente associada ao lazer (Svarstad, 2010), à substância exótica dos locais e à rudeza dos ambientes selvagens (Chhetri et al., 2004), ao baixo risco (Bentley & Page, 2001), à fluidez (Hill et al., 2014) e à forma mais pura de retorno à calma (Olafsdottir, 2013).

3.5.2. Qual é a associação do turismo de natureza ao bem-estar físico, mental e social?

O presente estudo incidiu sobre a atividade turística em ambientes naturais. O turismo de natureza estava positivamente associado ao bem-estar mental, mais especificamente, à restauração da atenção, aos afetos positivos e à redução do stress. Resultados similares foram obtidos em três estudos de revisão que exploraram a associação da paisagem e/ou infraestruturas verdes à saúde e ao bem-estar mental (Coutts & Hahn, 2015; Hartig et al., 2014; Abraham et al., 2010). O exercício em envolvimentos naturais estava, também, associado a sentimentos mais fortes de revitalização e empenho, ao decréscimo da tensão, confusão, irritação e depressão, e ao aumento de energia (Coon et al., 2011).

Esta tendência é corroborada por pesquisas recentes desenvolvidas em áreas verdes ou em laboratório. Frash Jr, Blose, Norman e Patience (2016) reportaram que o desejo inato dos seres humanos pela felicidade pode ser encontrado nos parques públicos. Gidlow et al. (2016) e Rogerson, Brown, Sandercock, Wooller e Barton (2015) observaram que o andar/correr em espaços naturais estava associado a experiências restaurativas mais fortes, ao aumento da autoestima, à redução do stress e à melhoria da função cognitiva. Tomao, Secondi, Corona, Carrus e Agrimi (2016) realçaram os benefícios mentais e físicos advindos das visitas a áreas verdes urbanas e semiurbanas. Estudos anteriores tinham igualmente demonstrado que, primeiro, a visualização de cenários naturais conduzia a melhorias no processo de recuperação (Brown, Barton, & Gladwell, 2013); segundo, as visitas a áreas costeiras estavam associadas à calma, à descontração, à revitalização e ao retempero (White et al., 2013); terceiro, o andar em corredores verdes estava relacionado com a menor perceção do stress e aos afetos positivos (Marselle, Irvine, & Warber, 2013); e quarto, a visualização de paisagens de bosques/parques urbanos apresentava efeitos relaxantes (Tsunetsugu et al., 2013).

Os estudos revistos esboçaram uma associação positiva entre a atividade turística e o bem-estar físico. Esta relação foi igualmente observada em dois estudos de revisão envolvendo exemplos não-exclusivos da atividade turística. Andkjær e Arvidsen (2015) e Hartig et al. (2014) reportaram que as pessoas alcançaram experiências de atividade física em envolvimentos naturais e que estas foram variáveis em função da idade. Coutts e Hahn (2015) observaram que quanto mais verde foi o envolvimento, mais elevados foram os níveis de atividade física e mais baixa foi a prevalência de sobrepeso e obesidade. Similarmente, as pessoas que viviam nas áreas mais verdes apresentaram uma razão de chances mais elevada para alcançar os níveis de atividade física recomendados, comparativamente às pessoas que viviam em áreas menos verdes (Mytton et al., 2012). A caminhada na floresta ou em envolvimentos naturais estava associada à redução da pressão arterial, à prevenção da doença cardiovascular e à diminuição no risco de doença mental (Mao et al., 2012; Mitchell, 2012).

Indo ao encontro da associação entre o turismo de natureza e o bem-estar social, a nossa revisão foi reveladora do reforço dos laços familiares e incremento da amizade. Conquanto a pesquisa centrada na atividade turística não seja vasta, Coutts e Hahn (2015) concluíram que 'mais verde' estava associado a 'mais uso' e que, por sua vez, o maior uso resultou no aumento dos laços sociais. Doughty (2013) observou que o 'andar em grupo' tinha um impacto significativo na interação social. A tendência para 'perceber' a beleza natural foi, também, mediadora da associação entre a beleza e o pró-social, como por exemplo, a afabilidade e a empatia (Zhang, Piff, Iyer, Koleva, & Keltner, 2014). Kázmierczak (2013) encontrou uma associação entre a qualidade dos parques públicos, o carácter das visitas e a extensão dos laços sociais, nos bairros urbanos. Não obstante, esta relação está envolta de alguma incerteza. Korpela, Borodulin, Neuvonen, Paronen e Tyrväinen (2014) observaram que o número de pessoas e a duração da atividade não foram mediadores da associação entre o tempo médio despendido na atividade recreativa desenvolvida na natureza e o bem-estar emocional. A este propósito, Hartig et al. (2014) deixaram em aberto a questão 'se a coesão social, o sentido de segurança, o comportamento agressivo e a taxa de criminalidade medeiam uma eventual relação entre o contato com a natureza e a saúde'.

3.5.3. Quais são as metodologias e os instrumentos de pesquisas utilizados no turismo de natureza?

Os estudos revistos, na sua larga maioria, utilizaram o questionário autoadministrado e/ou a entrevista para avaliar os parâmetros de saúde e bem-estar. A recolha de dados ocorreu apenas num único ponto no tempo, preferencialmente, no fim da atividade turística (Chan & Baum, 2007; Farber & Hall, 2007). A inexistência de qualquer avaliação antes da exposição ao estímulo poderá ser limitativa dos resultados.

Todavia, houve exemplos da recolha de dados antes e após a experiência turística (Cater, 2006), ou em vários pontos do percurso (Chhetri et al., 2004). Esta opção foi consistente com Ballantyne, Packer e Hughes (2009) e Hughes e Morrison-Saunders (2002) na avaliação dos impactos de mensagens dos turistas *wildlife* e de sinais interpretativos ao longo do trilho. A recolha de informação em dois ou mais pontos do tempo poderá, também, 'contaminar' as respostas devido ao contato prévio com os tópicos de pesquisa (Madin & Fenton, 2004).

As técnicas de recolha de dados tiveram o envolvimento direto dos pesquisadores. Mais revelador foi a diversificação das fontes e instrumentos numa mesma pesquisa; por exemplo, a combinação do questionário/entrevista com a etnografia (Olafsdottir, 2013) e/ou fontes secundárias (Willis, 2015). Sobre a totalidade dos estudos revistos, apenas um optou por utilizar um instrumento de registo/medição de um parâmetro fisiológico, o eletrocardiograma (Chang, 2014). Tal opção poderá estar subjacente aos custos elevados dos instrumentos, às dificuldades de transporte para o terreno, às exigências de manuseamento, aos riscos de perda e à preocupação com a privacidade dos turistas.

3.6. Conclusões e novos desafios

A investigação sobre a atividade turística em ambientes naturais foi realizada numa variedade de segmentos/nichos. A caminhada, entre outros tipos de atividade, estava positivamente associada à restauração da atenção, aos afetos positivos e à redução do stress. A bipolaridade de sentimentos, o pico emocional, o estado de fluxo e o *rush* emergiram de uma mescla de emoções; enquanto a dificuldade dos trilhos, as más condições atmosféricas e a preocupação com as doenças autóctones geraram emoções negativas. A associação entre a atividade turística em ambientes naturais e o bem-estar físico centrou-se na melhoria da aptidão física, estilos e qualidade de vida, longevidade e dieta saudável. A atividade turística foi reveladora do reforço dos laços familiares e amizade, embora a investigação focalizada nos turistas fosse reduzida. A totalidade das associações, i.e., a atividade turística em ambientes naturais e o bem-estar mental, físico e social foi estudada via questionário/entrevista, diário, estudo de caso e observação.

Os desafios são, por conseguinte: (1) identificar as caraterísticas da atividade turística em ambientes naturais que atraem os turistas, em particular, através da visão, audição, tato e olfato; (2) identificar outras medidas independentes da atividade turística na natureza, como, por exemplo, a inclinação e distância dos trilhos, as alterações do declive ao longo dos percursos e a acessibilidade para as crianças, adultos, adultos idosos e pessoas com deficiência; (3) quantificar a frequência, a intensidade, o tipo e a duração da atividade turística em ambientes naturais; a este propósito é urgente o uso de medidas diretas de atividade física e aptidão, como, por exemplo, o cardiofrequencímetro, o acelerómetro, o pedómetro e os sensores de passada; é, também, importante associar a atividade turística na natureza à especificidade geográfica do local, via sistemas de posicionamento global, sistemas de informação geográfica e câmaras para captação de imagens; (4) quantificar a associação da atividade turística em ambientes naturais à capacidade cognitiva, ao equilíbrio e ao risco de quedas nos jovens, adultos e adultos idosos; (5) quantificar o risco associado à atividade turística em ambientes naturais em indivíduos de diferentes idades, grupos socioeconómicos, estado de saúde e culturas; (6) explorar a longevidade dos efeitos do turismo de natureza na saúde e, em particular, na prevenção da doença cardiovascular; e (7) estudar a associação da atividade turística ao bem-estar mental, físico e social em diferentes ambientes naturais, condições climatéricas e estações do ano.

Contudo, tal investigação terá que assumir um carácter multidisciplinar e apresentar um delineamento longitudinal para captar a mudança. Paralelamente, é necessário explorar a definição de turismo de natureza. O estudo da associação da atividade turística ao bem-estar mental, físico e social irá beneficiar, entre outros, os académicos, os setores do turismo e viagens, os responsáveis pela saúde pública, os gestores da paisagem, as companhias de seguros e os ambientalistas.

3.7. Referências

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Capítulo 4

Visual landscape, sounds and smells perceived by nature-based tourists

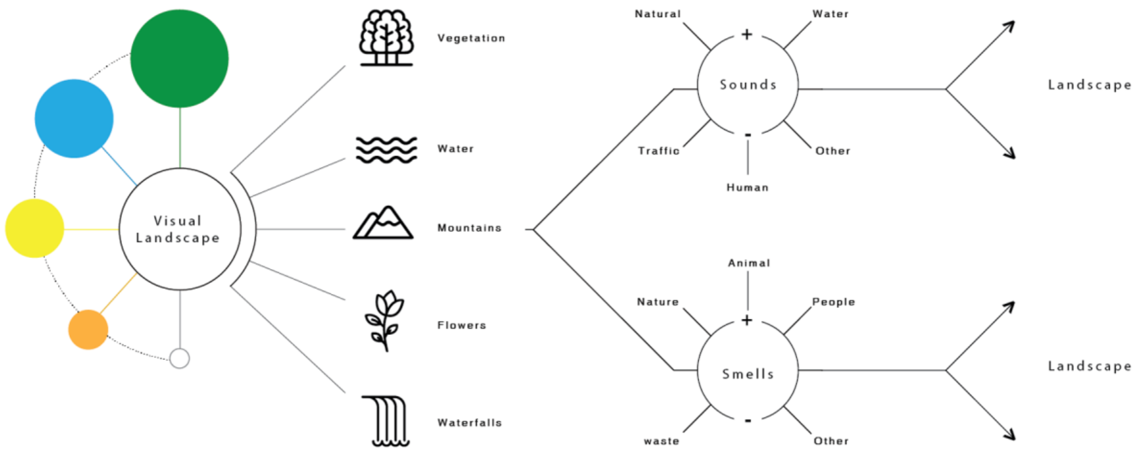
4. Visual landscape, sounds and smells perceived by nature-based tourists

Abstract

This study investigated the visual landscape, sounds and smells perceived by 1377 nature-based tourists who visited Madeira Island, Portugal. Data was collected via questionnaire in the middle (T0) and at the end (T1) of the ‘levadas’ and trails. Multilevel ordinal logistic regression models were used to explore the extent to which the sounds and smells influenced the tourists’ perceived visual landscape quality. The vegetation, water, mountains, green and blue emerged as main elements and colours, while water sounds, nature sounds, and nature smell ‘dominated completely’ the ‘levadas’ and trails. The predicted odds of tourists’ perceived visual landscape in the higher categories reduced by a factor of 0.807 for traffic noise, 0.746 for waste smell, 0.687 for other negative smell, and increased by a factor of 1.536 for nature smell. Results revealed that nature-based tourists perceived the landscape via multiple senses and that incongruent sensory stimuli reduced landscape quality.

Keywords: visual landscape, sounds, smells, nature-based tourism, Madeira

Graphical abstract



Highlights

Vegetation, water, mountains, flowers, sea, waterfalls, and green and blue, emerged as main elements and colours.

Tourists perceived the visual landscape quality of the ‘levadas’ and trails of Madeira Island as ‘very good’ or ‘good’.

The ‘levadas’ and trails were mainly characterized by nature sounds, water sounds, and nature smell.

The perceived visual landscape in the middle of the ‘levadas’ and trails was positively associated with the end.

Tourists’ perceived visual landscape was sensitive to traffic noise, waste smell, nature smell, and other smells.

4.1. Introduction

Current research on nature-based tourism has focused on multisensory lived experiences. That is, the need to trigger all the senses to reinforce the action and interaction of the individual and the place (Filova, Vojar, Svobodova, & Sklenicka, 2014; Kirillova, Fu, Lehto, & Cai, 2014). Landscape perception and preferences may differ from individual to individual and across user-groups. In two recent studies, vegetation type, colour and built heritage emerged as elements of the rural visual landscape (Carneiro, Lima, & Silva, 2015). Trees, flowers, and beach constituted important visual impressions for tourists in south-west Portugal (Agapito, Pinto, & Mendes, 2017). Visitors in Belgium (De Valck et al., 2017), China (Huang & Xu, 2018), Finland (Mäntymaa, Ovaskainen, Juutinen, & Tyrväinen, 2017) and Spain (López-Martínez, 2017) noted especially water and vegetation. Nature-based tourists also perceived the colours in the so-called ‘green and blue spaces’ (Bell, Foley, Houghton, Maddrell, & Williams, 2018; Finlay, Franke, McKay, & Sims-Gould, 2015). Carneiro et al. (2015) reported sounds from ‘nature’, birds, wind, and water, based on the tourists’ perception. Pérez-Martínez, Torija, and Ruiz (2018) highlighted the sounds of birds, water, and visitors as dominant in Alhambra of Granada, Spain. According to Agapito et al. (2017), Carneiro et al. (2015) and

Kastenholz, Carneiro, Marques, and Lima (2012), visitors most often perceived the fresh air/ocean air, flowers, trees, soil/wet earth, and flora.

The literature addressing the interrelationship among visual landscape, sounds and smells is less extensive. The effects of visual landscape on the perception of individual sounds seem to be more important in nature sounds than in artificial sounds (Liu, Kang, Luo, & Behm, 2013). In rural landscapes, sounds were highly variable and landscape characteristics influenced sound perception (Matsinos et al., 2008). In urban green spaces, nature smells had a positive impact on the tourists' perceived landscape (Henshaw, 2014). The influence of age, sex, and education as predictors of landscape perception or preference is inconclusive (López-Martínez, 2017; Filova et al., 2014).

The present study focused on nature-based tourists who hiked in 'levadas' and trails on Madeira Island. The first aim of this paper is to describe the visual landscape of the 'levadas' and trails, as nature-based tourists perceived them, based on type, sun's luminosity, elements, forms, colours, and overall visual landscape quality. Two other aims were (1) to identify the tourists' perceived sounds and smells, and (2) to explore the extent to which the sounds and smells influence the tourists' perceived visual landscape quality, controlling for the tourists' perceived visual landscape in the middle of the 'levadas' and trails, and tourists' socio-demographic characteristics. These results may contribute to evidence-based practice in nature-based tourism, informing guides, travel agencies, government, and other decision-making bodies about the relevance of interactions among perceptual qualities in forming an overall impression of a tourist site.

4.2. Literature review

4.2.1. Landscape, perception, and preferences

The European Landscape Convention defines landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Council of Europe, 2000; Article 1, a.). This definition covers 'a territory as a whole, including natural, rural, urban and peri-urban areas, across land, inland and water, and marine areas' (Council of Europe, 2000; Article 2). The core of this definition is the sensory and emotional perception of the landscape (Council of Europe, 2008), and the 'character of a landscape' or uniqueness of a place (Swanwick, 2004).

The first issue of the landscape' definition encompasses an active engagement and practices, which occur in the landscape (Butler, 2016). That is, 'the activity that occur in the landscape and the individual's thoughts, meanings, and understandings' (Butler & Berglund, 2012). It seems that the more intense the experience, the more intense are the perceptions, feelings, images, and symbols (Lengen, 2015). In fact, some aspects of landscape, such as sense of wildness, sense of security, the quality of light and perceptions of beauty or scenic attractiveness may be subjective and responses to them might be more personal and coloured by the experience of the individual (Swanwick, 2002). Hence, from a practical sense of view, different people or groups may perceive the same landscape in different ways, and these perceptions may change over time (Haines-Young & Potschin, 2005).

The second issue concerns landscape character. The U.S. Forest Service (1974) argued that landscape character is primarily determined in terms of form, line, colour, and texture. Swanwick (2004; 2002) added scale, enclosure, diversity, balance, movement, and pattern to the aesthetic aspects. Tveit, Ode, and Fry (2006) proposed nine key concepts in a framework for analysing visual landscape character: stewardship, coherence, disturbance, historicity, visual scale, imageability, complexity, naturalness, and ephemera. Swanwick (2004) defined landscape character as 'a distinct and recognizable pattern of elements that occur consistently in a particular type of landscape'. In this view, it is the character of the landscape that creates the sense of place (Swanwick, 2004). Landscape character can change over time, creating a succession of landscapes (Van Eetvelde & Antrop, 2009). In tourism literature, 'sense of place' or 'place attachment' has been extended to 'place bonding'; that is, the bonds between individuals and specific places (Woosnam et al., 2018; C.-K. Cheng & Kuo, 2015).

To understand perceptual experiences, it is crucial to know what people value or prefer (R. Kaplan, 1985). This involves the viewer's experience and the characterization of the landscape (Tveit et al., 2006). In a perception-based or subjective approach, the landscape quality is based on overt choices, rankings, or landscape ratings that human viewers provide. In the expert-based or objective approach, the biophysical properties of the landscape are translated into formal properties and relationships among them (Daniel, 2001). Because the two approaches can lead to different perceptions/preferences, a combination of both has been proposed in more recent studies (Tieskens, Van Zanten, Schulp, & Verburg, 2018; Wartmann, Acheson, & Purves, 2018; Atik, Işıklı, Ortaçeşme,

& Yıldırım, 2017; Pardo-García & Mérida-Rodríguez, 2017). In this framework, evolutionary and cultural theories explain the perception and preferences. To begin with, there is a bio-evolutionary preference for landscapes based on our origins on the Africa savannah and needs to 'see without being been' (Gobster, 1999). The second theory is related to our culture, history, and socio-demographic characteristics, which shape our preferences (Tveit et al., 2006; Gobster, 1999; Appleton, 1975). Kaplan, Kaplan, and Brown (1989) proposed a model focusing on physical attributes, land cover types, and informational and perception-based variables, as predictors of environmental preference.

4.2.2. Studies on landscape and nature-based tourism

4.2.2.1. Landscape type and landscape elements, forms, and colours

The visual quality of a landscape tends to increase with the number of natural elements and decrease with the amount of unwanted manmade elements. In Spain, the area of water visible, the degree of wilderness, the presence of mountains, and the percentage of vegetation increased the visual quality of the landscape (Arriaza, Cañas-Ortega, Cañas-Madueño, & Ruiz-Aviles, 2004). In contrast, visual quality decreased with the growing presence of roads, electric power lines and industries. Nevertheless, well-preserved manmade, cultural elements, such as the Andalusian white houses, farm-buildings, and beauty spots, improved the quality of agricultural landscape (Arriaza et al., 2004). In Turkey, the sea, hills, and natural vegetation cover, provided positive effects on the visual quality of landscapes, whereas electric lines, roads, and agricultural fixed equipment had detrimental effects (Bahali & Tamer-Bayazıt, 2017). Cultural landscapes were also outstanding constituents of Greece's protected areas (Vlami et al., 2017) and Ireland rural landscapes (Howley, 2011).

A more recent study in Spain, reported that water bodies and vegetation contributed to a positive evaluation of landscape scenes, while mine sites and industrial units were the least valued landscapes (López-Martínez, 2017). In Chile, landscape scenes with high vegetation density of trees and bushes had a positive effect on visual quality (De La Fuente De Val & Mühlhauser, 2014). In Slovakia and in the Czech Republic, respondents perceived wayside crosses, chapels, high seats, guideposts, and greenery positively (Filova et al., 2014).

A second wave of studies was performed in Portugal. Agapito et al. (2017) investigated tourists' reported sensory impressions of Southwest Portugal, *in situ* and six-month after they returned home. For the sense of sight, sensory impressions reported *in situ* were landscape, natural light, diversity of colours, architectural details, trees, flowers, maritime scenario, animals, sky, river, and beaches. In the post-visit phase, tourists reported seeing landscape, animals, natural light, diversity of colours, local people, architectural details, and river. It was worth pointing out that the trees, flowers, maritime scenery, sky, and beaches had no expression in the post-visit phase. These results led the authors to suggest that perceived richer sensory tourist experiences may have a significant role in the long-term memory of individuals' experiences of places. In another study, tourists appreciated the land covers, such as visual structure, color contrast, and a perceived sense of wilderness (Surová & Pinto-Correia, 2016). In a rural experience, tourists most preferred the natural landscape, mountains, green fields, stones, and monuments, particularly the castle and stone houses and roads. Tourists also perceived the colours green, related to nature, and grey, from the stone (Kastenholz et al., 2012).

4.2.2.2. Sounds and smells

The concept of soundscape is currently defined as the 'acoustic environment as perceived or experienced and/or understood by a person or people, in context' [International Organization for Standardization (ISO), 2014]. The identification of perceived sounds, such as nature sounds, human sounds and technological sounds has been mainly explored in urban environments. In general, people tend to perceive nature sounds as positive, human sounds as eventful and technological sounds as negative (Axelsson, Nilsson, & Berglund, 2010).

A study on the Gezi Park, Turkey, showed that the most positive sounds were bird sounds, street musicians and water sounds, while rubbish/cleaning cars, traffic, police sounds, and construction sounds, were the most negative sounds (Bahali & Tamer-Bayazıt, 2017). In urban open spaces, nature sounds were preferred to urban sounds, such as construction sounds, music from passenger cars and vehicle (Yang & Kang, 2005). Biological sounds and geophysical sounds also affected soundscape perception in an urban area in Germany (Liu, Kang, Luo, Behm, & Coppack, 2013). Moreover, temporal sound variability seems to reflect the daily cycle of anthropogenic activities and biological processes (Matsinos et al., 2008).

The importance of smell is less frequently explored in landscape and tourism research. In a preliminary study, Porteous (1985) introduced the concept of smellscape, suggesting that also smells are spatially ordered or place related. Porteous (1985) noted that the smellscape was not continuous, but fragmentary in space and time. In cities and urban lives, the odours of trees and greenspaces were the most widely favoured, while the smell of traffic fumes was one of the most disliked smells, forming 14% of responses for least favourite odours (Henshaw, 2014).

Xiao and Higgins (2018) developed a model to understand people's judgments regarding the pleasantness of smellscapes. Overall, nine indicators emerged from participants' descriptions: intensity, purity, cleanliness, freshness, calmness, liking, familiarity, appropriateness, and naturalness. In the same line of studies, Gorman (2017) reported that smell could serve as a powerful aide memoire, triggering memories, nostalgia, and a sense of familiarity. Odours were also powerful stimuli that can evoke emotional states (Sullivan, Wilson, Ravel, & Mouly, 2015).

For the sense of hearing, Agapito et al. (2017) revealed that the most common sensory impressions reported *in situ* were birdsong, wind, and sea, whereas in the post-visit stage the focus was on nature, birdsong, and people. For the sense of smell, the top three smellscapes reported *in situ* were sea salty air, plants, and fresh air. In the post-visit phase, the focus was on fresh air, plants, and flowers. The sounds of wind, birds, crickets, and the smells of plants, flowers, and land, were also the sensory appraisals of a rural village (Kastenholz et al., 2012). In Spain, Pérez-Martínez et al. (2018) found that the sounds of birds, water and visitors were the sounds primarily reported as dominant. In addition, the throngs of visitors affected the soundscape quality negatively, whereas nature sounds improved it.

4.2.2.3. Landscape perception and socio-demographic characteristics

In the scope of tourism, Surová and Pinto-Correia (2016) found that user-group, education level and gender influenced people's preferences. New rural inhabitants were mostly likely to prefer identity landscape, while tourists preferred aesthetic landscape.

People with university degrees were most likely to prefer aesthetic landscape. For men, there was no considerable difference between preferring production landscape and wilderness landscape. Italian-speaking tourists were more likely to associate cultural ecosystem services with the landscape, and so were women compared to men (Zoderer, Tasser, Erb, Lupo Stanghellini, & Tappeiner, 2016).

Age-associated variation on the perceived soundscape quality was investigated in some studies. With increasing age, people tended to prefer nature sounds and were more tolerant to human sounds but may have felt annoyed with sounds from young people's activities (Liu, Kang, Luo, Behm, & Coppack, 2013; Yang & Kang, 2005). With regards to gender, females were more favourable to, or tolerant towards, sounds such as church bells, water, music played on the street, clock times or music and children's shouting (Yang & Kang, 2005). In Europe and China, age and education influenced the sound preference, although the effect varied with different types of urban open spaces and sounds. In contrast, gender, occupation, and residence did not influence the sound preference (Yu & Kang, 2010).

Few studies have explored the influence of socio-demographic characteristics in relation to smells. Rawal, Hoffman, Bainbridge, Huedo-Medina, and Duffy (2016) found that the prevalence of self-reported smell alteration was 23% and that this prevalence increased with age, being highest in those aged 80+ years (32%). The authors did not observe an independent influence of sex in self-reported smell alterations. Ferdenzi et al. (2013) found that women rated odours as significantly more intensive than men did and had better identification scores than men, but no reliable sex differences were found for verbal affective responses to odours.

4.3. Methods

4.3.1. Study area

This study took place in Madeira Island. Madeira is in the North Atlantic Ocean, southwest of Portugal, and along with Porto Santo, Desertas and Selvagens Islands form the archipelago of Madeira (Figure 4.1). The archipelago of Madeira is a Portuguese region, the Autonomous Region of Madeira (ARM), with its own government and legislative assembly. Madeira covers an area of 758.5 km^2, with 262 302 inhabitants, approximately half of them living in the city of Funchal, the capital (INE, 2011). The ARM is an integral part of the European Union, having a status of an outermost region.

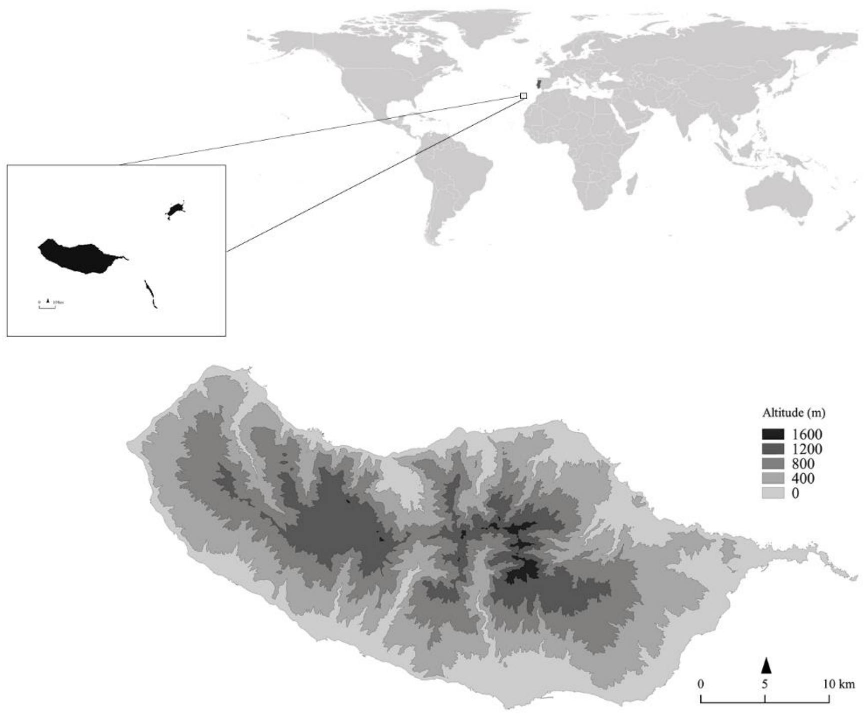


Figure 4.1 The location of the study area, Madeira Island, Portugal. Source: Regional Directorate for Spatial Planning and Environment.

Madeira is the largest island of the archipelago with 57 km length, 22 km at its widest point, and 150 km of coastline. Its orography is characterised by deep valleys, steeped slopes, and scarps (Fernandes, 2015), with an imposing central mountainous massif, that reaches 1862 m at its highest point. The climate of Madeira is predominantly temperate oceanic with clear variations between north- and south-facing slopes (Quintal, 2007; Ribeiro, 1985). The mean annual temperature is 19.6º C and the mean annual precipitation is 627.2 mm, at Funchal. There are 2 447.2 h of sunshine per year. Madeira has a Natural Park that covers about two thirds of its territory. The Laurissilva, the indigenous forest, occupies 22.0% of its surface, mainly in the northern slopes of Madeira, and was classified as World Heritage Site by UNESCO (IFCN, 2018).

In the 18th and 19th centuries, Madeira Island became a resort of therapeutic ends, using curative or therapeutic qualities of its climate to cure tuberculosis (Estudante, 2011). Nowadays, tourism consumption accounts for 26.6% of the Regional Gross Domestic Product of the Autonomous Region of Madeira, Portugal [Direção Regional de Estatística da Madeira (DREM), 2018].

The Madeira Tourism Board reported that the main motive of travelling to Madeira Island was the contact with nature (Secretaria Regional de Turismo da Madeira, 2010). Among the nature-based activities experienced in Madeira Island, hiking is highly appreciated and has some advantages over other leisure activities, because the individual can control the level of skills, the pace of the walk and is available to young and old (Saayman & Viljoen, 2016; Thompson, 2013).

One of the greatest tourist attractions of the Island lies in its 'levadas' which are human-made water canals, with parallel monitoring pathways, built in the fifteenth century, to carry water from the north to the south for agricultural purposes. Today, the 'levadas' are also used for transporting water for human consumption, production of electrical energy and a space for leisure-time activities (Fernandes, 2015; 2010). There are over 1500 km of 'levadas' in Madeira Island. The Madeira Tourism Board recommends 30 'levadas' and trails. The 5 'levadas' and trails more sought by tourists are, in descending order: 'Rabaçal – Risco – 25 Fontes', 'Achada do Teixeira – Pico Ruivo', 'Ponta de São Lourenço', 'Caldeirão Verde', and 'Pico do Arieiro – Pico Ruivo' (Quintal, 2011) (Figure 4.2). In the current study, tourists were surveyed in 45 'levadas' and trails of Madeira Island.

Figure 4.2 Two photographs, left and right, from (1) ‘Rabaçal – Risco – 25 Fontes’, (2) ‘Achada do Teixeira – Pico Ruivo’, (3) ‘Ponta de São Lourenço’, (4) ‘Caldeirão Verde’, and (5) ‘Pico do Arieiro – Pico Ruivo’. Sources: All photographs were provided by the Madeira Tourism Board. An exception was the left photograph of trail 2, Achada do Teixeira – Pico Ruivo, which was provided by Francisco Correia.

4.3.2. Tourists

In total, 1626 tourists participated in a study called ‘The impact of nature tourism and landscape on health: The case of ‘levadas’ and trails in Madeira’ (LevMadeira). The Faculty of Social and Human Sciences of NOVA University of Lisbon, the Faculty of Social Sciences of University of Madeira, and the Faculty of Sports of University of Porto conducted this study. The Research Ethics Committees of the three Universities approved the LevMadeira study protocol and all tourists gave written informed consent. For the tourists, aged 5 to 17 years, an additional written informed consent was obtained from their parents or guardians. Tourists voluntarily took part in the LevMadeira study and received no compensation.

Of the 1626 tourists, 94 were excluded from the analysis due to self-reported difficulties in seeing for getting around, hearing, or smelling; 120 were also eliminated because they had incomplete data; and 35 were left off because they were 14 years old or less. In all, 1377 tourists, 830 females and 547 males, from 27 countries, are included in the analysis. The details on the tourists’ characteristics are presented in the next section, Table 4.1.

4.3.3. Procedures

A team of 10 experienced researchers, with backgrounds in Geography, Sport Sciences, and Nursing, performed this field study between July 2016 and October 2017. Before starting the LevMadeira study, the questionnaires were refined on-site through a pre-test, with members of the research team and local tourists (n = 9), and a first pilot study with friends and relatives (n = 18). Second (friends and relatives, n = 16) and third (hikers from a local nature-based group, n = 21) pilot studies, with test-retest applications, were carried out in June and July 2016. Most of the items of the questionnaire were originally in English and then translated into French, German, Portuguese, and Spanish by native-speaking colleagues from the Faculty of Arts and Humanities of University of Madeira. In a second stage, other native-speaking academic colleagues did a back translation to validate the linguistic versions. We reworded some items of the questionnaire and maintained the originality of the English scales.

Data collection was carried out on 'closed groups', i.e., groups of nature-based tourists who come to Madeira for hiking on 'levadas' and trails, for one week or more, and were led by a mountain guide. The tourist's assessment followed a six-step process. To begin with, we contacted the travel agencies and the mountain guides with the purpose of explaining the study and getting permission. Second, one member of the research team went to the accommodation place to explain the study and invite the tourists to participate. As the study progressed, the mountain guide did this task and a member of the research team only went to the accommodation place when it was strictly necessary. Third, after obtaining permission and scheduled the day, the team members went to the accommodation place, approximately 30 minutes before the departure, to fit the tourists with one electronic device each (ActiGraph accelerometry monitor, Polar V800 GPS sports watch, and Polar Stride Sensor). A member of the team gave a brief explanation regarding to the use of the electronic devices and information collected. Tourists also filled the first part of the questionnaire. Fourth, depending on the size of the group, one or all team members moved to the beginning of the 'levadas' and trails to switch on the heart rate monitors, which were synchronized with the stride sensors. Fifth, one member of the team accompanied the tourists along each 'levada' and trail to solve the problems that could arise with the electronic devices and to carry, and hand out, the printed questionnaires in the middle and at the end of the 'levadas' and trails. The member of the team clarified the doubts that could exist in filling out the questionnaires. At the end of the 'levadas' and trails, the team member switched off the electronic devices. Finally, upon the arrival to the accommodation place, the tourists filled the last questionnaire.

The assessment took place on weekdays and on Saturdays from 08h00 to 20h00. Nineteen travel agencies and 53 mountain guides collaborated in this study. The minimum of hikers assessed per group was one, the maximum was 16, and the mean value was 7.53. The peak flow of assessment was between April and October 2017.

4.3.4. Questionnaires

4.3.4.1. Visual landscape

The items for tourists perceived visual landscape included type, sun's luminosity, dominant elements and forms, and predominant colours. Type and sun's luminosity were assessed in two continuous semantic scales. The scales consisted of a horizontal line, divided in 7 segments, with the first segment representing the most negative response and the last one the positive extreme. For type, the endpoints of the scale were defined by ‘natural’ and ‘cultural’, whereas for sun’s luminosity, the endpoints were ‘very weak’ and ‘very strong’.

Twenty-one items assessing landscape’ perceived elements and forms: water, valley, flowers, farm fields, settlements, cliffs, lake, forest, houses/buildings, road structures, skyline/depth, trails, sea, waterfalls, brook/stream/creek, ‘levadas’, beach, animals, mountain, vegetation, and others, were drawn from the literature. For colours, the scale was a horizontal line, divided in 7 segments, equally distributed, with one colour on each vertical scale mark, describing the seven colours of the rainbow, i.e., red, orange, yellow, green, blue, indigo, and violet. We added white and an extra space to ‘other’. For landscape’ perceived elements, forms and colours, tourists were asked to tick off one or more item, and added some that were missing. Tourists were also asked on the perceived overall visual landscape quality using a 5-point ordinal category scale. The visual landscape items were filled in the middle and/or at the end of the nature-based activity.

4.3.4.2. Sounds and smells

The sound sources were adapted from the ‘Swedish Soundscape-Quality Protocol’ (Axelsson, Nilsson, Hellström, & Lundén, 2014; Nilsson & Berglund, 2006). The sound sources were divided into ‘traffic noise’ (e.g., cars, buses, and airplanes), ‘other noise’ (e.g., construction noise, industry, machines, sirens, and music), ‘sounds from human beings’ (e.g., conversation, laughter, children at play, and footsteps), ‘nature sounds’ (e.g., wind whisper-ring in the trees and singing birds) and ‘water sounds’ (e.g., ‘levadas’, streams of water, waterfalls, and sea). The response format was a 5-point ordinal category scale.

Thirty smells were selected from the literature, mainly from Henshaw (2014) and Porteous (1985), and identified in the preliminary field visits, pre-test, and pilot studies. Smells were grouped into independent categories: ‘waste smell’ (e.g., garbage, plastic bags, smoking related litter, and burning leaves), ‘people smell’ (e.g., body odour, faeces, flatulence, urine, and vomit), ‘animals smell’ (e.g., animal faeces, decomposing animals, and animal odours), ‘nature smell’ (e.g., fresh air, ocean air, flowers, trees, water, streams of water, waterfalls, wind, wind flow, wood, soil, stone, local flora, hay, and aromatic vegetation), and ‘other smell’ (e.g., car fumes, building materials, and industrial pollution). A 5-point ordinal category scale was used for the tourists formulate their answers. Sounds and smells were collected in the middle and at the end of the nature-based activity.

4.3.4.3. Socio-demographic characteristics

Tourists’ socio-demographic characteristics (e.g., gender, age, education, marital status, employment status and home country), frequency of visits to natural environments, and self-rated heath, were provided at the accommodation place, just after the end of the nature-based activity.

4.3.5. Reliability of the questionnaires

Test-retest of the scales was performed via the last two pilot studies. The first group was tested on 25 June and retested on 1 July 2016 (n = 16, 8 females and 8 males). The second group was tested on 2 July and retested on 9 July 2016 (n = 21, 11 females and 10 males). In total, 37 participants, 19 females and 18 males, aged 16–72 years, were included in the reliability analysis. Spearman’s rank-order correlation coefficient for the perceived visual landscape quality was low (*rho* = 0.270) in the middle and moderate at the end (*rho* = 0.614) of the nature-based activity. For types of sounds, correlations were low to moderate in the middle (*rho* between 0.313 and 0.653) and at the end (*rho* between –0.022 and 0.602) of the nature-based activity. For types of smells, correlations were low to high in the middle (*rho* between 0.284 and 0.800) and low to moderate at the end (*rho* between 0.146 and 0.646). In the middle, correlations of other noise, waste smell, animals smell and other smells, were not computed because at least one of the variables was constant.

4.3.6. Data analysis

Descriptive analyses were performed in the two software programmes IBM SPSS (IBM Corp. Released, 2017) and STATA (StataCorp, 2017).

To explore the extent to which the sounds and smells, at the end of the 'levadas' and trails, influence the tourists' perceived overall visual landscape quality, we used two-level models for ordinal outcomes with tourists at Level 1, nested within 'levadas' and trails at Level 2. Several models were fitted to the data. Model 1 is the so-called 'null' or 'the intercept-only model', which does not include any predictors. In Model 1, the intra-class correlation coefficient (ICC) is 0.051 (Table S4.1, see Appendix 1). Therefore, 5.1% of the variance in the tourists' perceived visual landscape quality is accounted for by 'levadas' and trails, which justifies the need of a multilevel approach (Hedeker, 2015).

The tourists' perceived visual landscape in the middle of the 'levadas' and trails was used as covariate. We then added sounds (Model 2), smells (Model 3), and socio-demographic characteristics (Model 4). We also employed higher-order polynomials for age (i.e., age-squared, and age-cubic terms) to test for possible non-linear relationships between age and perceived visual landscape quality. We found no evidence regarding the need to retain either quadratic ($p = 0.311$) or cubic ($p = 0.298$) terms in the final model (Model 4).

The dependent variable is the tourists' perceived visual quality of the landscape along the 'levadas' and trails, recoded in three-categories: 0 = [(very bad), (bad), and (neither good, nor bad)]; 1 = good; 2 = very good. We defined sounds, smells and age as continuous variables and centered them on their sample means to facilitate the interpretation of the parameters. We defined level of education, an ordinal variable, creating two dummies ('no education completed and primary education' vs 'high education', and 'secondary education' vs 'high education') to represent the differences among levels of education. We fixed the exploratory variables at Level 1 allowing the intercepts to vary across Level 2. All the statistical parameters were estimated with adaptive quadrature using the SuperMix software (Hedeker, Gibbons, Du Toit, & Cheng, 2008). Statistical significance was defined by $p < 0.05$.

4.4. Results

4.4.1. Tourists' characteristics

Table 4.1 presents tourists' characteristics. The percentage of female is higher than male ones, 60.3% and 39.7%, respectively. Of the tourists, more than half belong to the age intervals 45–54 and 55–64 years, followed by the tourists with 65–74 and 25–34 years. Seventy-two percent of tourists have higher education; most of them are married/living common-law (46.6%) and have a paid job (69.8%). Tourists are from 27 countries with the highest percentage being from France (73.6%), followed by Germany (6.7%) and United Kingdom (6.6%). A less percentage of tourists are from Spain (3.9%), Belgium (2.7%) and Switzerland (2.2%). All other countries represent 4.4% of the sample. The frequency of visits to natural environments is highly variable. Roughly, half of the tourists report 1–2 (25.7%) or 3–4 (22.0%) visits, per year, while 31.9% stated 9 or more. A great share of the tourists rates their health as very good (48.6%), good (35.0%) and excellent (14.2%).

Table 4.1 Tourists’ socio-demographic characteristics, visit frequency and self-rated health

Socio-demographic		*f*	%
Gender	Male	547	39.72
	Female	830	60.28
Age, years	15–24	35	2.54
	25–34	140	10.17
	35–44	225	16.34
	45–54	384	27.89
	55–64	371	26.94
	65–74	201	14.60
	75–84	21	1.53
Education	Primary	33	2.40
	Secondary	295	21.42
	Higher	1049	76.18
Marital status	Married/living common-law	639	46.61
	Widows	55	4.01
	Separated/divorced	218	15.9
	Single	459	33.48
Employment status	Paid job	949	69.83
	Student	30	2.21
	Housewife	11	0.81
	Retired	320	23.55
	Unemployed	11	0.81
	Other	38	2.8
Country	France	1014	73.64
	Germany	92	6.68
	United Kingdom	91	6.61
	Spain	53	3.85
	Belgium	37	2.69
	Switzerland	30	2.18
	Other countries†	60	4.35
Visits to natural environments, per year	First time	46	3.37
	1–2	351	25.68
	3–4	300	21.95
	5–6	150	10.97
	7–8	84	6.14
	≥ 9	436	31.89
Self-rated health	Excellent	195	14.17
	Very good	669	48.62
	Good	481	34.96
	Fair	29	2.11
	Poor	2	0.15

†Austria (n = 8), Brazil (n = 1), Bulgaria (n = 1), Canada (n = 9), Colombia (n = 1), Congo (n = 1), Czechia (n = 1), Hong Kong (n = 2), India (n =1), Ireland (n = 1), Italy (n = 1), Lithuania (n = 4), Luxemburg (n = 1), Netherlands (n = 3), New Zealand (n = 1), Poland (n = 5), Portugal (n = 5), Vietnam (n = 1), Slovenia (n = 3), United Arab Emirates (n = 1), United States of America (n = 9).

4.4.3. Tourists’ perceived visual landscape

The types of visual landscape and sun’s luminosity are presented in Table 4.2. Most of the tourists perceive visual landscape as natural (79.4%) and with a very strong sun’s luminosity (66.4%).

Table 4.2 Semantic differential items assessing tourists’ perceived visual landscape.

Variables	Semantic scale							Median	Mode
	1	2	3	4	5	6	7		
Landscape type (n = 1349)									
Cultural – natural	23 (1.7)†	24 (1.8)	9 (0.7)	90 (1.2)	132 (9.8)	352 (26.1)	719 (53.3)	7	7
Sun’s luminosity (n =1346)									
Very week – very strong	19 (1.4)	46 (3.4)	104 (7.7)	253 (18.8)	30 (2.2)	303 (22.5)	591 (43.9)	6	7

†Number and percentage in brackets. Semantic scale with 1 representing the most negative response (cultural or very week) and 7 indicating the positive extreme (natural or very strong). Cultural landscape means manmade.

Table 4.3 presents the frequency with which the tourists’ perceived the elements, forms, and colours of visual landscape. More than half of the tourists perceive vegetation, trail, water, mountain, cliff, valley, flowers, ‘levadas’ and forest as the dominant elements and forms. A reasonable percentage of tourists also perceives sea (47.0%), waterfalls (39.6%), skyline/depth (25.9%) and farm fields (21.8%), as dominant elements of the visual landscape. Interestingly, only few tourists perceive Laurissilva forest (3.7%) and volcanic rocks (0.4%) as dominant elements of visual landscape throughout the ‘levadas’ and trails of Madeira Island. The green (90.6%) and blue (40.2%) are the colours that tourists perceive the most, followed by yellow (20.2%), orange (11.0%) and white (10.5%). On the other hand, the less reported colours of visual landscape are the rose (0.2%) and brick (0.1%).

Table 4.3 Tourists' perceived elements, forms, and colours of visual landscape.

Visual landscape		*f*	%
Elements and forms[†]	Vegetation	989	71.8
	Trail	950	69.0
	Water	948	68.9
	Mountain	838	60.9
	Cliffs	796	57.8
	Valley	782	56.8
	Flowers	761	55.3
	'Levada'	757	55.0
	Forest	716	52.0
	Sea	647	47.0
	Waterfalls	545	39.6
	Skyline/depth	356	25.9
	Farm fields	300	21.8
	Settlements	260	18.9
	Brook/stream/creek	252	18.3
	Houses/buildings	193	14.0
	Beach	153	11.1
	Road structure	138	10.0
	Animals	108	7.8
Colours	Green	1247	90.6
	Blue	551	40.0
	Yellow	278	20.2
	Orange	152	11.0
	White	144	10.5
	Red	112	8.1
	Brown	97	7.0
	Grey	63	4.6
	Indigo	48	3.5
	Violet/purple	27	2.0
	Black	18	1.3
	Rose	3	0.2
	Brick	1	0.1

[†]Others: lake (4.9%), Laurissilva forest (3.7%), clouds (0.7%), volcanic rocks/dike/scree (0.4%), fog (0.4%), plateau (0.3%), desert (0.2%), seaport (0.2%), burned trees/forest (0.2%), walkers (0.2%), garden (0.1%), birds (0.1%), minerals (0.1%), wind turbine (0.1%), stairs (0.1%), grass/undergrowth (0.1%).

The perceived overall visual landscape quality is presented in Figure 4.3. In the middle of the 'levadas' and trails, 55.6% of the tourists perceive visual landscape as very good and 36.8% as good. The other tourists perceive the visual landscape as 'neither good, nor bad' (6.0%), bad (1.2%), and very bad (0.4%). At the end of the 'levadas' and trails, 43.0% of the tourists perceive visual landscape as very good, 44.4% as good and 11.0% as 'neither good, nor bad'. This indicate that the overall perception of visual landscape quality is very good and good, albeit a slightly shift from the 'very good' to 'good' or 'neither good, nor bad' categories can be noted from the middle to the end of the 'levadas' and trails.

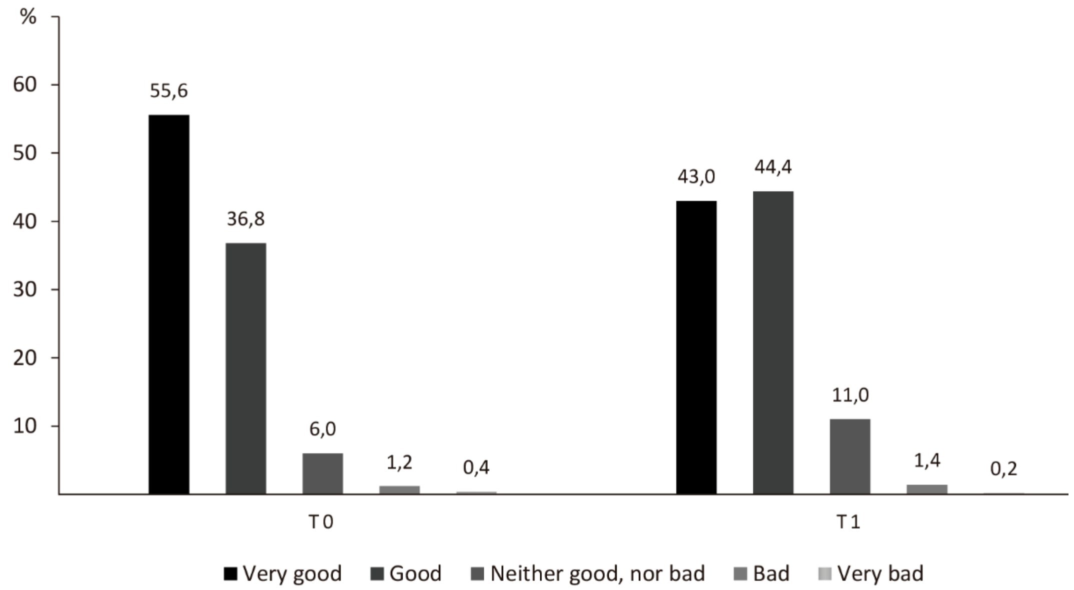


Figure 4.3 Tourists' perceived overall visual landscape quality in the middle of the 'levadas' and trails (T0) and at the end (T1).

4.4.4. Tourists' perceived sounds and smells

Figure 4.4 presents the types of sounds that tourists perceived. In the middle of the 'levadas' and trails, 39.9% of the tourists hear 'a lot' of nature sounds and 34.0% scale nature sounds as 'dominate completely'. Substantial percentages of tourists also hear water sounds 'a lot' (26.5%) or the sound of the water 'dominate completely' (35.4%). The tourists 'do not hear at all' (67.8%) or hear 'a little' (22.7%) the traffic noise. The percentages for 'other noise' in the previous categories are 74.0% and 15.3%, respectively. The human sounds are mainly perceived as 'moderately' (33.8%), followed by 'a little' (28.2%) and 'a lot' (18.5%).

Among smells, nature smells are largely perceived 'a lot' (36.5%) and 'dominate completely' (25.3%). The percentage of tourists who scale 'do not smell at all' is high for waste (85.1%), people (75.9%), animals (80.5%) and other smells (85.2%). At the end of the 'levadas' and trails, more than 50% of the tourists hear nature sounds 'a lot' or 'dominate completely', whereas over than 50% of the tourists 'do not hear at all' traffic and other noises. Near two-third of the tourists scale 'nature smell' as 'moderately', 'a lot' and 'dominate completely'. The largest percentage of tourists 'do not smell at all' waste (84.8%), people (72.8%), animals (86.0%) and other smells (78.0%) (Figure 4.5).

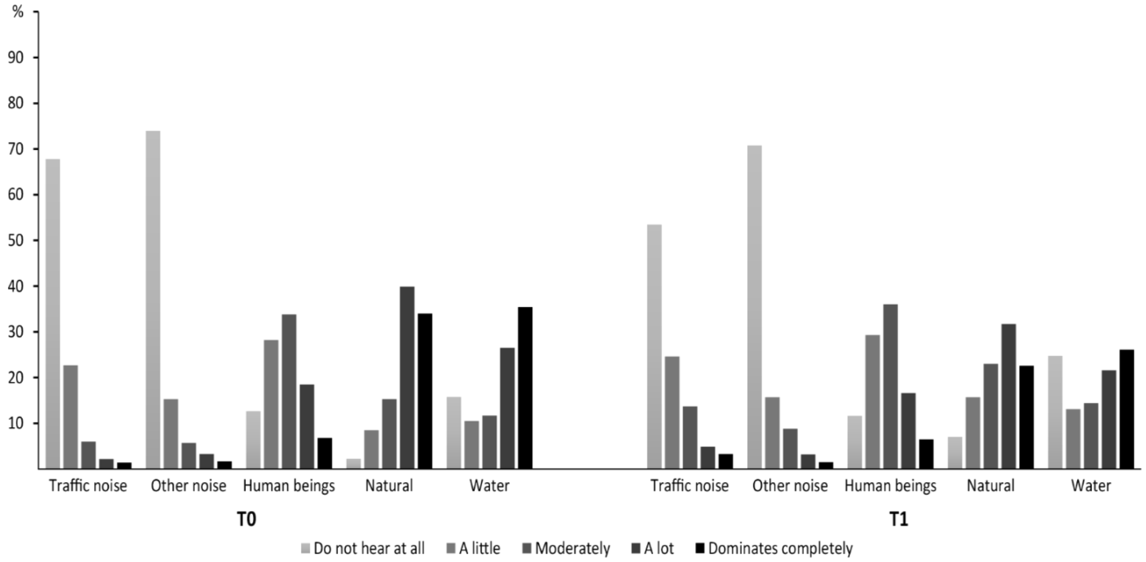


Figure 4.4 Tourists' perceived sounds in the middle of the 'levadas' and trails (T0) and at the end (T1).

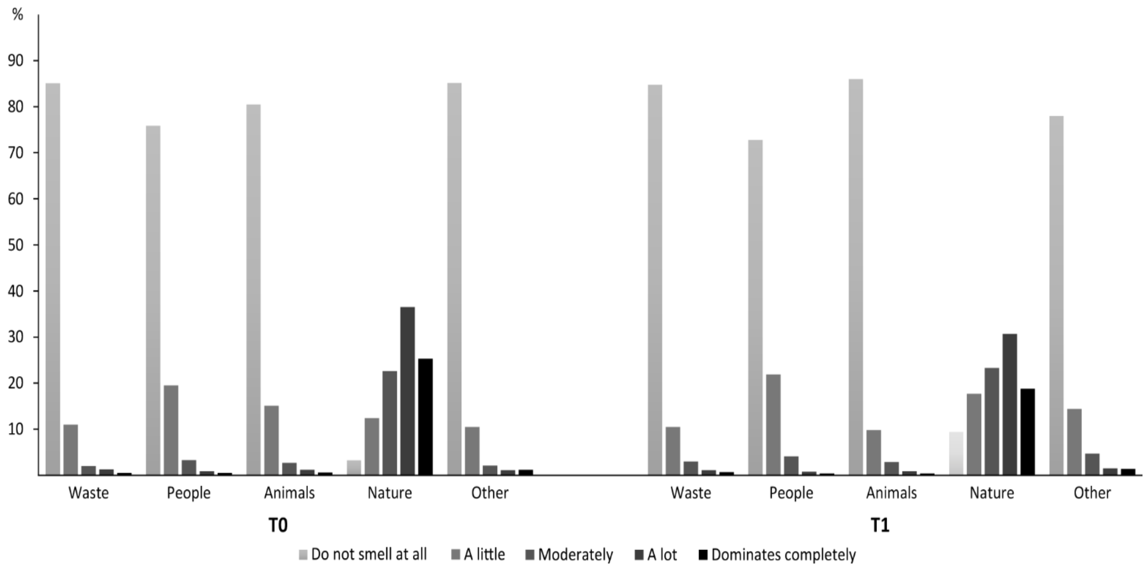


Figure 4.5 Tourists' perceived smells in the middle of the 'levadas' and trails (T0) and at the end (T1).

4.4.5. Tourists' perceived visual landscape, sounds and smells

Table 4.4 presents the estimated coefficients, standard errors, *z*-values, *p*-values, odds ratios and 95% odds ratios confidence intervals of the full multilevel model; that is, the model that includes the tourists' perceived visual landscape in the middle of the 'levadas' and trails, the types of sounds and smells, and the socio-demographic characteristics. The estimated parameters of all multilevel models are provided in supplementary material (Table S4.1, Appendix 1).

One of the assumptions underlying multilevel ordinal outcomes is that the covariate effects relate to both of the cumulative logits. In other words, the regression slopes would be equal, regardless of how one did the dichotomization (1 vs 2 and 3, and 1 and 2 vs 3) (Hedeker, 2015). Thus, for tourists' perceived visual landscape covariate, the predicted odds of tourists' perceived visual landscape in the higher categories increase by a factor of 2.576 or are 2.576 times greater ($p < 0.001$), at the end of the 'levadas' and trails, holding the other predictors and the random effect constant. This means that tourists with a higher perception of the visual landscape, in the middle of the 'levadas' and trails, are more likely to show a high perception of the visual landscape, at the end of the 'levadas' and trails.

Similarly, for traffic noise, the predicted odds of tourists' perceived visual landscape in the higher categories decrease by a factor of 0.807 (or reduce by 19.3%) ($p = 0.001$), given that the other predictors in the model and random effect are held constant. That is, higher levels of traffic noise increase the odd of reporting lower levels of visual landscape.

Waste smell and other smell are negatively related to tourists' perceived visual landscape. The predicted odds of tourists' perceived visual landscape in the higher categories decrease by a factor of 0.746 (or reduce by 25.4%) ($p = 0.006$) for waste smell and decrease by a factor of 0.687 (or reduce by 31.3%) ($p < 0.001$) for other smell, holding the other predictors and the random effect in the model constant. Nature smell is positively related to tourists' perceived visual landscape quality. The predicted odds of tourists' perceived visual landscape in the higher categories increase by a factor of 1.536 or are 1.536 times greater ($p < 0.001$), holding the other predictors and the random effect in the model constant. In other words, the higher the nature smell, the higher the tourists' perceived visual landscape quality, at the end of the 'levadas' and trails.

Table 4.4 Summary of the final multilevel ordinal logistic regression model exploring the relationship of tourists' perceived visual landscape with sounds, smells and socio-demographic characteristics.

Model Term	Coefficient	Std. Error	*z*	Sig.	Odds ratio	95% odds ratio confidence intervals	
						Lower	Upper
Fixed effects							
Threshold (1)	–1.054	0.177					
Threshold (2)	1.821	0.181					
Tourists' perceived visual landscape (T0)	0.946	0.094	10.12	< 0.001	2.576	2.145	3.095
Sounds							
Traffic noise	–0.214	0.067	–3.19	0.001	0.807	0.708	0.921
Other noise	–0.125	0.074	–1.69	0.091	0.883	0.764	1.020
Human beings	–0.079	0.056	–1.40	0.162	0.924	0.827	1.032
Natural	0.117	0.064	1.84	0.066	1.124	0.992	1.273
Water	0.073	0.050	1.45	0.148	1.075	0.975	1.187
Smells							
Waste	–0.293	0.106	–2.75	0.006	0.746	0.606	0.919
People	0.105	0.104	1.01	0.311	1.111	0.906	1.362
Animal	0.119	0.117	1.02	0.307	1.126	0.896	1.416
Nature	0.429	0.054	7.90	< 0.001	1.536	1.381	1.709
Other	–0.376	0.092	–4.09	< 0.001	0.687	0.573	0.822
Socio-demographic characteristics							
Sex	0.001	0.114	0.01	0.994	1.001	0.800	1.252
Age	0.004	0.005	0.90	0.366	1.004	0.995	1.013
Education†							
Primary	–0.103	0.373	–0.28	0.782	0.902	0.435	1.873
Secondary	0.016	0.142	0.12	0.908	1.017	0.770	1.341
Random effect							
'Levada'/trail variance (level 2)	0.148	0.068					
Model fit							
Deviance (-2 log *L*)				2291.82			

Notes: Tourists' perceived visual landscape quality (dependent variable), 0 for 'very bad, bad, and neither good, nor bad'; 1 for 'good'; 2 for 'very good'. T0, middle of the 'levadas' and trails. †High education as reference. Age and types of sounds and smells are treated as continuous variables and are mean-centred.

4.5. Discussion

This study focuses on visual landscape of 'levadas' and trails of Madeira Island. Most of the participants perceived the visual landscape as natural. Two reasons for this high natural assessment might be the 'perceived beauty' and 'naturalness' as Scott (2002) reported. Indeed, findings from other studies have shown that natural landscapes received high preferences scores (Simonič, 2003), while human impact on landscapes detracted their scenic beauty (López-Martínez, 2017; Kirillova et al., 2014). It is noteworthy that few participants perceived the 'levadas' and 'agricultural dry-stone terraces' as cultural landscapes. This unity of man and nature is the living expression of how human intervention is possible without causing damage to the local ecosystems (Quintal, 2011).

The participants perceived the sun's luminosity of 'levadas' and trails as very strong. On potential explanation might be the high number of hours of sunshine, open areas, skyline/depth, and high mountains that offers great views of the forest, cities, villages, and sea. The present results are consistent with previous studies showing that light, colour, and brightness influenced the participants' preferences (Agapito et al., 2017; De Valck et al., 2017; Brown & Brabyn, 2012; Strumse, 1994; R. Kaplan, 1985).

The results of the 'LevMadeira study' revealed that more than 50% of the participants picked out vegetation, trails, water, mountain, cliffs, valleys, flowers, 'levadas', and forest, as dominant elements and forms of the visual landscape. Other relevant elements included sea, waterfalls, and farm fields (Table 4.3). Carneiro et al. (2015) found that vegetation type, colour and built heritage emerged as key experience elements. Agapito et al. (2017) reported trees, flowers, and beach as sight impressions, *in situ*, of 181 tourists surveyed in Southwest Portugal. In line with these studies, Madeira Island retained positive landscape's attributes and added others, which guarantee some distinctiveness.

The participants perceived the green and blue colours the most. Such areas have been referred as 'green and blue spaces' and play an important role in promoting health and wellbeing (Bell et al., 2018; Finlay et al., 2015; Volker & Kistemann, 2011). It should be noted that landscape perception is light dependent. As the light diminishes, the landscape become into a 'pared down palette of blacks and greys' (Edensor, 2013). In a Portuguese village, tourists reported the green of the vegetation, the grey of the houses, the blue of the sky, and the orange of the sunset/roofs. In another village, tourists reported the brown of the schist stone used in the local (Carneiro et al., 2015). In the present study, in addition to green and blue, the participants indicated an array of colours, which might be explained by the different landscapes and colour's intensities.

In the 'levadas' and trails of Madeira, natural and water sounds dominated completely, or the participants heard them a lot (Figure 4.4). Agapito et al. (2017) found similar results in the Southwest Portugal. The same holds for rural landscapes (Carneiro et al., 2015) and a monumental site (Pérez-Martínez et al., 2018). Agapito, Valle, and Mendes (2014) strengthened the idea that these sounds 'help to activate the aural sense' and Abbott, Taff, Newman, Benfield, and Mowen (2016) stated that nature sounds facilitate attention restoration. Half or more of the participants perceived nature smells as 'a lot' or 'dominates completely'. In the studies performed in Southwest Portugal (Agapito et al., 2017; 2014) and the two Portuguese villages of Linhares da Beira and/or Janeiro de Cima (Carneiro et al., 2015; Kastenholz et al., 2012), the fresh air/ocean air, flowers, trees, soil/wet earth, and flora were the smells the visitors perceived the most. Madeira Island seems to add to the previous studies the streams of water and waterfalls insuring diversity, novelty, and uniqueness.

The visual landscape the participants perceived in the middle of the 'levadas' and trails was significantly associated with the visual landscape they perceived at the end (Figure 4.3). This may not be surprising considering the maintenance of landscape attributes alongside the 'levadas' and trails. However, some participants changed their visual landscape's perceptions from 'very good' to 'good' or from 'very good' to 'neither good, nor bad' or from 'good' to 'neither good, nor bad' categories. One explanation for this landscape-related decline may be fatigue. The mean hike time was 6.03 h (SD = 1.45 h) and some participants could arrive at the end of the 'levadas' and trails without sensitivity to appreciate the landscape attributes. Another explanation might be the change in sounds and smells. We found an increase of traffic noise and other noises from the middle to the end of the 'levadas' and trails, while an inverse trend was seen for nature and water sounds (Figure 4.4).

In the final multilevel model, traffic noise, waste smell and other smells had a negative influence on the visual quality of the landscape. These sounds and smells seem to affect the image of a place and are perceived as 'out of place' (Henshaw, 2014; Kirillova et al., 2014). In contrast, nature smells had a positive influence on visual quality of the landscape and are more likely to be identified, expected, and accepted in the green spaces (Henshaw, 2014). The smell of trees, green space and water provoke fascination and are associated with positive recollections of environment (Henshaw, 2014). In addition, nature sounds, and smells contributed to the long-term memory of tourist experiences, encouraging favourable tourist behaviour towards destinations (Agapito et al., 2017).

In this study, socio-demographic characteristics were not significantly associated with the visual quality of the landscape. Although these characteristics were only used as covariates in the multilevel models, this finding is consistent with the results of López-Martínez (2017) in a study carried out in Mediterranean areas. However, this stands in contrast with the results of Filova et al. (2014), who observed a significant effect of sex and place of resident on visual preferences in Slovakia and Czech Republic.

The questionnaire, statistical models and tourists' characteristics may confine our findings. The Swedish Soundscape Quality Protocol was developed for measuring the soundscape perception in open urban and suburban areas. Although we included a variety of sounds and smells that may be present in the 'levadas' and trails, the low to moderate test-reliability may reflect some insensitivity of the questionnaire in expressing the perceived sounds and smells sources. Second, the statistical model could be extended to a three-level model and explore whether the sounds and smells explained any change over time on tourists' perceived visual landscape. We performed this analysis and the results showed remarkable commonalities with the two-level models; however, the deviances were lower in the two-level models and we decided for this approach. Third, French tourists were overrepresented in our sample. We believe that this homogeneity may lead to bias towards the tourists' perceptions of visual landscape, sounds and smells, although previous research about this issue has been inconclusive (Jeon et al., 2018; Pérez-Martínez et al., 2018; Buijs, Elands, & Langers, 2009). Finally, perceptions of nature-based tourists who visited Madeira for hiking one week or more may be quite different from day-hikers or those who give a tour by car through the island and only stop in scenic spots.

Despite these potential limitations, some strengths and practical benefits must be acknowledged. The large sample of nature-based tourists, the data collected over a period of 1.2 years, the variety of 'levadas' and trails, the two time-points of the tourists' perceived visual landscape quality, and the multilevel analysis exploring the influence of sounds and smells on tourists' perceived visual landscape quality, are some strengths of this study.

With regards to the practical benefits, there are at least four, which deserve our attention. The first of these is the use of the landscape attributes by the nature-based tourists. A baseline data is now available and can serve as a guide to select a destination and a standard against which the tourists can interpret or assign a meaning to their own perceptions (Daniel, 1992). In addition, sounds and smells may heighten nature-based activity. A second, is the information that the mountain guides provide. These professionals should enhance tourists' hearing and smell experiences along the 'levadas' and trails. The tourists' lack of knowledge of volcanic rocks and Laurissilva forest requires an intervention of the mountain guides to bridge this gap. Tourists and mountain guides should maintain a litter-free environment aiming to create a better landscape. A third benefit is related with the travel agencies' use of the tourists' perceptions. Nature sounds and smells should be considered as a new tourism resource and be incorporated into destination image (Jiang, Zhang, Zhang, & Yan, 2017; Ciach et al., 2017; T.-M. Cheng, Hung, & Chen, 2015). A fourth benefit is the possibility for the Madeira Tourism Board and other decision-making bodies to make use of tourists' perceptions. Key factors of better-informed decisions are the identified elements, forms and colours of visual landscape, and sound and smell experiences. The knowledge about landscape attributes is of high relevance and can stimulate attempts of diagnosis, protecting, managing, planning, and brand's identity (Filova et al., 2014). Based on the previous benefits, special efforts should be designed to reduce traffic noise, protect nature sounds and nature smells, eliminate the waste and others smells, and preserve and promote a balance, diverse, novel, and unique landscape.

4.6. Conclusions

The tourists described the visual landscape as natural. The perceived elements and forms were the vegetation, water, mountains, cliffs, valleys, flowers, sea, and waterfalls. Tourists also perceived the green and blue as the main colours. We also found that the tourists' perception of visual landscape quality was high but changed from the middle to the end of the 'levadas' and trails. Tourists also identified the nature sounds and smells, and water sounds, as the sounds and smell sources that were presented in the 'levadas' and trails. We also found an increase of traffic noise and other noises, and a decrease of nature and water sounds from the middle to the end of the 'levadas' and trails. Traffic noise, waste smell and other smells had a negative influence on the tourists' perceived visual landscape. Furthermore, nature smells had a positive influence on visual landscape.

In the context of the nature-based tourism research, future studies should include more effective scales of sounds and smells sources. A third assessment of visual landscape, sounds and smells, would be valuable in studying change, stability, and prediction of visual landscape quality. With three time-points, a three-level model will be a useful approach to visual landscape. A balanced sample in terms of nationalities and type/level of hikers, as well as expert judgements will reinforce and complement the present findings.

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Capítulo 5

Short-term change, prediction, and mediation of emoticons in nature-based tourism

5. Short-term change, prediction, and mediation of emotions in nature-based tourism

Abstract

This study assessed the change in emotions during one-day hiking activity. The sample comprised 1346 tourists, 15-84 years old, who visited Madeira Island. Emotions were self-reported on-site at the beginning, middle and end of 45 trails. A range of variables, including socio-demographic, environmental, hike and restorative quality was used as predictors. Tourists increased valence, pleasant activation, and pleasant deactivation from the beginning to the middle and from the middle to the end of the trails. Nature smells were among the positive significant predictors in the two-halves of the trails. The effectiveness of all 17 predictors varied in the first and second halves. The highest variance explained by the predictors was 56.2% in the first half and 34.5% in the second. Being away and fascination mediated the relationship between landscape and emotions. To enhance emotions, tourism professionals should maximize the landscape features and promote the engagement of effortless attention.

Keywords: nature-based tourism, landscape, emotions, restorative quality, Madeira Island.

5.1. Introduction

It has long been acknowledged that Madeira Island attracts tourists due to the ‘levadas’, Laurissilva forest, landscape, mild climate, sun-sand, unique story, pallet of flavours, unmissable events, safety and hospitality of local people (Turismo da Madeira, 2020).

There is a broad consensus that natural environments promote restorative experiences (S. Kaplan, 1995) and elicit positive emotions (Abraham, Sommerhalder, & Abel, 2010). Prior studies in tourism research highlighted the importance of affects, emotions, and moods as key components of the affective or hedonic experience (Moyle, Moyle, Bec, & Scott, 2019; Gao, Zhang, Kerstetter, & Shields, 2018; Malone, McKechnie, & Tynan, 2018; d’Hauteserre, 2015; Lin, Kerstetter, Nawijn, & Mitas, 2014; Hull, Stewart, & Yi, 1992; Hull, 1990). Such concepts seem to be important to understanding how to promote tourism destinations, to enhance and shape experiences, and to develop mindful experiences (Bastiaansen et al., 2019; Skavronskaya et al., 2017).

Empirical findings of tourism research indicated that nature-based destinations' aesthetics was highly associated with the sense of fascination (Kirillova & Lehto, 2016). Pleasure had a positive significant impact on satisfaction and loyalty (Carneiro, Eusébio, Caldeira, & Santos, 2019) and those experiencing greater pleasure and arousal showed an increased level of satisfaction (Bigné & Andreu, 2004). Some former studies have also provided evidence that emotions change during tourist's vacations (Lin et al., 2014; Nawijn, Mitas, Lin, & Kerstetter, 2012; Hull, Michael, Walker, & Roggenbuck, 1996) and that tourists used different emotion regulation strategies (Gao et al., 2018). A small amount of research has been done on predictors of core affect (Fossgard & Fredman, 2019; Agapito, Pinto, & Mendes, 2017; Ratcliffe, Gatersleben, & Sowden, 2013; Hull et al., 1992).

Until now few research has been made about emotions or core affect and predictors of change during one-day hiking activity. There are also few studies on the relationship between core affect – valence and activation – and restorative qualities of person-environment transactions in nature-based tourism. To help address these issues, the aims of this study are: (1) to assess the dynamic pattern of core affect of nature-based tourists during a one-day hiking activity; (2) to explore how far socio-demographic characteristics of nature-based tourists, demographic characteristics of mountain guides, environmental characteristics, hike features and perceived restorative quality account for change in core affect; and (3) to investigate whether psychological distance from ordinary demands (being away) and positive engagement with the environment (fascination), two conceptual properties of restorative environments, mediate the relationship between perceived visual landscape and change in core affect. We focused on four questions: (1) Is there a change in core affect from the beginning to the middle and from the middle to the end of the 'levadas' and trails? (2) What are the predictors of change of core affect from the beginning to the middle and from the middle to the end? (3) Has one-specific predictor a similar relationship with core affect in the two halves of the 'levadas' and trails? (4) Are being away and fascination mediators of the relationship between perceived visual landscape and change in core affect? A theoretical model is proposed, suggesting that change in core affect is partially explained by a range of predictors and that visual landscape has an effect on change in core affect through restorative quality.

This study develops in Madeira Island, otherwise known as ‘the island of eternal spring’, which has taken the title of ‘World’s Leading Island Destination’ for the past five years [World Travel Awards (WTA), 2020] and is a prime destination to nature-based tourism. Our research intends to help individuals to understand the affective dynamics that unfold while walking a trail and to promote tourism experiences. We first introduced concepts concerning to core affect and restorative experience and then presented the results on core affect and restorative experience over the course of a walk/hike and studies on tourism.

5.2. Literature review

5.2.1. Core affect

Core affect is ‘a neurophysiological state that is consciously accessible as the simplest raw (nonreflective) feelings evident in moods and emotions’ (Russell, 2003). In other words, ‘the most elementary consciously accessible affective feelings’ (Russell & Barrett, 1999) or ‘the basic affective qualities of any emotional experience, always present and cognitively accessible at any given moment’ (Västfjäll & Gärling, 2007; Russell, 2003). Core affect is what is commonly called a feeling and is the heart of emotion, mood and any other emotionally charged event (Yik, Russell, & Steiger, 2011; Russell, 2003).

The structure of core affect or any affective experience, as assessed through self-reports, is best represented in a two-dimensional bipolar space (Russell, 1980). The two dimensions reflect degree of valence or pleasantness, the horizontal axis, and degree of activation or arousal, the vertical axis. The valence dimension ranges from pleasure, the right side of the circle, to displeasure, the left side. The activation ranges from active, the top half of the circle, to passive, the bottom half (Russel, 2003; Russell & Barrett, 1999). At any point in time, a person sense being somewhere on a continuum ranging from high to low levels of both dimensions, passing through the centre, the subjective neutral point (Russell & Barrett, 1999). In the valence dimension, the feeling is an assessment of one’s current condition, i.e., how well one is doing, whereas in the activation dimension, the feeling is one’s sense of mobilization or energy (Russell, 2003). Core affect is assessed by asking how one is feeling right now (Russell & Barrett, 1999). In the scope of the

‘Swedish Core Affect Scale’ (SCAS), Västfjäll and Gärling (2007) and Västfjäll, Friman, Gärling, and Kleiner (2002) proposed 12 bipolar adjectives to tape valence and activation, as well as two intermediate dimensions labelled ‘pleasant activation–unpleasant deactivation’ and ‘unpleasant activation-pleasant deactivation’.

5.2.2. Restorative experience

Another concept is restorative experience, one widely disseminated account of which is offered in attention restoration theory (ART) (S. Kaplan, 1995; Kaplan & Kaplan, 1989). ART builds on the concepts of ‘voluntary attention’ (active) and ‘involuntary attention’ (effortless) by James (1892) and on the idea of fatigue explored by Olmsted (1865). ART holds that ‘any prolonged mental effort leads to directed attention fatigue’ and that this attentional resource can be restored in natural environments rich in being away, fascination, extent or coherence and compatibility (S. Kaplan, 1995).

In ART, the terms ‘voluntary attention’ and ‘involuntary attention’ were called directed attention and fascination, respectively, with the aim of avoiding misunderstandings others had with James’ (1892) terminology. Directed attention requires effort, while involuntary attention is effortless and both types of attention are similar in being inhibitory and in having their effect through suppression of competition (S. Kaplan, 1995). Thus, central to ART, is that involuntary attention is likely to be resistant to fatigue. Further, while the individual is in involuntary mode, directed attention should be able to rest (S. Kaplan, 1995).

One way to regain full effectiveness in functioning of directed attention is through natural or preferred environments (Kaplan & Kaplan, 1989). That is, an environment that has the potential for eliciting fascination or that can permit fascination to come in to play (Hartig, Korpela, Evans, & Gärling, 1996). According to these authors, ‘when a person can rely on fascination in ongoing activity, demands on the central inhibitory capacity are relaxed and a capacity for directing attention can be renewed’. It is worth noting that only ‘soft’ fascination, i.e., an experience of moderate fascination with aesthetically pleasing stimuli, such as clouds, sunsets, snow patterns, the motion of the leaves in the breeze, waterfalls, caves and fires, is connected to effortless attention and this form of fascination is more common in natural environments (S. Kaplan, 1995; Kaplan & Kaplan, 1989). Soft fascination also provides an opportunity to reflect on one’s life, on one’s priorities and possibilities, on one's actions and one's goals (S. Kaplan, 1995). In a related sense, fascination refers to 'the way in which attention becomes captured by environmental elements and the process of exploration' (Nordh, Hartig, Hagerhall, & Fry, 2009) or being engaged with effortless attention (Packer, 2014).

To proceed with the restoration of attentional resources, ART posits that a natural environment has to promote senses of being away, extent or coherence and compatibility. S. Kaplan (1995) and Kaplan and Kaplan (1989) refer to being away as 'being distinct from the everyday environment' or 'being involved in cognitive content different from the usual'. It involves a change of scenery and the absence of the pressures, constraints, and distractions (Kaplan, 1983). In other words, a distance from routine activities, demanding tasks, thoughts and the pursuit of given goals and purposes (Korpela & Hartig, 1996). Extent refers to the sense of being 'in a whole other world' (Kaplan & Talbot, 1983). It implies connectedness, i.e., 'interrelatedness of the immediately perceived elements of the situation' (Kaplan & Kaplan, 1989) and 'a domain of larger scope to anticipate, explore and contemplate' (Kaplan & Talbot, 1983). The environment has 'to be rich and coherent enough so that it constitutes a whole other world' (S. Kaplan, 1995). The last component is compatibility, i.e., 'a setting in which what people wanted to do, needed to do, and were interested in observing, converged or matched' (S. Kaplan, 1983).

5.2.3. Change in core affect and restorative experience over the course of a walk/hike

In exploring the ebb and flow of brief leisure experiences, Hull et al. (1996) reported changes from phase to phase and within the on-site phase in walking along a rural road or walking in a built setting. Walkers increased their feeling of self-esteem, lessened negative feelings of anxiety and dullness, and enhanced positive feelings of calmness and perceived freedom. In another study, Hull and Michael (1995) found that feelings of anxiety, tiredness and energy levels decreased with time in a brief leisure experience at an urban park. In an exploratory study, More and Payne (1978) also observed a decrease in most negative affects of visitors to three Audubon nature centers in Massachusetts.

More recent studies have focused on the qualities of natural environments/ experiences and the mechanisms through which the human-nature relationship occurs.

For example, Marselle, Irvine, Lorenzo-Arribas, and Warber (2015) examined the effect of perceived environment type and indicators of perceived environmental quality on short-term emotional well-being following outdoor group walks in England. Results revealed that perceived restorativeness and perceived walk intensity predicted greater positive affect and happiness. Yet, Marselle, Irvine, Lorenzo-Arribas, & Warber (2016) reported that perceived restorative quality mediated the effect of perceived environmental quality on emotional well-being, namely post-walk positive affect, happiness, and negative affect. That is, perceived naturalness and bird biodiversity offered opportunities for a restorative experience which then contributed to positive emotional well-being.

In line with the above, Sato and Conner (2013) observed that fascination enhanced the relationship between time spent in nature and higher positive affect. Further, fascination played a significant role in the process between exposure to nature and reduced negative affect among women. In urban and peri-urban green spaces, Carrus et al. (2015) showed a positive role of biodiversity upon perceived properties and self-reported well-being. Scopelliti et al. (2012) showed a positive relation between biodiversity in the settings, perceived restorative properties, and self-reported benefits. Perceived restorativeness also mediated the relation between exposure to nature and self-reported benefits.

Within this framework, features of natural environments can interact with being away, fascination, extent, and compatibility, as experienced by a person, which in turn can affect the degree of restoration achieved by that person (Lindal & Hartig, 2015; S. Kaplan, 2001).

5.2.4. Studies on tourism and restorative environments

In studies covering the entire vacation, Kirillova and Lehto (2016) found that the most salient aspect of perceived restorative qualities was fascination, i.e., nature-based destinations' aesthetics was highly associated with the sense of fascination, which prompts a tourist to act on involuntary attention, allowing directed attention to rest. Gao and Kerstetter (2018) and Gao et al. (2018) showed differences in the use of emotion regulation strategies, suggesting variation over different stages of a tourist's vacation. Specifically, tourists used three phases of emotion regulation strategies during their vacations: interpersonal, situational, and intrapersonal. Socio-demographic characteristics also played a significant role in explaining patterns of changes (Gao et al., 2018).

The effects of destination restorativeness on recovery and satisfaction were more pronounced in urban rather than nature-based vacations for Chinese travellers (Lehto, Kirillova, Li, & Wu, 2017). Lin et al. (2014) reported that American and Dutch tourists felt better during the second section rather than the end of their vacation and that none of the negative emotions exhibited significant changes over time. Nawijn (2010) reported that mood of tourists was lower among people who were in the first 'travel phase' and highest during the 'core phase', which covers about 70% of the holiday time. Mood then declined slightly but increased during the last part of the holiday. A recent study by Kwon and Lee (2020) found that life satisfaction and affect had risen 15 days before travel and lasted for about 1 month after travel. Travel satisfaction had a direct effect on the change rate of life satisfaction after travel, and expectation and serendipity had a significantly indirect effect on the change rate of life satisfaction after travel, mediated by travel satisfaction.

Another body of research focused on a particular event. For example, Bigné, Andreu, and Gnoth (2005) and Bigné and Andreau (2004) studying the tourists' emotions of visitors to a theme park/museum reported that those experiencing greater pleasure and arousal showed an increase level of satisfaction and that cognitive theory of emotions better explains the effect of pleasure on satisfaction. Indeed, emotions seem to be crucial to the away in which touring bodies relate to others and to places (Buda, d'Hauteserre, & Johnston, 2014). In 'the Medieval Journey in the Land of Saint Mary', Carneiro et al. (2019) observed that pleasure was the only dimension of emotions that had a significant impact on satisfaction and loyalty and a mediating role between eventscape and satisfaction.

In short periods, Hartig, Mang, and Evans (1991) exploring the restorative experience through a quasi-experimental field study and a true experimental, reported that participants in the natural environmental group experienced being away, fascination, coherence/extent and compatibility to a greater degree than did participants in either the urban walk or relaxation conditions. In a day-hike event, Hull et al. (1992) observed that feelings of excitement, bored and relaxed varied significantly from point to point along the trail, while dominance and being rushed were nearly constant across all markers.

The studies cited above reinforces that core affect change along the vacation, in specific events and during one-day hiking activity or even in some minutes walking in green spaces. Being away and fascination, two perceived restorative qualities, mediate the relationship between perceived environmental quality and emotional well-being. The effect of background characteristics or other predictors are not consistent in the literature.

5.3. Methods

5.3.1. Study site

The study was carried out in Madeira Island, Portugal. The Island is located at 967 km of southwest of Lisbon, the Portuguese capital, and is approximately at the same latitude as the Moroccan city of Casablanca. Its coastline of 150 km delimits 758.5 km^2 of surface that rises towards the center and interior of the Island and culminate in peaks with over 1 800 m of altitude. The Island is of volcanic origin and has a flat shell form flanked by cliffs and cut by deep narrow valleys, with a strong slope often perpendicular to the sea.

The climate is generally temperate oceanic. The northern slope of the Island, exposed to the fresh and humid northeast winds, has lower average temperatures and more precipitation than the southern slope, sheltered by the central mountain crest. In the south, the climate has more pronounced dryness characteristics, with long dry summers resembling the Mediterranean climate (Ribeiro, 1985). For these reasons and because of the harsh relief that discourages human settlement, the forest and wooded areas dominate the north of the Island, displaying the best specimens of the three Laurissilva indigenous forest communities: the ‘barbuzano’, ‘til’ and ‘vinhático’ (Capelo, Sequeira, Jardim, & Costa, 2004). The Laurissilva forest occupies 22.0% of the surface area of the Island and is a World Heritage Site (IFCN, IP-RAM, 2020), as well as a Biogenetic Reserve (Council of Europe, 1992).

The geographical distribution of the population, currently estimated at around 250 thousand, is uneven, with only 5.8% residing in the north of the Island [Direção Regional de Estatística da Madeira (DREM), 2017]. The main city is Funchal, which alone concentrates almost 105 000 inhabitants. The relatively remote location and the special features of Madeira’s topography, flora, and fauna work together to make tourism an important source of income. Nowadays, the tourism consumption accounted for 26.6% of the Regional Gross Domestic Product of the Autonomous Region of Madeira, Portugal (DREM, 2018). So, research in emotions and restorative quality can enhance tourism experiences (Bastiaansen et al., 2019; Zhang & Xu, 2019; Agapito et al., 2017; Skavronskaya et al., 2017) and attract more tourists to Madeira Island. In doing so, we promote a higher standard of living of local population.

One of the tourists' attraction of Madeira Island are the 'levadas'. The 'levadas' are small waterways, often flanked by a monitoring/maintenance support rail. Its origins date back to the early settlers. Currently, the Island has nearly 200 'levadas' with an approximately length of 1500 km. The 'levadas' cross protected territories, rural localities and urban centers (Turismo de Portugal, 2019; Mata et al., 2013). Initially outlined for agricultural purposes and human' water supply, the role and dimensions of the 'levadas' expanded with the first hydroelectric power stations. Nowadays, the 'levadas', along with the footpaths and old walking paths, become attracting places for thousands of nature-based tourists and trail runners who visit the Island. The Madeira Tourism Board, supported by the Institute of Forests and Nature Conservation, recommends 30 walking routes.

The Madeira's weather conditions are determined by the Azores High and the Island's rugged and elevated orography. The average annual value of the average air temperature varies between 14 ºC and 18 ºC in coastal areas and between 6 °C and 12 °C in the areas of higher altitude. The average maximum temperature in summer is slightly above 23º C in the coastal regions and 16º C in the peaks. The precipitation, especially of the orographic type, exceeds 2600 mm/year at the highest elevations, while at Funchal the precipitation is, on average, 596.4 mm. The precipitation is more abundant during the months of December and January. The solar insolation reaches 2165 hours at Funchal (AEMET & IM, 2012; Valente, Coelho, Miranda, & Tomé, 2006). Tourists visit the Island throughout the year with the high season for nature-based tourism being between March (spring) and September (summer).

5.3.2. Participants

One thousand six hundred and twenty-six nature-based tourists were enrolled in the LevMadeira study. Of these, 280 were removed from the analysis because they were less than 15 years old (n = 38) or had missing data on core affect (n = 168) and perceived restorativeness (n = 74) scales. The final sample size consisted of 1346 nature-based tourists, 804 females and 542 males. Table 5.1 summarizes the information about the socio-demographic characteristics of the participants.

Table 5.1 Sample descriptive.

Variable	Value	(n = 1346)	Percent
Gender	Female	804	59.73
	Male	542	40.27
Age, years	15–24	34	2.53
	25–34	145	10.77
	35–44	233	17.31
	45–54	357	26.52
	55–64	357	26.08
	65–74	206	15.30
	75–84	20	1.49
Country	France	972	72.21
	Germany	90	6.69
	United Kingdom	106	7.88
	Other†	178	13.22
Education	Primary	25	1.87
	Secondary	276	20.64
	High	1036	77.49
Marital status	Married/living common-law	614	45.99
	Widows	51	3.82
	Separated/divorced	215	16.10
	Single	455	34.08
Employment status	Paid job	940	71.00
	Student	28	2.11
	Housewife	3	0.83
	Retired	301	22.73
	Disability pension	5	0.15
	Unemployed	6	0.83
	Other	7	2.34
Visits to natural environments, per year	First time	41	3.07
	1–2	337	25.24
	3–4	301	22.55
	5–6	153	11.46
	7–8	82	6.14
	≥ 9	421	31.54
Self-rated health	Excellent	196	14.59
	Very good	652	48.55
	Good	464	34.55
	Fair	29	2.16
	Poor	2	0.15

†This category includes nature-based tourists from 26 countries.

The high frequencies of age were between 45 to 54 and 55 to 64 years (mean age 50.9 years, range 15 to 84 years). The largest group was French, pursued higher education, were married, or lived in common law, and were professionally active. Most of the participants reported 9 or more visits to natural environments per year and self-rated their health as excellent, very good or good.

5.3.3. Measures

5.3.3.1. Landscape features

We used colours of the landscape, elements and forms of the landscape, nature sounds, nature smells and vegetation zones in the final regression models. For colours of the landscape, the scale was a horizontal line, divided in 7 segments, equally distributed, with one colour on each vertical scale mark, describing the seven colours of the rainbow, i.e., red, orange, yellow, green, blue, indigo, and violet. We added white and an extra space to ‘other’. We assessed elements and forms of the landscape with 21 items drawn from the literature. These entails water, valley, flowers, farm fields, settlements, cliffs, lake, forest, houses/buildings, road structures, skyline/depth, trails, sea, waterfalls, brook/stream/creek, ‘levadas’, beach, animals, mountain, vegetation and others. For both, colours and elements and forms, tourists were asked to tick off one or more items, and add some that were missing. We also asked to tourists to rate the landscape being viewed using a 5-point ordinal category scale. Answers ranged from 1 (very bad) to 5 (very good). The landscape items were filled in the middle and/or at the end of the nature-based activity.

The sound sources were adapted from the ‘Swedish Soundscape-Quality Protocol’ (Axelsson, Nilsson, Hellström, & Lundén, 2014; Nilsson & Berglund, 2006). Nature sounds included wind whisper-ring in the trees and singing birds. Nature smells were mainly selected from previous research (Henshaw, 2014; Porteous, 1985) and identified in the preliminary field visits, pre-test, and pilot studies. Nature smells involved fresh air, ocean air, flowers, trees, water, streams of water, waterfalls, wind, wind flow, wood, soil, stone, local flora, hay, and aromatic vegetation. The response format was a 5-point ordinal category scale. Both, nature sounds, and nature smells were collected in the middle and at the end of the hiking activity.

Measures of vegetation included 4 zones: coastal vegetation, transitional zone, laurel forest and high mountain vegetation. These were adopted from the works of Alcoforado et al. (2014), Packham (2004) and Ribeiro (1985). Since some ‘levadas’ and trails cross the zones, other 4 combinations were formed, in a total of eight vegetation zones. One member of the research team geo-located the vegetation zone of each ‘levada’ and trail.

5.3.3.2. Hike features

We used distance, ascent and descent as objective measures of the ‘levadas’ and trails. Participants were fitted with a POLAR V800 GPS sports watch (Polar Electro OY, Kempele, Finland) on the left wrist. This sport watch has a barometer which measures altitude and altitude changes, i.e., ascent and descent. Total ascent is the cumulative elevation gain throughout all activity, while total descent is the cumulative elevation loss. Total ascent and distance are important measures of the ‘strenuousness’ of a trail [International Trail Running Association (iTRA), 2020]. The difficulty of the ‘levadas’ and trails was measured using the single-statement: ‘without considerable risks – easy’. Tourists were asked to indicate their agreement on a 1-5 ordinal category scale.

5.3.3.3. Core affect

We used the ‘Swedish Core Affect Scale’ (SCAS) (Västfjäll & Gärling, 2007; Västfjäll et al., 2002) to assess core affect of nature-based tourists. We chose SCAS because parsimoniously represents the affect circumplex and requires little time to complete (between 3 to 5 min). It therefore meant only a slight intrusion on the tourist’s experience. This self-reported scale entails twelve bipolar adjectives that tap valence (unpleasantness-pleasantness) and activation (quietness–excitement) dimensions, as well as the two dimensions rotated 45 degrees to them, labelled pleasant activation–unpleasant deactivation and unpleasant activation-pleasant deactivation. The adjective pairs defining valence were ‘displeased–pleased’, ‘sad–glad’ and ‘depressed–happy’; those defining activation were ‘sleepy-awake’, ‘dull-peppy’ and ‘passive-active’; those defining pleasant activation-unpleasant deactivation were ‘bored–interested’, ‘indifferent–engaged’ and ‘pessimistic–optimistic’; and those defining unpleasant activation–pleasant deactivation were defined by the adjective pairs ‘tense–serene’, ‘anxious–calm’ and ‘nervous–relaxed’ (Västfjäll & Gärling, 2007; Västfjäll et al., 2002).

We asked the tourists to describe ‘how you feel right now, at this moment’. They could respond with any number from 1 (left-end adjective) to 9 (right-end adjective) through 5, the neutral point. We assume that low scores reflect undesirable feelings, while high scores reflect desirable ones. The reliability of the SCAS was acceptable in the LevMadeira study and parallels those reported by Västfjäll et al. (2002). Cronbach’s alphas for activation ranged from 0.80 to 0.88; those for valence ranged from 0.86 to 0.91; those for pleasant activation-unpleasant deactivation ranged from 0.71 to 0.76; and those for unpleasant activation-pleasant deactivation ranged from 0.83 to 0.86.

5.3.3.4. The nature-based restorative experience

The Perceived Restorativeness Scale (PRS) (Hartig, Kaiser, & Bowler, 1997; Hartig, Korpela, Evans, & Gärling, 1997), an instrument based on Attention Restoration Theory (ART) (Kaplan & Kaplan, 1989; S. Kaplan, 1995), was used to capture the restorative experience of the nature-based tourists. The PRS comprises the subscales of being away, fascination, coherence (extent), and compatibility. The coherence (extent) and compatibility subscales were not included in the LevMadeira study, in keeping with other studies that have focused on psychological distance and engagement as general features of restorative experience (Dahlkvist et al., 2016; Lindal & Hartig, 2013).

The being away subscale consists of six items (e.g., ‘This place is a refuge from unwanted distractions’; ‘Spending time here gives me a break from my day-to-day routine’). The fascination subscale also consists of six items (e.g., ‘There is much to explore and discover here’; ‘My attention is drawn to many interesting things here’) (Cf. Dahlkvist et al., 2016; Lindal & Hartig, 2013). All items were coded on 11-point scales, ranging from zero (not at all) to 10 (completely), to indicate ‘how much does each statement apply to his/her experience here’.

Analyses of the internal consistencies for ‘being away’ and ‘fascination’ subscales were 0.59 and 0.92, respectively. For the ‘being away’ subscale, the reliability coefficient did not achieve the conventional standard for internal consistency of 0.70 (Nunnally, 1978). However, Cronbach’s alpha increased to 0.72 if the item ‘This place is a refuge from unwanted distractions' is deleted from the analysis. To check whether analyses done with the 4-item version of being away produced correlations of similar magnitude to those obtained with the 5-item version, we reran the bivariate correlations among the being away and SCAS subscales scores using the 4-item version. The correlations obtained using the 4-item version differed little from those obtained with the 5-item version and we decided to use the latter in keeping with previous studies that affirmed its criterion validity (e.g., Dahlkvist et al., 2016; Dzhambov, Markevych, & Lercher, 2018).

5.3.4. Procedures

A team of 10 experienced researchers, with backgrounds in Geography and Sport Sciences, performed the field study between July 2016 and October 2017. Before starting the LevMadeira study, the questionnaires were refined on-site through a pre-test and two pilot studies. To ensure homogeneity in all linguistic versions of the questionnaire, a Portuguese version was first agreed and then translated into French, German, and Spanish by native-speaking colleagues from the University of Madeira. In a second stage, other native-speaking academic colleagues did a back translation to validate the linguistic versions. We maintained the originality of the English scales.

The participants were nature-based tourists who come to Madeira for hiking on 'levadas' and trails for 8-10 days and were led by a mountain guide. To approach the nature-based tourists, we first established contact with the travel agencies and tourist entertainment companies. Of the 26 invitations, 7 (26.9%) declined to participate. The most stated reasons for not participating in the study was that tourists disliked being disturb in their nature experience and that bus driver schedules did not allow spend time filling questionnaires.

Upon receiving the informed consent from travel agencies and tourist entertainment companies, one of the researchers made efforts to connect with the mountain guides (n = 53, 15 females and 38 males). After explaining the aims and procedures of the study to mountain guides, arrangements were made to meet the tourists. A meeting was held at the accommodation place, where tourists first received information about the study and then were invited to participate in a voluntary basis. Once scheduled the day of the assessment, the research team arrived at the accommodation place, just after the breakfast. The tourists first provided informed consent and then were instructed to complete the SCAS (T1). Tourists were then instrumented with a POLAR V800 GPS sports watch on the left wrist.

Each tourist participated only once, and only on one day during the study period. The outdoor assessment was conducted on 45 ‘levadas’ and trails of Madeira Island, thus ensuring considerable variability in environmental conditions. One member of the research team escorted the group, i.e., the tourists and mountain guide. When the tourists arrived at the middle of the ‘levada’ or trail, which usually coincided with a brief pause, the tourists filled out the PRS and again the SCAS (T2). Precautions were taken to clarify anything that seemed ambiguous and to find an optimal environment to fill out the questionnaires. At the end of the ‘levada’ or trail, participants completed again the SCAS (T3). On arrival at the accommodation place, tourist filled out a questionnaire including socio-demographic characteristics (age, gender, country, level of education, marital status, occupation, and employment status), experience of nature-based tourism [visits to natural environment across a year; 6-point rating scale ranging from 1 (first time) to 6 (≥ 9 times)] and self-reported health [5-point rating scale ranging from 1 (excellent) to 5 (poor)]. Mountain guides fulfilled the background questionnaire. Participants were rewarded with a health-related physical fitness report, which was theoretically explained by a researcher.

The number of tourists assessed per day varied between 1 and 16, with a mean of 7.53. We obtained approval to conduct the LevMadeira Study from the Scientific Boards of the Faculty of Social and Human Sciences of NOVA University of Lisbon, the Faculty of Social Sciences of University of Madeira, and the Faculty of Sports of University of Porto.

5.3.5. Statistical analysis

All analyses outlined in this study were performed with IBM SPSS (IBM Corp. Released, 2017) and STATA (StataCorp, 2017) statistical packages.

We began by assessing change in core affect during one-day hiking activity using one-way repeated measures ANOVA. We then assessed the strength of the relationships between the SCAS scores [dependent variables (DVs)] and PRS scores [independent variables (IVs)]. Pearson correlation coefficients (r) ranged from 0.07 to 0.42 at each time point, i.e., at the beginning (T1), at the middle (T2) and at the end (T3), while for the change among time points, i.e., from T1 to T2 and from T2 to T3, correlations ranged from -0.19 to 0.32. Hence, SCAS scores were somewhat correlated with PRS scores and parallel past research (Kirillova & Lehto, 2016; Lindal & Hartig, 2013). To identify potential predictors, we calculated zero-order correlations between change in core affect and landscape and hike features. Variables with correlations of 0.10 or higher entered in stepwise regressions, using 33% of the cases selected at random without replacement. Colours of the landscape, elements and forms, nature sounds, nature smells, vegetation zones, distance, ascent/descent and difficulty of the 'levadas' and trails, arose as significant predictors of change and entered as IVs in further analyses.

We then conducted hierarchical multiple regressions in the total sample size, with change from T1 to T2 and T2 to T3 in each SCAS subscale, as the DVs, and 6 blocks of IVs entering the equations in following order: the given T1 affect score (block 1), age, gender, country of origin and level of education of the nature-based tourist (block 2), age and gender of the mountain guide (block 3), colours of the landscape, elements and forms, nature sounds, nature smells, and vegetation zones (block 4), distance, difficulty and ascent/descent of the 'levadas' and trails (block 5), and being away and fascination (block 6). Country of origin involved 3 dummy variables and level of education was dichotomized by collapsing the participants having primary and secondary education in one group and participants having high education in another group. Nature-based tourists were excluded from the analysis if they had constant core affect scores at T1, T2 and T3 (see also Hull et al., 1992). Only a small percentage of nature-based tourists [ranging from 3.86% (pleasant activation-unpleasant deactivation) to 13.52% (valence)] did not change core affect during one-day hiking activity. From these, 77.5% to 78.8% rated the maximum score on the 9-point scale at T1, T2 and T3.

Issues of multicollinearity and outliers were fulfilled. Participants with standardized residuals of more than 4 or less than -4 were dropped from the analysis involving the underlined core affect subscale. Variance inflation factors (VIFs) were below 2.0. The change in the four indices of core affect was normally distributed. However, valence, activation, pleasant activation-unpleasant deactivation, and unpleasant activation-pleasant deactivation, per se, were left-skewed. Since the best approach to normalize some of these distributions was 'identity', we did not carry out any transformation of these variables.

Subsequently, we conducted serial multiple mediator models using the PROCESS macro for SPSS v3.5 developed by Hayes (2020) to empirically estimate and test the hypothesis that being away and fascination mediate change in core affect that occurred from the beginning (T1) to the end (T3) of the 'levadas' and trails. We used change from T1 to T3 of the specific-core affect subscale as dependent variable (Y), perceived visual landscape as the independent variable (X), being away (M_1) and fascination (M_2) as mediators, and nature smells (C_1) and nature sounds (C_2) as covariates (see Figure 5.2). We specified serial mediation with model 6, placing being away first in the series and then fascination. This model assumes that psychological distance from ordinary demands and routines 'opens up for the experience of fascination' (Dahlkvist et al., 2016). We used 5000 bootstrap samples to generate 95% confidence intervals (CIs) for the indirect effects. Statistical significance was observed as a 95% CI that does not include zero. In a two-mediator model, X is modelled as affecting Y through four pathways: (1) the indirect path that runs from X to Y through M_1 only, (2) the indirect path that runs through M_2 only, (3) the indirect path that passes through both M_1 and M_2 in serial, with M_1 affecting M_2, and (4) the direct effect of X on Y without passing through either M_1 or M_2 (Hayes, 2018).

In the stepwise regression, the probability of F-to-enter and F-to-remove was ≤ 0.05 and ≥ 0.01, respectively. In the remaining analyses, we set the level of significance at $p < 0.05$.

5.4. Results

5.4.1. Descriptive statistics

The results of core affect are displayed in Figure 5.1 and summarized in Table S5.1 (Appendix 2). Nature-based tourists enter the 'levadas' and trails (T1) with high scores in core affect and slightly increase their scores throughout the hiking experience (T3). On average, change from the beginning to the end ranges from 0.14 (pleasant activation-unpleasant deactivation) to 0.83 (unpleasant activation-pleasant deactivation) units on a 9-point scale.

Table S5.1 displays the means and standard deviations for the restorative experience at the middle of the 'levadas' and trails. The rated-mean scores of being away and fascination are high, above the midpoint of the 11-point scale, and spread out over a wide range.

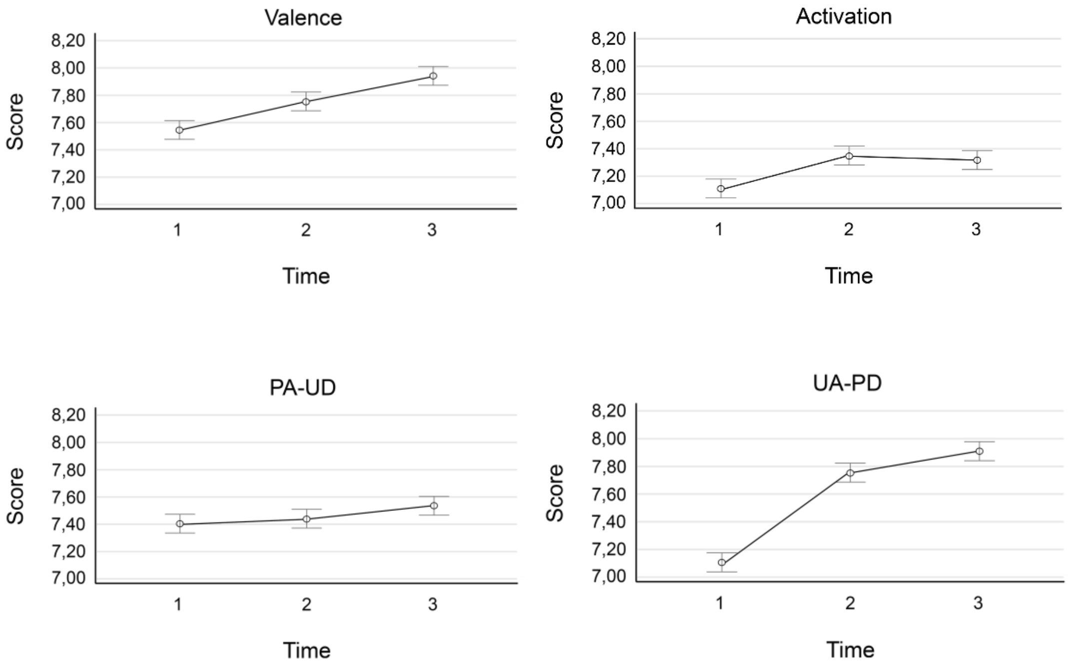

Figure 5.1 Mean ratings of core affect by time (1, beginning; 2, middle and 3, end) on one-day hiking activity. Error bars are 95% CI's. Core affect was assessed through the Swedish Core Affect Scale (Västfjäll & Gärling, 2007; Västfjäll et al., 2002) on a 9-point scale, ranging from 1 (left end-adjective) to 9 (right-end adjective). PA-UD, pleasant activation-unpleasant deactivation; UA-PD, unpleasant activation-pleasant deactivation.

5.4.2. Core affect and predictors of change along the 'levadas' and trails

The final models of hierarchical multiple regressions are presented in Tables 5.2-5.5. Descriptive statistics and details of the analyses are provided in Tables S5.2-S5.6 (Appendix 2). The mean age of the mountain guides is 43.6 years with 28.3% being female. The green and blue are the most reported colours, while vegetation, water, mountains, flowers, sea, waterfalls, and skyline are among the perceived elements and forms of the landscape. A large percentage of nature-based tourists report nature smells and nature sounds along the 'levadas' and trails. The mean distance of the 'levadas' and trails is 11.85 km, while the mean ascent and descent is 483.8 m and 552.2 m, respectively. The perceived difficulty is slightly above the midpoint of the 5-point scale, i.e., a mean of 2.57 (Table S5.2).

Table 5.2 Full model (step 6) of the hierarchical multiple regression with change in valence from T1 to T2 and from T2 to T3 as dependent variables and demographics, environmental and hike characteristics, and perceived restorative quality as independent variables.

Variable	Valence							
	Change (ΔT1-T2)				Change (ΔT2-T3)			
	B	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*
Valence	-0.646	0.022	-0.635	0.000	-0.436	0.026	-0.527	0.000
Age (tourists)	0.005	0.002	0.052	0.023	0.002	0.002	0.038	0.187
Gender (tourists)	-0.100	0.051	-0.042	0.051	-0.035	0.047	-0.020	0.462
Country								
United Kingdom	0.139	0.101	0.033	0.167	-0.017	0.091	-0.005	0.856
Germany	0.216	0.111	0.048	0.051	0.165	0.101	0.051	0.103
Other	-0.088	0.078	-0.025	0.259	-0.017	0.072	-0.007	0.813
Education								
High	-0.009	0.062	-0.003	0.885	-0.070	0.057	-0.034	0.222
Mountain guide								
Age	0.004	0.003	0.027	0.233	-0.003	0.003	-0.028	0.313
Gender	0.042	0.087	0.012	0.631	0.151	0.079	0.060	0.055
Environmental characteristics								
Colours	0.034	0.023	0.032	0.151	-0.009	0.021	-0.012	0.662
Elements and forms	0.006	0.008	0.015	0.485	0.017	0.007	0.063	0.023
Nature sounds	0.064	0.026	0.057	0.015	0.036	0.022	0.051	0.106
Nature smells	0.071	0.024	0.067	0.004	0.037	0.022	0.053	0.092
Vegetation zones	-0.015	0.016	-0.025	0.359	0.020	0.015	0.045	0.190
Hike features								
Distance	-0.028	0.015	-0.044	0.069	-0.019	0.007	-0.084	0.006
Ascent	0.021	0.020	0.031	0.287	-0.010	0.009	-0.039	0.287
Descent	0.053	0.017	0.079	0.002	0.014	0.008	0.056	0.084
Difficulty	-0.055	0.023	-0.053	0.016	-0.037	0.021	-0.049	0.080
Perceived restorative quality								
Being away	0.115	0.020	0.151	0.000	0.046	0.019	0.083	0.014
Fascination	0.148	0.016	0.249	0.000	-0.008	0.015	-0.018	0.597
R^2	0.535				0.255			
ΔR^2	0.109^{***}				0.005^{*}			

[†]T1, T2 and T3, beginning, middle and end of the ‘levadas’ or trails, respectively; *B*, unstandardized coefficients; *SE B*, standard error of *B*; *β*, standardized coefficients; variables entered into the model at step 1: valence at T1 (change from T1-T2) or T2 (change from T2-T3); variables entered into the model at step 2: age, gender, country of origin and education level of the nature-based tourists; variables entered into the model at step 3: age and gender of the mountain guides; variables entered into the model at step 4: colours, elements and forms of the landscape, nature sounds and nature smells at T2 (change from T1 to T2) and T3 (change from T2 to T3), and vegetation zones; variables entered into the model at step 5: distance, ascent and descent and difficulty of the ‘levadas’ and trails; variables entered into the model at step 6: being away and fascination. ; ΔR^2, R^2 change; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{**}p < 0.001$.

The total variance explained by each model (R^2) is presented in Tables S5.3-S5.6. For valence, the full model explains 53.5% of the variance from the beginning (T1) to the middle (T2), whereas for activation, pleasant activation-unpleasant deactivation and unpleasant activation-pleasant deactivation, the models explain 47.4%, 49.2% and 56.2% of variance, respectively. For change from T2 to T3, the amount of variance explained by the models range from 25.5% (valence) to 34.5% (unpleasant activation-pleasant deactivation).

The full model for valence is given in Table 5.2. Details of previous steps are shown in Table S5.3. Valence at T1 and T2 are negatively related to change, indicating that the higher the initial level, the lower the gain. On the other hand, being away (T1-T2 and T2-T3) and fascination (T1-T2) are positively related to valence. The greater the psychological distance from everyday life pressures and obligations and positive engagement with the environment, the greater the gain in valence. Descent, nature smells and nature sounds enhance valence during the first half of the 'levadas' and trails. Difficulty has a negative effect on change (T1 to T2). The older the nature-based tourist is, the greater the gain (T1 to T2). A longer distance is linked to a lower gain in valence (T2 to T3) and the number of elements and forms of the landscape is positively related to change (T2 to T3).

Table 5.3 reports the full model for activation (see also Table S5.4). Activation at T1 is negatively related to change. That is, nature-based tourists who present high levels of activation at T1 and T2, gain less in activation from T1 to T2 and T2 to T3. Similarly, those nature-based tourists who are more engaged with the environment gain more in activation from T1 to T2. Age and nature smells are positively related to change. Older nature-based tourists gain more in activation and the higher the amount of nature smells, the greater the gain in activation. Being away is a significant predictor of change from T1 to T2. The nature-based tourists who experience more psychological distance from ordinary demands show higher gains in activation scores from T1 to T2. Nature sounds are related to change from T1 to T2. The higher the score, the greater the gain in activation. Difficulty is negatively related to change from T1 to T2 and from T2 to T3. In the second half of the 'levadas' and trails (T2 to T3), those tourists who have a male mountain guide increase activation more than those tourists who have a female mountain guide. From T2 to T3, those 'levadas' and trails that show descent lead to gains in activation.

Table 5.3 Full model (step 6) of the hierarchical multiple regression with change in activation from T1 to T2 and from T2 to T3 as dependent variables and demographics, environmental and hike characteristics, and perceived restorative quality as independent variables.

Variable	Activation							
	Change (ΔT1-T2)				Change (ΔT2-T3)			
	B	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*
Activation	-0.655	0.023	-0.635	0.000	-0.573	0.029	-0.532	0.000
Age (tourists)	0.008	0.002	0.082	0.000	0.010	0.003	0.102	0.000
Gender (tourists)	-0.070	0.057	-0.027	0.221	-0.060	0.064	-0.023	0.353
Country								
United Kingdom	0.015	0.112	0.003	0.897	0.011	0.124	0.002	0.932
Germany	0.003	0.125	0.001	0.981	-0.090	0.140	-0.018	0.519
Other	-0.074	0.086	-0.019	0.391	-0.134	0.096	-0.037	0.163
Education								
High	-0.112	0.069	-0.036	0.105	-0.060	0.078	-0.020	0.440
Mountain guide								
Age	0.003	0.003	0.019	0.405	0.003	0.004	0.019	0.471
Gender	0.010	0.096	0.003	0.913	0.299	0.108	0.080	0.005
Environmental characteristics								
Colours	0.021	0.026	0.018	0.418	0.004	0.029	0.004	0.884
Elements and forms	-0.001	0.009	-0.003	0.882	0.011	0.010	0.029	0.262
Nature sounds	0.073	0.029	0.059	0.013	0.049	0.030	0.047	0.109
Nature smells	0.068	0.028	0.058	0.013	0.104	0.030	0.102	0.000
Vegetation zones	0.000	0.018	0.000	0.996	0.029	0.021	0.045	0.154
Hike features								
Distance	-0.014	0.017	-0.020	0.400	-0.002	0.010	-0.007	0.797
Ascent	0.037	0.022	0.048	0.099	-0.017	0.013	-0.045	0.189
Descent	0.012	0.019	0.017	0.511	0.022	0.011	0.061	0.039
Difficulty	-0.055	0.025	-0.049	0.027	-0.090	0.028	-0.083	0.001
Perceived restorative quality								
Being away	0.051	0.022	0.061	0.021	0.012	0.025	0.015	0.630
Fascination	0.169	0.018	0.258	0.000	-0.010	0.020	-0.016	0.606
R^2	0.474				0.288			
ΔR^2	0.076^{***}				0.000			

†T1, T2 and T3, beginning, middle and end of the 'levadas' or trails, respectively; *B*, unstandardized coefficients; *SE B*, standard error of *B*; *β*, standardized coefficients; variables entered into the model at step 1: activation at T1 (change from T1-T2) or T2 (change from T2-T3); variables entered into the model at step 2: age, gender, country of origin and education level of the nature-based tourists; variables entered into the model at step 3: age and gender of the mountain guides; variables entered into the model at step 4: colours, elements and forms of the landscape, nature sounds and nature smells at T2 (change from T1 to T2) and T3 (change from T2 to T3), and vegetation zones; variables entered into the model at step 5: distance, ascent and descent and difficulty of the 'levadas' and trails; variables entered into the model at step 6: being away and fascination. ; ΔR^2, R^2 change; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{**}p < 0.001$.

Table 5.4 provides the full model for pleasant activation-unpleasant deactivation (see also Table S5.5). The given T1 and T2 affect score are negatively related to change in pleasant activation-unpleasant deactivation. Nature smells and age of the nature-based tourists are also significant predictors of change from T1 to T2 and from T2 to T3. The greater the number of nature smells and the older the nature-based tourists are, the greater the gain in pleasant activation-unpleasant deactivation. Being away and fascination are predictors of change from T1 to T2. In addition, female's nature-based tourists gain more in pleasant activation-unpleasant deactivation than males from T1 to T2. Ascent and descent are positively related to change from T1 to T2 (ascent) or from T2 to T3 (descent). From T2 to T3, the elements and forms of the landscape are positively related to pleasant activation-unpleasant deactivation. Difficulty is negatively related to change from T1 to T2. The higher the perceived difficulty at the beginning of the ‘levadas’ and trails, the lower the gain in pleasant activation-unpleasant deactivation.

Table 5.4 Full model (step 6) of the hierarchical multiple regression with change in pleasant activation-unpleasant deactivation (paud) from T1 to T2 and from T2 to T3 as dependent variables and demographics, environmental and hike characteristics, and perceived restorative quality as independent variables.

Variable	Pleasant activation – unpleasant deactivation							
	Change (ΔT1-T2)				Change (ΔT2-T3)			
	B	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*
Paud	-0.641	0.023	-0.592	0.000	-0.475	0.025	-0.531	0.000
Age (tourists)	0.008	0.002	0.093	0.000	0.007	0.002	0.100	0.000
Gender (tourists)	-0.150	0.051	-0.062	0.003	-0.081	0.050	-0.041	0.106
Country								
United Kingdom	0.048	0.102	0.011	0.634	-0.020	0.098	-0.006	0.836
Germany	-0.100	0.111	-0.021	0.372	-0.177	0.109	-0.046	0.103
Other	-0.111	0.077	-0.032	0.148	-0.087	0.075	-0.030	0.246
Education								
High	-0.002	0.061	-0.001	0.979	-0.012	0.060	-0.005	0.846
Mountain guide								
Age	-0.001	0.003	-0.011	0.618	-0.001	0.003	-0.006	0.822
Gender	-0.025	0.086	-0.007	0.772	0.097	0.084	0.033	0.251
Environmental characteristics								
Colours	0.045	0.023	0.043	0.050	-0.018	0.022	-0.021	0.429
Elements and forms	0.010	0.008	0.027	0.217	0.018	0.008	0.059	0.021
Nature sounds	0.012	0.026	0.010	0.652	0.027	0.023	0.033	0.255
Nature smells	0.106	0.024	0.099	0.000	0.085	0.023	0.107	0.000
Vegetation zones	-0.017	0.016	-0.028	0.286	0.007	0.016	0.014	0.663
Hike features								
Distance	-0.010	0.015	-0.016	0.499	-0.011	0.007	-0.040	0.150
Ascent	0.044	0.020	0.062	0.027	-0.013	0.010	-0.045	0.178
Descent	0.025	0.017	0.036	0.143	0.018	0.008	0.066	0.026
Difficulty	-0.055	0.022	-0.053	0.013	-0.035	0.022	-0.042	0.103
Perceived restorative quality								
Being away	0.105	0.020	0.138	0.000	0.006	0.019	0.010	0.754
Fascination	0.176	0.015	0.296	0.000	0.002	0.015	0.003	0.913
R^2	0.492				0.277			
ΔR^2	0.132^{***}				0.000			

†T1, T2 and T3, beginning, middle and end of the ‘levadas’ or trails, respectively; *B*, unstandardized coefficients; *SE B*, standard error of *B*; *β*, standardized coefficients; variables entered into the model at step 1: paud at T1 (change from T1-T2) or T2 (change from T2-T3); variables entered into the model at step 2: age, gender, country of origin and education level of the nature-based tourists; variables entered into the model at step 3: age and gender of the mountain guides; variables entered into the model at step 4: colours, elements and forms of the landscape, nature sounds and nature smells at T2 (change from T1 to T2) and T3 (change from T2 to T3), and vegetation zones; variables entered into the model at step 5: distance, ascent and descent and difficulty of the ‘levadas’ and trails; variables entered into the model at step 6: being away and fascination. ; ΔR^2, R^2 change; $^*p < 0.05$; $^{**}p < 0.01$; $^{**}p < 0.001$.

The full model of change in unpleasant activation-pleasant deactivation is presented in Table 5.5 (see also Table S5.6). Unpleasant activation-pleasant deactivation at T1 (change from T1 to T2) and T2 (change from T2 to T3) are negatively related to change. Being away, nature smells, and distance are also significant predictors of change from T1 to T2 and from T2 to T3.

Table 5.5 Full model (step 6) of the hierarchical multiple regression with change in unpleasant activation-pleasant deactivation (uapd) from T1 to T2 and from T2 to T3 as dependent variables and demographics, environmental and hike characteristics, and perceived restorative quality as independent variables.

Variable	Unpleasant activation – pleasant deactivation							
	Change (ΔT1-T2)				Change (ΔT2-T3)			
	B	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*
Uapd	-0.713	0.021	-0.699	0.000	-0.493	0.022	-0.586	0.000
Age (tourists)	0.005	0.002	0.041	0.055	0.002	0.002	0.024	0.358
Gender (tourists)	0.019	0.062	0.006	0.760	-0.130	0.049	-0.066	0.009
Country								
United Kingdom	-0.058	0.122	-0.011	0.631	-0.065	0.094	-0.019	0.488
Germany	-0.197	0.132	-0.034	0.135	-0.096	0.105	-0.026	0.359
Other	-0.019	0.093	-0.004	0.841	-0.075	0.073	-0.027	0.306
Education								
High	-0.048	0.075	-0.013	0.520	0.032	0.059	0.014	0.583
Mountain guide								
Age	0.002	0.004	0.014	0.504	-0.001	0.003	-0.012	0.646
Gender	-0.086	0.104	-0.019	0.408	0.114	0.082	0.040	0.164
Environmental characteristics								
Colours	0.036	0.028	0.027	0.203	0.022	0.022	0.025	0.325
Elements and forms	-0.004	0.010	-0.009	0.667	0.015	0.008	0.048	0.057
Nature sounds	0.031	0.032	0.021	0.327	-0.011	0.023	-0.013	0.641
Nature smells	0.136	0.030	0.099	0.000	0.074	0.023	0.093	0.001
Vegetation zones	0.018	0.020	0.023	0.364	0.017	0.016	0.033	0.291
Hike features								
Distance	-0.044	0.018	-0.053	0.017	-0.031	0.007	-0.117	0.000
Ascent	0.042	0.024	0.047	0.084	-0.014	0.010	-0.049	0.147
Descent	0.061	0.021	0.069	0.004	-0.003	0.008	-0.010	0.735
Difficulty	-0.100	0.027	-0.076	0.000	-0.041	0.022	-0.049	0.055
Perceived restorative quality								
Being away	0.165	0.024	0.172	0.000	0.045	0.019	0.073	0.020
Fascination	0.084	0.019	0.111	0.000	-0.008	0.015	-0.016	0.605
R^2	0.562				0.345			
ΔR^2	0.055^{***}				0.004^{*}			

[†]T1, T2 and T3, beginning, middle and end of the 'levadas' or trails, respectively; *B*, unstandardized coefficients; *SE B*, standard error of *B*; *β*, standardized coefficients; variables entered into the model at step 1: uapd at T1 (change from T1-T2) or T2 (change from T2-T3); variables entered into the model at step 2: age, gender, country of origin and education level of the nature-based tourists; variables entered into the model at step 3: age and gender of the mountain guides; variables entered into the model at step 4: colours, elements and forms of the landscape, nature sounds and nature smells at T2 (change from T1 to T2) and T3 (change from T2 to T3), and vegetation zones; variables entered into the model at step 5: distance, ascent and descent and difficulty of the 'levadas' and trails; variables entered into the model at step 6: being away and fascination. ; ΔR^2, R^2 change; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{**}p < 0.001$.

Beta coefficients of being away and fascination are positive, while distance is negatively related to unpleasant activation-pleasant deactivation. The greater the increase in being away and fascination, the greater the gain in unpleasant activation-pleasant deactivation. However, the long distance of the 'levadas' and trails are associated with less gain in unpleasant activation-pleasant deactivation. Fascination and descent increase the gain in unpleasant activation-pleasant deactivation from T1 to T2. The higher difficulty of the 'levadas' and trails diminishes the gain in unpleasant activation-pleasant deactivation from T1 to T2. From T2 to T3, female's nature-based tourists gain more in unpleasant activation-pleasant deactivation than males.

5.4.3. Mediation analysis

The statistical diagram of the serial multiple mediator model for the causal relationship between visual landscape and valence (change from T1-T3) is depicted in Figure 5.2. Table S5.7 (Appendix 2) provides the regression coefficients, standard errors, and model summary information. Table S5.8 (Appendix 2) gives the direct and indirect effects along with inferential tests. The long-way mediation, which involves visual landscape, being away, fascination and valence is statistically significant (indirect effect = 0.027, 95% CI: 0.012 to 0.045). Visual landscape has an indirect effect on valence through fascination (indirect effect = 0.090, 95% CI: 0.043 to 0.140), but not through being away (indirect effect = 0.007, 95% CI: -0.020 to 0.036). The direct effect of visual landscape on valence is not significant (direct effect = 0.032, 95% CI: -0.072 to 0.136). The analysis reveals that visual landscape increases the experiences of psychological distance from ordinary demands and routines (a_1 = 0.506), which in turn enables engage effortless attention (d_{21} = 0.589), which positively influences valence (b_2 = 0.090).

The statistical diagram, regressions coefficients and direct and indirect effects for activation are provided in Figure S5.1 and Tables S5.9 and S5.10 (Appendix 2), respectively. A serial mediation from visual landscape, passing through being away and fascination is established (indirect effect = 0.029, 95% CI: 0.010 to 0.050). Nature-based tourists who report high scores on visual landscape present high levels of being away (a_1 = 0.518), which in turn experience high levels of fascination (d_{21} = 0.586) and this high engagement with the environment translates into a greater activation (b_2 = 0.095). Similarly, the indirect effect of visual landscape on activation through fascination is significant (indirect effect = 0.029, 95% CI: 0.010 to 0.050). The indirect effect of visual landscape on activation through being away is not significant (indirect effect = -0.018, 95% CI: -0.053 to 0.016) as is not the direct effect of visual landscape on activation (direct effect = -0.023, 95% CI: -0.102 to 0.147). Given this non-significant direct effect, differences among nature-based tourists on activation are related to being away and fascination.

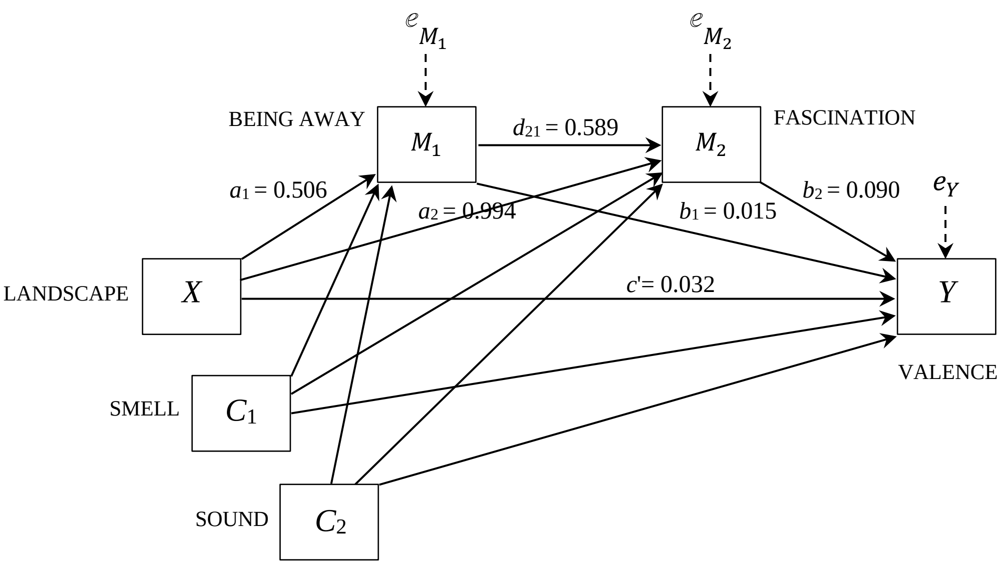

Figure 5.2 Serial multiple mediator model for the causal relationship between visual landscape and valence. Being away and fascination are mediators. Nature smells and nature sounds are covariates. The paths marked a_1, a_2, d_{21}, b_1, b_2 and c' are unstandardized regression coefficients.

A causal flow from visual landscape to pleasant activation-unpleasant deactivation through being away and fascination is claimed (indirect effect = 0.035, 95% CI: 0.019 to 0.053) (Figure S5.2 and Tables S5.11 and S5.12, Appendix 2). The path running from visual landscape, passing through fascination, and attaining pleasant activation-unpleasant deactivation is also significant (indirect effect = 0.109, 95% CI: 0.063 to 0.160). There are no significant differences in the other two effects. As for the previous models, visual landscape enhances a sense of being away (a_1 = 0.520), which in turn increases fascination (d_{21} = 0.594), which positively influences pleasant activation-unpleasant deactivation (b_2 = 0.113).

Figure S5.3 displays the serial multiple mediator model of the causal effect of visual landscape on unpleasant activation-pleasant deactivation and Tables S5.13 and S5.14 (Appendix 2) summarizes the model coefficients and direct and indirect effects. Only the sum of all specific indirect effects is significant (total indirect effect = 0.013, 95% CI: 0.044 to 0.181). The same analysis using change from T1 to T2, instead of change from T1 to T3, as DV is provided in Figure S5.4 and statistics of these models are shown in Tables S5.15 and S5.16 (Appendix 2). All specific and total indirect effects are statistically significant.

5.5. Discussion

In the scope of nature-based tourism, this study focused on the dynamic pattern of core affect during one-day hiking activity in Madeira Island. All core affect subscales, except activation, increased from the beginning to the middle and from the middle to the end of the 'levadas' and trails, and perceived restorative quality, landscape features and hike features mostly explained these changes. In general, predictors were most effective in the first half of the 'levadas' and trails. We also added empirical evidence that nature-based tourism has restorative outcomes and that being away, and fascination mediated the relationship between perceived visual landscape and change in core-affect.

Regarding the change in core affect, our findings parallel that of Hull et al. (1992). We found an increase of energy (activation) and a decrease of tension (unpleasant activation-pleasant deactivation) in this study. This state is the so-called 'calm energy' (Thayer, 2003) and it was also reported in four different leisure-time experiences (Hull et al., 1996) and as an outcome of single sessions of Qigong (Johansson & Hassmén, 2013).

We verified that valence and pleasant activation-unpleasant deactivation unfolded gradually along the 'levadas' and trails. A somewhat different dynamic pattern was reported by More and Payne (1978) when assessing affective responses to natural areas near cities. Specifically, entering levels of positively valued moods were moderately high, but, contrary to our study, levels of positive mood decreased slightly during the one-site visit. In addition, a study of Hull and Michael (1995) showed that energy levels decreased with time at leisure. Hence, consistent with these studies, we could expect a slightly decrease in valence and pleasant activation-unpleasant deactivation from the middle to the end, since the middle of the 'levadas' and trails generally coincides with the highest point of scenic beauty. In fact, after reaching the 'goal', the nature-based tourist had to return to the starting point by the same 'levadas' and trails. Consequently, the absence of novelty and some monotony could lead to a decrease in core affect (Mitas & Bastiaansen, 2018). Instead, the participants in the present study were engaged (pleasant activation) and pleased (valence). This may have to do with the landscape richness (Hull & Stewart, 1995) or because the way back was an opportunity to have a full glance of the hike (Kaplan & Kaplan, 1989).

In the current study, older nature-based tourists gained more in valence (T1-T2) (e.g., pleased), activation (e.g., active) and pleasant activation-unpleasant deactivation (e.g., engaged) (both in the first and second halves of the 'levadas' and trails) than younger nature-based tourists. Females also gained more in pleasant activation-unpleasant deactivation (T1-T2) and unpleasant activation-pleasant deactivation (T2-T3) (e.g., relaxed) than males. Country and level of education had no significant effects. These results are consistent with some previous studies, but not with others. In one-day visitors to natural areas, More and Payne (1978) reported that positive and negative affects were unrelated to socioeconomic characteristics. In the context of vacations, Gao et al. (2018) observed that females were more likely to use positive and negative strategies to regulate their emotions at the beginning of their vacations (the average length of stay was 8 days) than were males. In addition, participants with higher levels of education were significantly more likely to regulate their positive emotions during the middle sections of the vacation than their counterparts who had lower education levels. Yet, Nawijn (2010), excluding day trippers from the analysis (80% of the tourists were on a trip of 17 days or less), did not find differences in mood during holidays across age, marital status, gender, and income categories. Not long after, Nawijn et al. (2012) reported that changes in emotions over time (average trip, 8- to 13-day) did not differ between American and Dutch vacationers. Of course, we cannot compare what is not comparable, but from our results older nature-based tourists and females were more likely to gain in core affect than were younger and males' participants. Thus, although nature-based tourists felt good along the 'levadas' and trails, some explained variance in core affect was due to age and gender.

Of the demographic characteristics of the mountain guides, only gender had a positive and statistically significant influence on activation in the second half of the 'levadas' and trails. Given that emotions reflect attributes of a leisure experience (Hull & Michael, 1995) and are influenced by an active participation in the experience (Su, Cheng, & Swanson, 2020), it may be that male mountain guides promoted better the engagement of the nature-based tourists in meaningful experiences, including the opportunity to co-create their own hike activity (Kwon & Lee, 2020; Campos, Mendes, Valle, & Scott, 2018) and managed better the physical fatigue that could be started to set in nature-based tourists (Hull & Stewart, 1992).

In the context of environmental characteristics, nature sounds, nature smells, and elements and forms of the landscape were significant predictors of change in core affect. This association was also explored in previous research. For example, Hull and Harvey (1989) explaining the emotion people experience in suburban parks, observed that pleasure (valence) increased as tree density increased, and understory density decreased. On the other hand, arousal (activation) increased with increasing understory vegetation density. Hull et al. (1992) observed significant changes in four mood measures (bored, excited, rushed, and relaxed) occurring during a day hike and these changes were correlated with physical characteristics of the trail and stages of the hike. Also, Kaplan and Kaplan (1989) exploring the relationship between people and the natural environment, reported positive experiences when participants saw and heard birds. More recently, Ratcliffe et al. (2013) suggested that certain bird sounds may aid perceived restoration from stress or fatigue by encouraging positive affect and reduced arousal. Agapito et al. (2017) addressed the contribution of nature sounds and nature smells as perceived by tourists to memorable destination experience. Sights, scents, and sounds were also the more important resources of any nature-based tourism product (Fossgard & Fredman, 2019). Yet, Agapito (2020) indicated that opportunities for future research on tourism experience design around the senses were related to sustainability and technology. In all, these studies support that nature sounds and nature smells, and landscape characteristics, are associated with positive emotions and added memories, loyalty, and current lines in tourism research.

Our measures of hike features (distance, ascent and descent and difficulty of the trails) showed different associations with change in core affect. However, only few studies have focused on this issue. In long distance walkers, Crust, Keegan, Piggott, and

Swann (2011) observed an increase in positive feelings throughout the duration of the walk. Hull and Stewart (1992) reported that hiking uphill *vs* hiking downhill accounted for differences between on-site and photo-based scenic beauty ratings. Su et al. (2020) reported that tourism activity group's arousal was significantly higher than the relaxing tourism activity group. Marselle et al. (2016) observed that perceived walk intensity had a direct effect on positive affect and happiness. In analysing the results of these studies, it seems that the longer and intense the walk is, the more likely it is that a person will show positive affect. We observed negative associations of distance and difficulty with core affect. So, our results did not confirm the above studies. We believe that physical fatigue might underlies the negative associations observed in the current study.

Being away and fascination were positive predictors of all core affect subscales in the first half of the 'levadas' and trails. It is important, however, to realize that both restorative qualities were almost unrelated to core affect in the second half. This is novel and go further the initial belief of Kaplan, Kaplan, and Brown (1989) in that predictors in general vary in their effectiveness in different kinds of environments. Apart from this, our results follow the literature. In the case of Marselle et al. (2016), being away and fascination were positively associated with post-walk positive affect and happiness. Kirillova and Letho (2016) reported that mentally away, a sub-dimension of being away, and fascination were found to positively affect aesthetic judgement. Letho et al. (2017) observed that mentally away played the most important role for vacation satisfaction for Chinese tourists. Certainly, aesthetic judgement, satisfaction and core affect are different constructs, and some care should be considered when interpreting these results.

One of the more striking aspects of this study is the chance of exploring the performance of each predictor in the first and second halves of the 'levadas' and trails. From the results (Tables 5.2-5.5) it was clear that a higher percentage of variance in core affect was explained in the first half of the 'levadas' and trails. It should be also noted that perceived restoration quality and environmental characteristics made the greatest contribution to the explained variance of core affect during one-day hiking activity. On the other hand, mountain guide characteristics added little to the variance explained. A real surprise was the large amount of variance unexplained in the second half of the 'levadas' and trails and the effect of the tourist's age. If the variance that remains unexplained opens a new research window, the second issue reinforce that older nature-based tourists derive more benefits from the hiking activity. This finding is true for one-day hiking activity and appears to have a significant role in the long-term memory of tourists' experiences (Agapito et al., 2017).

In regard to the effect that perceived visual landscape has on core affect and the 'mechanisms' through which this relationship occurs, our results revealed a full mediation of valence, activation and pleasant activation-unpleasant deactivation through being away and fascination. These results parallel earlier studies (Dahlkvist et al., 2016; Marselle et al., 2016; Carrus et al., 2015; Lindal & Hartig, 2015; Sato & Conner, 2013; Gonzalez, Hartig, Patil, Martinsen, & Kirkevold, 2010; Nordh et al., 2009) exploring similar relationships in different contexts.

Lastly, being away and fascination did not play a significant role in the relationship between perceived visual landscape and unpleasant activation-pleasant deactivation. However, when we used change from T1 to T2 as dependent variable, the mediation effects arose (see Tables S5.15 and S5.16, Appendix 2). These results confirm the previous believe that the effectiveness of the predictors/mediators differs in each phase of the hiking activity and across different environments [see also Nordh et al. (2009) and Kaplan et al. (1989)].

5.6. Conclusions, implications, and future research

This study assessed the affective dynamics of nature-based tourists during one-day hiking activity in Madeira Island. All core affect subscales, except activation, gradually increased from the beginning to the middle and from the middle to the end of the 'levadas' and trails. These results confirmed the long-standing evidence that core affect 'fluctuates' along one-day hiking activity (Hull et al., 1996; 1992; More & Payne, 1978) and extended the recent findings of Gao and Kerstetter (2018) and Gao et al. (2018) regarding to the transient, dynamic and variable nature of emotions during a vacation.

Among a range of variables used to predict change in core affect, age and gender of the nature-based tourists, nature smells, distance, descent, difficulty and being away were significant predictors of core affect in both, first and second halves of the 'levadas' and trails in at least one core affect subscale. Nature sounds, ascent and fascination were also significant predictors of core affect in the first half, while gender of the mountain guide and elements and forms of the landscape were significant predictors of core affect in the second half. Taken together, the highest variance explained by the predictors was 56.2% in the first half of the ‘levadas’ and trails and 34.5% in the second. As a group of predictors, perceived restorative quality and environmental characteristics explained the highest percentage of variance in core affect. These results acknowledged that predictors of change in core affect differ in the two-halves of the ‘levadas’ and trails and that one-specific predictor has different relationships with change in core affect when modelled in the first or second half. In this framework, we theoretical moved a step forward the initial questions raised by Kaplan et al. (1989) and Hull et al. (1992) regarding to the effectiveness and robustness of predictors across different kinds of environments.

Of interest in this study was also the mediation effect of perceived restorative qualities on the relationship between perceived visual landscape and core affect. We found a full mediation of valence, activation, and pleasant activation-unpleasant deactivation through being away and fascination. We also found that fascination played a more important role in the mediation analysis than being away. These findings are consistent with previous research (e.g., Marselle Irvine, Lorenzo-Arribas, & Warber, 2016; Sato & Conner, 2013; Lindal & Hartig, 2015) and give a novel contribute to the person-environment transactions in nature-based tourism.

From a practical perspective, tourism professionals should increase gains of activation and unpleasant activation-pleasant deactivation in the second half of the ‘levadas’ and trails, and to promote a greater gain of pleasant activation-unpleasant deactivation in the first half. To ensure these gains, tourism professionals should enrich the nature-based tourists’ experiences (Bastiaansen et al., 2019; Zhang & Xu, 2019; Agapito et al., 2017). As long as elements and forms of the landscape, nature smells and nature sounds were positively related to change in core affect, tourism professionals should maximize these landscape features. In the opposite, long and difficult ‘levadas’ and trails should be avoided due to their significant negative association with core affect. It is also important to trigger a sense of being quite distant from the world of pressures and obligations (Kaplan & Kaplan, 1989) and promote the engagement of effortless attention since being away and fascination were significant predictors and mediators of core affect. To increase the engagement of the nature-based tourists, tourism professionals should allow for co-creation of experiences. In Madeira Island, examples are to swim safely in crystal-clear swimming holes and hidden beaches and to explore grand vistas, such as mountain peaks and viewpoints, on their own. Younger nature-based tourists should also be the focus of tourism professionals since their gain in core affect was less than the older nature-based tourists. Thus, tourism professionals should promote stronger interactions of young adults with the environment (Campos et al., 2018).

We assessed core affect in a large sample of nature-based tourists at the beginning, middle and end of their one-day hiking activity. The three time-points of core affect allowed us to look for within-individuals change over time. We also used five predictor domains with multi-item measures as suggested by Kaplan et al. (1989) and reinforced by Hartig, Mitchell, de Vries, and Frumkin (2014) in a model establishing causal pathways between nature and health. Despite the significant strengths of this study, we acknowledge some limitations. First, we approached the dynamic pattern of core affect with a 'short-longitudinal design' rather than an experimental field study. The absence of a comparison condition makes it difficult to understand causal relationships, even though we distinguished between direct and indirect effects when ran the analysis. Additional prospective and intervention studies (White et al., 2019; Hartig et al., 2014) would allow for a more detailed understanding of core affect in nature-based tourism. Examples of specific design attributes are short *vs* long distance 'levadas' and trails and mountain *vs* sea-level trails. Second, the use of self-report scales allows for biased responses. While we recorded core affect and restorative quality in real-time, nature-based tourists were liable to over- or underestimate the processes and outcomes (Grassini et al., 2019). In this away, future research should address brain network activity using psychophysiological techniques, such as ambulatory electroencephalography, as recommended by Moyle et al. (2019) and William et al. (2018). Third, we did not track the main variables under study before and after the visit to Madeira. Such an extension would enable the study of the whole nature-based experience, i.e., from pre- to postexperience conditions (McMahan & Estes, 2015; Hull & Michael, 1995). Fourth, we did not control for the day on which we carried out the assessment. Since most of the tourists came to Madeira for hiking during 8-10 days, their human-nature relationship could vary as a function of the day. It is recommended that future research should consider both length of stay and the assessment day. Lastly, this study is limited by the over-representation of French tourists. This was because some tourism companies refused to participate in the study. On face of it, a more balanced sample would benefit future studies (Su et al., 2020; Breitsohl & Garrod, 2016).

We end this paper with the question of which predictors of core affect are at play on the second half of the 'levadas' and trails. In this regard, we should focus on direct measures of natural environment and contact with nature, together with attributes like air quality, physical activity, social contacts, and stress, building on the work of Hartig et al. (2014).

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5.7. References

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Capítulo 6

Nature-based tourism and physical health. The case of ‘levadas’ and trails of Madeira

6. Nature-based tourism and physical health. The case of ‘levadas’ and trails of Madeira

Abstract

This study described the ‘levadas’ and trails of Madeira Island and explored the relationship between nature-based tourism and physical well-being. The sample included 1575 nature-based tourists, aged 18-84 years. Physical activity and physical fitness were assessed. The distance, duration, elevation gain, elevation loss, stride length and walking speed were provided. Approximately 53% of the participants were in the target range of 150 to 300 minutes of moderate-to-vigorous physical activity. Moreover, participants attained, at least, 42 minutes at or above 70% of their maximal heart rate. Further analyses revealed that age, percent of body fat and participants’ perception of demanding ‘levadas’ and trails were negatively associated with moderate-to-vigorous physical activity. Finally, physical activity in the past year mediated the relationship between moderate-to-vigorous physical activity undertaken during the hike and health-related physical fitness. Health and tourism professionals can use this information in promoting active living and hiking experiences.

Keywords: tourism, hiking, physical activity, health, Madeira

6.1. Introduction

In the second half of the 18th century, Madeira arose as a resort of therapeutic ends and a port-of-call of scientific explorations (Vieira, 2008). The prophylactic qualities of the climate in curing tuberculosis and the diversity of flora and fauna attracted patients and researchers, mainly from England (Vieira, 2008). In the 40s of the 20th century, tourism has turned into a major driver for the Island development (Vieira, 2008). Nowadays, the economic contribution of tourism to Madeira territory represents 26.6% of the Regional Gross Domestic Product [Direção Regional de Estatística da Madeira (DREM), 2018].

A study carried out by the Madeira Tourism Board (2010) reported that within the visitors who come to Madeira for holidays, the main purpose of travel was the contact with nature (34%), followed by sun and sea (21%) and culture (13%). So, it is not surprising that the Madeira Tourism Board (2020) adopted the slogans: ‘Body. Mind. Madeira’ and ‘Active Tourism in Madeira: A Nature Rich in Adventure, Experiences and Emotions’. The Madeira Tourism Board (2020) also stated that walking along ‘levadas’, i.e., small waterways along with the footpaths, was one of the most outdoor activities undertaken.

While walking is the most natural form of physical activity (Morris & Hardman, 1997) and physical activity is one of the best things people can do to improve their health [Centers for Disease Control and Prevention (CDC), 2020; World Health Organization (WHO), 2018], little is still known about walking or hiking in the ‘levadas’ and trails of Madeira Island. Therefore, it is critical to describe the physical features of the ‘levadas’ and trails and provide the physical activity intensity when walking or hiking in such ‘levadas’ and trails. In doing so, we will provide the local community and nature-based tourists with essential information to choose the ‘levadas’ and trails that match with their age, level of experience, physical fitness, and interest (New Zealand Trails, 2020; Wellington Park Walking Track Strategy, 2003). It is also useful for being properly equipped and hike more safely (NationalParks.Fi, 2020). At the same time, we will assist in promoting active living and marketing walking experiences in ‘levadas’ and trails.

Currently, the distance, estimated time to complete the trail, gradient, steps, trail surface, signage, risks, user profile, activity level, difficulty, seasonality, type of obstacles and access for disabled people are among the elements of a classification system (Arias, Bent, & Wadsworth, 2007). In Madeira Island, the 30 ‘levadas’ and trails recommended by the Madeira Tourism Board and the Institute of Forests and Nature Conservation, include signage, trail description, distance, degree of difficulty, duration, minimum and maximum altitude, and safety and walking code. In the present study, we complement it with elevation gain, elevation loss, stride length, walking speed, levels of physical activity and heart rate training zones.

A literature revision on trails for tourism and outdoor recreation reported that the most-studied trail-based activity was hiking (Kling, Fredman, & Wall-Reinius, 2017). Among hikers, the choice of a trail varies according to the degree of difficulty (Collingwood, Adcock, & Librett, 2007; Hugo, 1999). Signage, trail maintenance, facilities, interactions between trail users, crowding and degradation were perceived of being of importance on the hike experience (Svajda, Korony, Brighton, Esser, & Ciapala, 2016; Nordbø & Prebensen, 2015; Ólafsdóttir & Runnström, 2013; Wearing, Scheinsberg, Grabowski, & Tumes, 2009).

The evidence for effects of, and associations between nature-experience on a wide range of health outcomes were recently highlighted in three revisions (Dzhambov, Browning, Markevych, Hartig, & Lercher, 2020; Mygind et al., 2019; Twohig-Bennett & Jones, 2018). Physical activity is one of the pathways through which contact with nature may affect health (Hartig, Mitchell, de Vries, & Frumkin, 2014). The 2018 Physical Activity Guidelines Advisory Committee Scientific Report (2018) and WHO (2010) recommend a health target range of 150 to 300 minutes of moderate-intensity aerobic physical activity throughout the week (or 75 to 150 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity aerobic physical activity) or even small increases in moderate-intensity aerobic physical activity to achieve substantial health benefits. Some physical activity is better than doing none (WHO, 2020) and health benefits can be accrued with minor volumes of physical activity or simply become physically active (Dzhambov et al., 2020; Griffin, Roselli, & Clemens, 2020; White et al., 2019; Warburton & Bredin, 2017).

In line with the above, it seems appropriate to determine what intensity the nature-based tourist is exerting him/herself over the course of the hike (Coetzee, 2018) or if one-day hiking activity in 'levadas' and trails is of sufficient intensity to induce a training effect and develops and sustains health-related physical fitness (Morris & Hardman, 1997). In England, Kelly, Murphy, Oja, Murtagh, and Foster, (2011) suggested that a considerable number of people would attain or exceed vigorous intensity activity (> 70% maximum heart rate) by walking at 3 mph. Porcari et al. (1987) also suggested that fast walking was intense enough to elicit a training heart rate, which was defined as ≥ 70% of maximal heart rate, and indeed offer an adequate aerobic training stimulus for 30- to 69-year-old men and women.

Previous research on correlates or predictors of walking or hiking focused almost exclusively on self-reported data and were mostly limited to urban environments. For example, demographic variables were significant predictors of walking level in the 'West Pedometer-Based Community Intervention Study' (Robertson et al., 2012). Data from 587 hikers on 'Namhansanseong Trail in South Korea' revealed that novice, behaviour-oriented, veteran, and potential veteran hikers showed differential patterns in the behavioural and cognitive dimensions of specialization (Kim & Song, 2017). The influence of two different green infrastructures on human health and well-being also differed across gender (Kim & Miller, 2019). In a treadmill walking test, older subjects (64 ±3 years) had significantly greater physiological parameters during uphill, level and downhill walking compared to younger subjects (23 ±3 years) (Navalta, Sedlock, & Park, 2004).

It is within this context that the aims of this study are: (1) to describe the 'levadas' and trails of Madeira Island and to measure physical activity intensity that characterizes one-day hiking activity by nature-based tourists; (2) to determine whether physical activity undertaken by nature-based tourists meets the global physical activity guidelines; (3) to investigate whether nature-based tourists achieve physical activity intensity that is sufficient to induce a training effect; (4) to identify predictors of the moderate-to-vigorous physical activity undertaken by nature-based tourists in 'levadas' and trails of Madeira Island; and (5) to assess whether habitual physical activity mediates the relationship between physical activity in the 'levadas' and trails and health-related physical fitness.

This study uses data from the 'LevMadeira Study', a large cross-sectional study exploring the relationships among nature-based tourism, landscape, and health. We hope to provide additional information on the 'levadas' and trails and physiological responses of nature-based tourists that accompany one-day hiking activity. We aim to make the hiking activity more secure and allow the creation of new experiences and, in turn, attract more tourists. Madeira Island won the prizes of 'World's Leading Island Destination from 2015 to 2019 and the Europe's Leading Island Destination from 2013 to 2014 and from 2016 to 2019.

6.2. Methods

6.2.1. Study area and 'levadas' and trails

This study was conducted in Madeira Island, Portugal. Madeira is located between the latitudes 32º 38´ N and 32º 52´ N and the longitudes 16º 39´W and 17º 16´W. The Island is of volcanic origin, covers an area of 758.5 km2 and had a population of nearly one-quarter million in 2018 (DREM, 2019).

The centre of the Island is a combination of plateau areas, peaks, some of them exceeding the 1800 m, valley headlands and circular depressions (Ribeiro, 1985). This orography provides a wide variety of microclimates and natural habitats. In the north, the Laurissilva forest dominates and offers an endemic flora and fauna [Instituto das Florestas e Conservação da Natureza (IFCN) IP-RAM, 2020]. The Laurissilva forest covers an area of 15000 ha, approximately 20% of the territory of the Island, and has been recognized as a UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage Site since 1999 and a Biogenetic Reserve of the Council of Europe since 1992.

The Island's climate is generally temperate oceanic. The average maximum temperature in summer is slightly above 23º C in the coastal regions and 16º C in the peaks. The precipitation, especially of the orographic type, exceeds 2600 mm/year at the highest elevations, while at Funchal, the main city, the precipitation is, on average, 596.4 mm. The precipitation is more abundant during the months of December and January. The solar insolation reaches 2165 hours at Funchal (AEMET & IM, 2012).

For a small island, Madeira has a surprisingly orography, a variation in climate, a heterogenous and iconic landscape, an endemic flora and fauna, and the absence of predators that make Madeira Island a prime destination of nature-based tourism. The island is also renowned for its hospitality and for the 'levadas' along with the footpaths that are rare and of outstanding beauty. The 'levadas' date back to the early settlers and were first related to agricultural purposes and human' water supply. Madeira has more than 200 'levadas' with a total length of some 1500 km. Today, the 'levadas', along with the footpaths and old walking paths, have been considered as 'recreation opportunities' for thousands of visitors each year. The Madeira Tourism Board and the Institute of Forests and Nature Conservation recommend 30 'levadas' and trails (walking routes).

A comprehensive knowledge of the 'levadas' and trails and an on-site understanding of health benefits of hiking activity are primary means of promoting the Island and healthy lifestyles. It also enables hikers to gauge whether a particular 'levada' and trail is suitable for their level of skill (Alberta Government, 2009). From this perspective and following the Australian Standard (2001), we minimize risk and enhance recreation opportunities associated with the use of 'levadas' and trails.

The current sample included 45 'levadas' and trails (Figure 6.1). Most of the 'levadas' and trails were in the north of the Island and mountain massive. Trails with more participants assessed were: P02, Pico Ruivo (Pico Areeiro or Achada do Teixeira); P25, Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos or Feiteiras; P21, Jardim do Mar – Prazeres – Paul do Mar; P01, 25 Fontes (Rabaçal); P14, Levada do Moinho (Porto Moniz); and P13, São Roque do Faial – Penha d'Águia – São Roque do Faial.

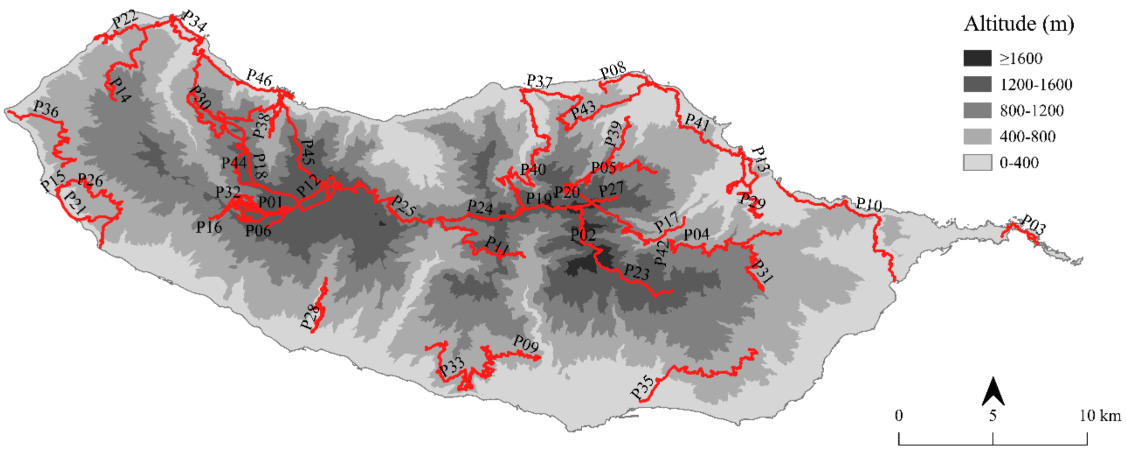

Figure 6.1 Location of the 45 'levadas' and trails in Madeira Island[†]. Source: Regional Directorate for Spatial Planning and Environment.

[†]P01, 25 Fontes (Rabaçal or 'Garagem'); P02, Pico Ruivo (Pico Areeiro or Achada do Teixeira); P03, Ponta de S. Lourenço (Cais do Sardinha); P04, Ribeiro Frio – Portela; P05, Caldeirão Verde (Queimadas or Pico das Pedras); P06, Levada do Alecrim (Lagoa D. Beja); P07, Levada do Rei; P08, Arco de S. Jorge – Quinta do Furão; P09, Levada do Norte (Estreito de Cª de Lobos – Cabo Girão); P10, Larano (Porto da Cruz – Machico); P11, Pico Grande (Encumeada – Pico Grande – Curral das Freiras); P12, Estanquinhos – Levada do Pico da Urze – Levada do Alecrim; P13, S. Roque do Faial – Penha d'Águia – S. Roque do Faial or Santana; P14, Levada do Moinho (Porto Moniz); P15, Levada Nova (Calheta) – Paul do Mar or Jardim do Mar; P16, Risco – Lagos (Lagoas do Vento e D. Beja) – Paul da Serra; P17, Fajã da Nogueira – Caldeirão do Inferno – Caldeirão Verde – Queimadas; P18, Estanquinhos – Pico Ruivo do Paul – Levada dos Cedros – Ribeira da Janela; P19, Encumeada – Pico Ruivo – Achada do Teixeira; P20, Ilha – Caldeirão Verde – Caldeirão do Inferno – Queimadas; P21, Jardim do Mar – Prazeres – Paul do Mar (caminhos reais); P22, Achadas da Cruz – Pombais – Pico – Porto Moniz; P23, Achada do Teixeira – Pico Areeiro – Poiso; P24, Boaventura – Encumeada (Picos); P25, Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos or Feiteiras; P26, Maloeira – Prazeres – Paul do Mar; P27, Achada do Teixeira – Pico Ruivo – Achada do Teixeira; P28, Levada Nova – Levada do Moinho (Ponta do Sol); P29, Referta – Terra Baptista; P30, Levada dos Cedros; P31, Levada da Serra do Faial (Santo da Serra – Portela); P32, Levada Velha – 25 Fontes – Levada do Alecrim – Lagoa D. Beja – Rabaçal; P33, Levada do Norte (Campanário – Quinta Grande); P34, Seixal (Cais) – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela; P35, Levada da Serra do Faial (Vale Paraíso) – Choupana – Funchal; P36, Levada Nova da Calheta (Prazeres) – Farol da Ponta do Pargo; P37, Boaventura – S. Jorge; P38, Seixal – Chão da Ribeira – Seixal; P39, Pico das Pedras – Caldeirão Verde – Ilha; P40, Levada dos Tornos (Boaventura) – Pousada da Boaventura; P41, Santana – Faial – S. Roque do Faial; P42, Balcões; P43, Arco de S. Jorge – S. Jorge – Praia de S. Jorge; P44, Estanquinhos – Paul da Serra – Seixal; P45, Encumeada – Estanquinhos – Paul da Serra – Chão da Ribeira – Seixal; P46, Seixal – Ribeira Funda – Ribeira da Janela – Lamaceiros –Porto Moniz.

6.2.2. Design and participants

A cross-sectional study was designed to investigate the relationships among nature-based tourism, landscape, and health. The sample included 1575 nature-based tourists from 29 countries, who visited Madeira Island between July 2016 and October 2017. Table 6.1 describes the socio-demographic characteristics and self-rated health of the participants.

The nature-based tourists tended to fall in the age groups of 45-54 and 55-64 years, with an average age of 51.9 years (standard deviation of 12.8 years; range 18-84 years). Females constituted the high percentage of the sample. The largest group was from France, followed by the nature-based tourists from United Kingdom, Germany, Spain, Belgium, and Switzerland. The majority held high education, were married, or lived in common law and were professionally active. A great share of participants reported 9 or more visits to natural environments per year and self-rated their health as very good, good, or excellent.

Table 6.1 Sample characteristics (n = 1575).

Variable	Value	(n = 1575)	Percent
Gender	Female	950	60.32
	Male	625	39.68
Age, years	15–24	26	1.65
	25–34	155	9.84
	35–44	252	16.00
	45–54	421	26.73
	55–64	439	27.87
	65–74	254	16.13
	75–84	28	1.78
Country	Belgium	39	2.48
	France	1149	72.95
	Germany	107	6.79
	Spain	58	3.68
	Switzerland	34	2.16
	United Kingdom	116	7.37
	Other†	72	4.57
Education	Primary	42	2.70
	Secondary	329	21.13
	High	1186	76.17
Marital status	Married/living common-law	737	47.40
	Widows	67	4.31
	Separated/divorced	247	18.88
	Single	504	32.41
Employment status	Paid job	1069	69.33
	Student	20	1.30
	Housewife	12	0.78
	Retired	387	25.10
	Disability pension	2	0.13
	Unemployed	11	0.71
	Other	41	2.66
Visits to natural environments, per year	First time	48	3.09
	1–2	392	25.23
	3–4	347	22.33
	5–6	170	10.94
	7–8	95	6.11
	≥ 9	502	32.30
Self-rated health	Excellent	222	14.18
	Very good	755	48.21
	Good	555	35.44
	Fair	32	2.04
	Poor	2	0.13

†This category includes nature-based tourists from 23 countries.

6.2.3. Measures

6.2.3.1. Socio-demographic characteristics, nature tourism and self-rated health

We used a combination of open-ended questions to explore the socio-demographic characteristics of the participants. Questions were derived from Census 2011 (Statistics Portugal, 2009-2014) and included birth date, gender, home country, marital status, and level of education. We assessed the years of nature-based tourism or the number of visits to natural environment per year. Answer's choices included first time, 1-2, 3-4, 5-6, 7-8 and ≥ 9 and were coded on a 1-6 ordinal category scale. The last question focused on health status and was adopted from the 12-Item Short-Form Health Survey (Ware, Kosinski, & Keller, 1996).

6.2.3.2. Trail-related features

We recorded elevation gain, elevation loss, stride length, distance and duration of the 'levadas' and trails through telemetry using POLAR V800 GPS sports watch and Stride Sensor Bluetooth® Smart devices (Polar Electro OY, Kempele, Finland). We assessed the participants' perceived physical proprieties of the 'levadas' and trails with 10 items: narrow, irregular, unprotected, degraded protection, poor signage, cliffs, landslides, slippery, falling rocks and demanding. Participants were asked to indicate their agreement on a 5-point ordinal category scale with 1 being no agreement and 5 being full agreement.

6.2.3.3. Physical activity

We fitted the nature-based tourists with accelerometers ActiGraph, model GT3X (ActiGraph, Pensacola, FL, USA) to objectively measure physical activity during one-day hiking activity. The ActiGraph GT3X (3.8 × 3.7 × 1.8 cm; 27.0 g) measures acceleration on 3 axes: vertical, horizontal, and perpendicular. The acceleration data is sampled by a 12-bit analog to digital converter at rates ranging from 30 Hz to 100 Hz and stored in a raw, non-filtered/accumulated format in the units of gravity (G's). This data is stored directly into non-volatile flash memory (ActiGraph, 2013). The raw data are processed and filtered in the ActLife 6 software and then converted into activity counts.

In the analysis, we used the intensity-threshold criteria developed by Troiano et al. (2008) for adults, ages 18 or older, i.e., sedentary (0 – 99 counts·min^{-1}), light (100 – 2019 counts·min^{-1}), moderate (2020 – 5998 counts·min^{-1}) and vigorous (≥ 5999 counts·min^{-1}).

Participants were also instrumented with a H7 Heart Rate Sensor (63 mm × 37 mm × 11 mm; 26.0 g) attached to a chest strap (Polar Electro OY, Kempele, Finland). The monitor on the left wrist and the sensor around the chest bellow the pectoralis major made it possible to continuously measure the heart rate of the nature-based tourists during the hiking activity.

To explore the relationship between physical activity undertaken on 'levadas' and trails and health-related outcomes of the participants, we assessed physical activity in the past year using a modified version of the Baecke questionnaire (Pols et al., 1995). The questionnaire entails 19 questions about physical activity at work or household activities or studying as their work (e.g., at work I sweat), sport during leisure time (e.g., during leisure time I play sport) and physical activity during leisure time excluding sport (e.g., during leisure time I walk). Except for questions 1 (what is your main occupation?) and 9 (do you play sport?) participants give their answers on a 5-point ordinal category scale. Three indices are derived from these dimensions: work, sport, and leisure-time. Scores from these indices are summed to compute the total physical activity.

6.2.3.4. Health-related physical fitness

6.2.3.4.1. Anthropometry and body composition

Height, body mass and skinfolds were measured following standardized procedures [American College of Sports Medicine (ACSM), 2018]. Height was measured with a portable stadiometer (Siber-Hegner, GPM) to the nearest 0.1 cm. Body mass was measured on a balance-beam scale accurate to 0.1 kg (Seca Optima 760). Abdominal, chest/pectoral, subscapular, suprailiac, and triceps skinfold thicknesses were measured with a Holtain caliper (Holtain, LTD) directly on the skin surface. All measurements were taken twice and an average of the two measures was used. A third measurement was taken if the first two differed by more than 5 mm (height), 1 kg (body mass) and 10% (skinfolds). Measurements were taken with participants without shoes, empty pockets and accessories removed. A three-site formula was used to predict body density from skinfolds measurements. We used chest/pectoral, triceps and subscapular skinfolds for men and triceps, suprailiac and abdominal skin folds for women. Population-specific formulas, i.e., ethnicity (Caucasian) and age- and sex-specific formulas, were used for estimating percent body fat from body density, following the guidelines of the ACSM (2018; p.78).

6.2.3.4.2. Physical fitness

We administered the YMCA 3-minute step test from the YMCA Fitness Testing and Assessment Manual (Golding, 2000) to assess physical fitness of participants, aged 18-59 years. This test uses a 30.5 cm bench, with a stepping rate of 24 steps·min^{-1}. Participants step up and down on the platform for a total of 3 minutes. After stepping is completed, the subject immediately sits down, and heart rate is counted for 1 minute. Counting must start within 5 seconds at the end of exercise.

6.2.3.4.3. Functional fitness

We administered the 6-minute walk test from the Senior Fitness Test (Rikli & Jones, 1999) to assess functional fitness of participants, aged 60 and above. The test consists in the maximum distance that can be walked in 6 minutes along a 50-yd (45.72 m) rectangular course. In the present study, most of the participants performed the test along 15-30-meter stretch of unimpeded walkway on an outdoor adjacent area of the accommodation place.

6.2.4. Procedures

The study was approved by the Scientific Boards of the Faculty of Social and Human Sciences of NOVA University of Lisbon, the Faculty of Social Sciences of University of Madeira, and the Faculty of Sports of University of Porto.

In the preparation of the fieldwork, we carried out a pre-test and two pilot studies aiming to refine the protocols and administration procedures. Participants in the two pilot studies were asked to fill in the questionnaires, wear the electronic devices and perform anthropometric measurements and motor tests. When a final Portuguese version of the protocols was achieved, they were translated to French, German and Spanish and back to Portuguese by native-speaking colleagues from the Faculty of Arts and Humanities of the University of Madeira. We maintained the originality of the English scales. We then invited the travel agencies and tourist entertainment companies to participate in the study. Of the 26 invitations, 7 (26.9%) declined to participate due to the disturbance of the hiking activity, time constraints, lack of interest in the research or non-authorization at the origin, mainly those operators based in Germany, Austria, Holland, and United Kingdom.

A team of 10 experienced investigators, with backgrounds in Geography, Sport Sciences and Nursing, performed the fieldwork between 14 July 2016 and 12 October 2017. We focused on ‘close groups’, i.e., small groups of tourists who come to Madeira to hike on ‘levadas’ and trails for 8-10 days and were led by a mountain guide. After gathered permission from the travel agencies and tourist entertainment companies, a meeting was held at the accommodation place with the nature-based tourists and mountain guides. We explained the study and invited them to participate on a voluntary basis. Tourists had the right to withdraw from the study at any time. For those willing to participate, the fieldwork team arrived at the accommodation place, on the testing day, just before the breakfast. The tourists first provided informed written consent and were instrumented with the electronic devices. The ActiGraph GT3X (ActiGraph, Pensacola, FL, USA) unit was set to collect raw triaxial acceleration at 80 Hz. The accelerometer was attached to an adjustable elastic belt and worn above the right hip, just above the iliac crest, and over clothing. The Polar V800 GPS sports watch (Polar Electro OY, Kempele, Finland) was worn on the left wrist, the H7 Heart Rate Sensor attached to a chest strap (Polar Electro OY, Kempele, Finland) was placed around the chest bellow the pectoralis major and the Stride Sensor Bluetooth® Smart (Polar Electro OY, Kempele, Finland) was worn on right foot placed on shoelaces with a fork. Both, heart rate and stride sensors were matched with the Polar V800. We computed individual heart rate zones through the estimation of maximum heart rate (220 minus age in years), and intervals provided by Polar (vert light, 50-60%; light, 60-70%; moderate, 70-80%; hard, 80-90%; and maximum, 90-100%).

One member of the research team escorted the group during one-day hiking activity to supervise the devices and explain and administer the questionnaires. At the end of the ‘levadas’ and trails, the electronic devices were turned off and participants filled in the questionnaire on trails features. Upon arriving at the accommodation place, participants fill in the socio-demographic, touristic activity, and habitual physical activity questionnaires. Participants also performed anthropometric measurements and motor tests. At the end, we provided a health-related physical fitness report to each participant. We collected the data on weekdays and on Saturdays from 8h00 to 20h00. Each tourist participated only once, and only on one day during the study period. The number of tourists assessed per day varied between 1 and 16, with a mean of 7.53. After the download, we sent accelerometery and heart rate personal data by email to all participants.

6.2.5. Statistical analysis

We reported descriptive statistics as frequencies, mean, standard deviation, minimum and maximum values, median, mode, and 95% confidence intervals (CIs). We then checked issues of normality and outliers of outcome measures, such as physical activity, heart rate and health-related physical fitness. Based on '2018 Physical Activity Guidelines Advisory Committee' (Physical Activity Guidelines Advisory Committee Scientific Report, 2018) and 'Global Recommendations on Physical Activity for Health' (WHO, 2010), we determined the percentage of tourists who met 150 minutes of moderate-to-vigorous physical activity for one day hiking activity in 'levadas' and trails. We conducted a similar analysis for heart rate 'training zones' (Morris & Hardman, 1997) and explored changes according to age and gender.

To evaluate predictors of moderate-to-vigorous physical activity, we commenced by conducting bivariate analysis measuring the strength and direction of the relationships among demographics, environmental characteristics (including visual landscape, sounds, smells, and landscape units), restorative quality, hike features, social well-being, health-related physical fitness, and physical activity. Correlations of 0.10 or higher entered in stepwise regressions, using 33% of the cases selected at random without replacement. Age, gender, percentage of body fat, distance, elevation gain, elevation loss, and demanding of the 'levadas' and trails were significant predictors of moderate-to-vigorous physical activity and entered as potential predictors in the further regression analyses.

We first checked for assumptions of multicollinearity, linearity, homoscedasticity, and independence of residuals in a single-level multiple regression. Then, we performed a two-level regression model with nature-based tourists (level 1) nested within 'levadas' and trails (level 2) to explore the relationships among the previous predictors and moderate-to-vigorous physical activity undertaken by the nature-based tourists along the 'levadas' and trails. We centred the predictors on their means and ran the analysis in four stages. First, we explored the variance partition of moderate-to-vigorous physical activity into its within- and between-groups components (null model). Intraclass correlation coefficient (ICC) was 0.78. That is, 78% of the variance of moderate-to-vigorous physical activity is accounted for 'levadas' and trails and justify the multilevel approach. Second, we tested the relationships of age and gender with moderate-to-vigorous physical activity (model 2). Third, we added percent body fat (model 3). Finally, we included distance, elevation gain, elevation loss, and demanding of the 'levadas' and trails (full model).

We conducted a simple mediation model with k consequent variables using the PROCESS macro for SPSS v3.5 (Hayes, 2020). We specified model 4 and tested the hypothesis that habitual physical activity mediates the relationship between physical activity on the 'levadas' and trails and physical fitness (aged 18-59 years) and functional fitness (aged 60 years and above) of the nature-based tourists. We used physical fitness and functional fitness as dependent variables (Y), moderate-to-vigorous physical activity as the independent variable (X), habitual physical activity as mediator (M) and 'levadas' and trails (C_1) and age (C_2) as covariates (see Figure 6.5). We estimated the paths running k PROCESS commands, substituting one Y variable for another at each run following the guidelines of Hayes (2018). We used 5000 bootstrap samples to generate 95% CIs.

We processed and analysed the data with the IBM SPSS (IBM Corp. Released, 2017), STATA (StataCorp, 2017) and SuperMix (Hedeker, Gibbons, du Toit, & Cheng, 2008) statistical packages. We mapped the geographical position of 'levadas' and trails with the QGIS software, v.3.14.15 (QGIS Development Team, 2020). We set the level of significance at $p < 0.05$.

6.3. Results

6.3.1. Descriptive statistics

Table 6.2 presents the descriptive statistics of the 45 'levadas' and trails. The average distance is 11.78 km and nature-based tourists take, on average, around 6 hours to hike on. The average cumulative elevation gain (ascent) and loss (descent) are about

482 m and 544 m, respectively. The average stride length is 62.91 cm and average walking speed is 3.88 km/h. Most of the nature-based tourists perform moderate physical activity (157 minutes) and spend more time at the very light heart rate zone (119 minutes). On average, heart rate is 100 beats per minute. All of the ‘levadas’ and trails represents a total of 550.45 km.

Table 6.2 Descriptive statistics (means, standard deviations and minimum and maximum values) for objective measurements of pooled data (45 ‘levadas’ and trails).

Variable	n	$\bar{x} \pm$ sd	min-max
Distance (km)	1575	11.78±3.6	3.0-24.4
Duration (h)	1573	6.03±1.4	2.2-10.3
Elevation gain (m)	1551	481.56±333.4	5.0-1320.0
Elevation loss (m)	1575	544.00±338.9	10.0-1696.0
Stride length (cm)	1501	62.91±11.2	20.1-101.7
Walking speed (km/h)	1572	3.88±0.8	1.2-7.5
Physical activity (min)			
Sedentary (0-99 counts·min^{-1})	1562	157.54±49.5	39.3-342.1
Light (100-2019 counts·min^{-1})	1562	54.11±24.2	11.0-185.6
Moderate (2020-5998 counts·min^{-1})	1562	156.69±48.8	8.3-323.9
Vigorous (≥ 5999 counts·min^{-1})	1562	5.85±8.9	0.0-78.0
Heart rate (bpm)			
Average	1571	100.11±13.5	62.7-140.8
Maximum	1570	148.84±19.8	66.0-199.0
Minimum	1570	66.04±10.0	40.0-112.0
Heart rate zones (min)			
Very light (50-60% HRmax)†	1571	118.60±65.7	0.0-361.5
Light (60-70% HRmax)	1571	90.35±60.2	0.0-373.7
Moderate (70-80% HRmax)	1571	44.01±44.1	0.0-302.2
Hard (80-90% HRmax)	1571	20.22±25.7	0.0-179.6
Maximum (90-100% HRmax)	1571	8.40±17.0	0.0-150.2

†HRmax, maximum heart rate.

Tables S6.1-S6.8 (Appendix 3) summarizes the descriptive of 16 ‘levadas’ and trails with 30 or more participants. The shortest trail is P21 (Jardim do Mar – Prazeres – Paul do Mar) with 7.66 km, while the longest is P34 (Seixal – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela) with 16.11 km, followed closely by P05 (Caldeirão Verde) covering an average distance of 15.39 km. In terms of duration, the shorted ‘levada’ is P09 (Levada do Norte) with 3.54 h and the longest trails are P13 (S.

Roque do Faial – Penha d'Águia – S. Roque do Faial or Santana) and P19 (Encumeada – Pico Ruivo – Achada do Teixeira) with 7.67 h and 7.66 h, respectively. The elevation gain is lower for P04 (Ribeiro Frio – Portela) with 8 m, while the greater elevation gains are for P13 (S. Roque do Faial – Penha d'Águia – S. Roque do Faial or Santana) and P34 (Seixal – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela) with 953.92 m and 952.81 m, respectively.

Table 6.3 indicates the nature-based tourists' perception of the 45 'levadas' and trails. Tables S6.9-S6.13 (Appendix 3) provide the descriptive of the 16 'levadas' and trails. Overall, around half of the participants perceive the 'levadas' and trails as being regular, protected, with good signage, without landslides and falling rocks, and undemanding. However, at least 20% of the nature-based tourists perceive the 'levadas' and trails as narrow, unprotected, with poor signage and slippery paths, and demanding.

Table 6.3 Distribution of the nature-based tourists' perception of the 'levadas' and trails-related features (n = 1575)

Variables	Ordinal category scale†						
	1	2	3	4	5	Median	Mode
Narrow	349 (22.7)	428 (27.8)	443 (28.8)	248 (16.1)	69 (4.5)	2.0	3
Irregular	403 (26.4)	434 (28.4)	407 (26.6)	192 (12.6)	93 (6.1)	2.0	2
Unprotected	371 (24.2)	448 (29.2)	390 (25.4)	238 (15.5)	86 (5.6)	2.0	2
Degraded protections	339 (22.1)	476 (31.1)	412 (26.9)	218 (14.2)	87 (5.7)	2.0	2
Poor signage	340 (22.1)	313 (20.4)	455 (29.6)	254 (16.5)	176 (11.4)	3.0	3
Cliffs	251 (16.3)	340 (22.1)	424 (27.6)	330 (21.5)	193 (12.5)	3.0	3
Landslides	527 (34.4)	511 (33.4)	337 (22.0)	124 (8.1)	32 (2.1)	2.0	1
Slippery	241 (15.6)	434 (28.1)	483 (31.3)	302 (19.6)	82 (5.3)	3.0	3
Falling rocks	635 (41.3)	499 (32.4)	292 (19.0)	83 (5.4)	30 (1.9)	2.0	1
Demanding	337 (21.9)	388 (25.3)	438 (28.5)	263 (17.1)	110 (7.2)	3.0	3

†Ordinal category scale with 1 representing no agree and 5 indicating fully agree. The percentage in brackets refers to 'valid percentage'.

6.3.2. Moderate-to-vigorous physical activity

The percentage of nature-based tourists performing different amounts of moderate-to-vigorous physical activity is displayed in Figure 6.2. About half (52.6 %) are in the target range of 150 to 300 minutes (per week) of moderate-to-vigorous physical activity. Point-five percent perform bellow 50 minutes of moderate-to-vigorous physical activity and 1.8% above 300 minutes of moderate-to-vigorous physical activity. The remaining nature-based tourists are in the time intervals of 50 or more and less than 100 (7.8%) and 100 or more and less than 150 (37.3%) of moderate-to-vigorous physical activity.

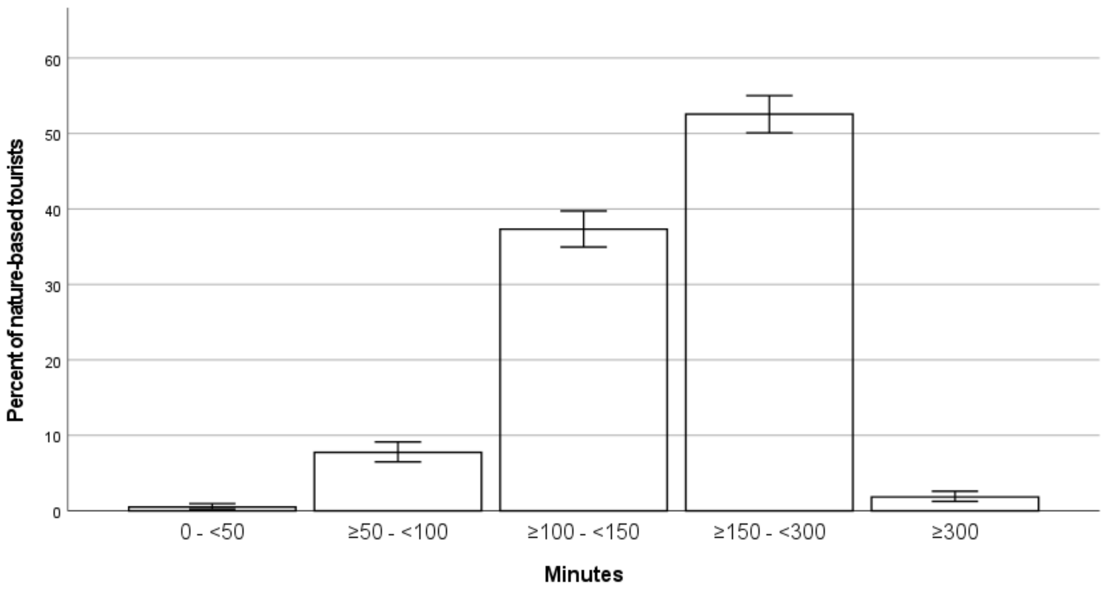

Figure 6.2 Percentage of nature-based tourists performing different amounts of moderate-to-vigorous physical activity over the course of the hike. Data include 45 'levadas' and trails and 1562 nature-based tourists. Error bars represent 95% confidence intervals.

Figure 6.3 presents the average values of moderate-to-vigorous physical activity performed in 16 'levadas' and trails. On average, nature-based tourists perform above 150 minutes of moderate-to-vigorous physical activity in 9 'levadas' and trails: P05, P10, P13, P14, P15, P19; P25, P34 and P39 (see Figure 6.1). The lowest percentage of moderate-to-vigorous physical activity is performed in P03, P09 and P21 (see Figure 6.1). For the other 'levadas' and trails, average values of moderate-to-vigorous physical activity are around 140 minutes.

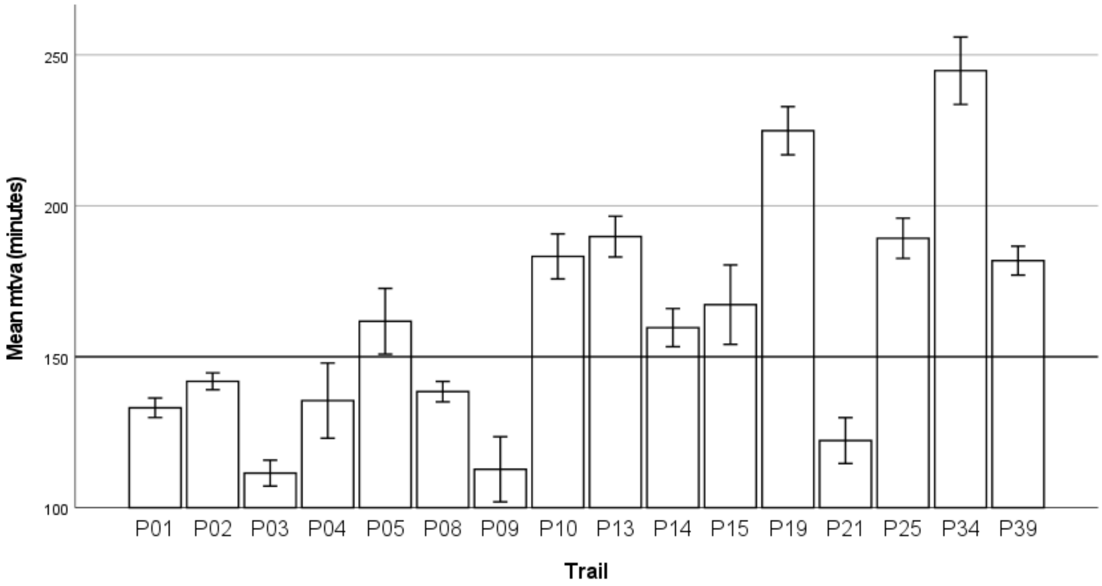

Figure 6.3 Average values of moderate-to-vigorous physical activity (mtvpa) by 'levadas' and trails. Of the 45 'levadas' and trails, 16 have more than 30 participants and are included in the analysis. Sample size is 1265 nature-based tourists. The horizontal line (150 minutes) indicates the minimum value for weekly level of moderate physical activity, based on the 'Global Recommendations on Physical Activity for Health' (WHO, 2010) and '2018 Physical Activity Guidelines Advisory Committee Scientific Report (2018)'. Error bars represent 95% confidence intervals.

Legend of the 'levadas' and trails:

P01, 25 Fontes (Rabaçal); P02, Pico Ruivo (Pico Areeiro or Achada do Teixeira); P03, Ponta de S. Lourenço (Cais do Sardinha); P04, Ribeiro Frio – Portela; P05, Caldeirão Verde (Queimadas or Pico das Pedras); P08, Arco de S. Jorge – Quinta do Furão; P09, Levada do Norte (Estreito de Cª de Lobos – Cabo Girão); P10, Larano (Porto da Cruz – Machico); P13, S. Roque do Faial – Penha d'Águia – S. Roque do Faial or Santana; P14, Levada do Moinho (Porto Moniz); P15, Levada Nova (Calheta) – Paul do Mar or Jardim do Mar; P19, Encumeada – Pico Ruivo – Achada do Teixeira; P21, Jardim do Mar – Prazeres – Paul do Mar; P25, Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos or Feiteiras; P34, Seixal (Cais) – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela; P39, Pico das Pedras – Caldeirão Verde – Ilha.

6.3.3. Heart rate zones

Figure 6.4 presents the average time attained by nature-based tourists at or above 70% of their maximal heart rate (optimal training zone) by age-group and gender. Nature-based tourists attained at least 42 minutes in an optimal training zone (men, age group

25-34 years). Average time in optimal training zones increases with age-range and reaches a maximum of 110 minutes (women, age group 65-74 years). In each age-group, the women achieved a higher time at 70% or more of their maximal heart rate than men.

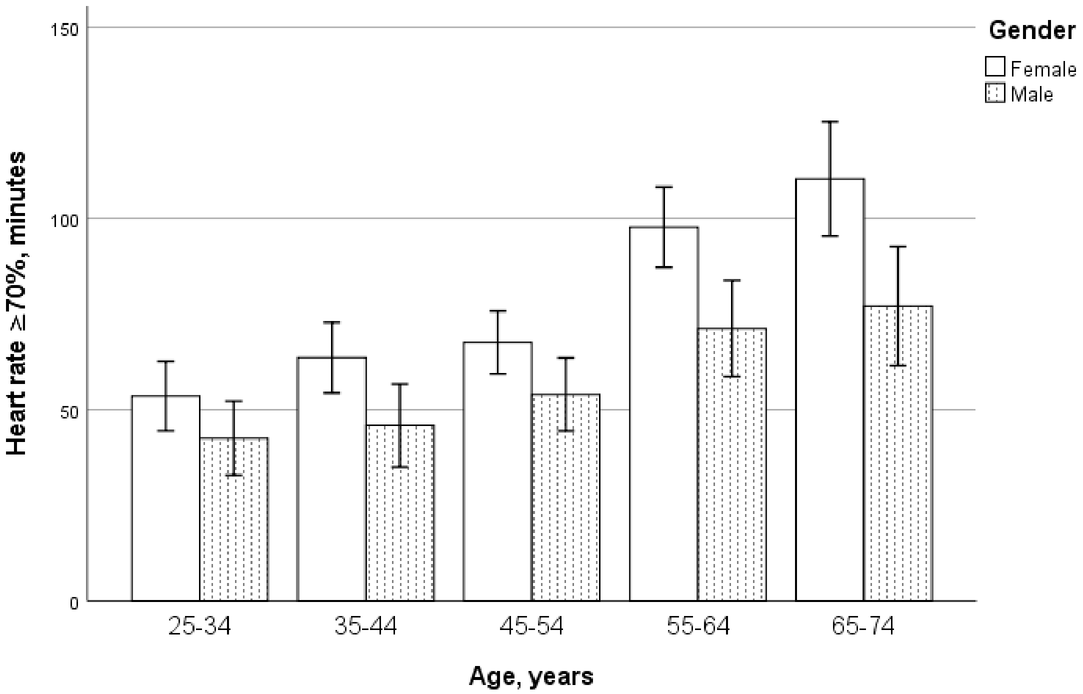

Figure 6.4 Average time attained by nature-based tourists (n = 1518) at a heart rate 70% and above of their maximal heart rate by age-group and gender.

6.3.4. Two-level regression models

Table 6.4 shows the estimated parameters, standard errors, and *p*-values of the full multi-level model. Results for all models are provided in Table S6.14 (Appendix 3). Age, percent of body fat and demanding of the 'levadas' and trails significantly affect moderate-to-vigorous physical activity. On average, older nature-based tourists present lower levels of moderate-to-vigorous physical activity than younger peers. A high percent of body fat and a high demanding of the 'levadas' and trails are associated with low levels of moderate-to-vigorous physical activity. Distance, elevation gain and elevation loss are positively associated with moderate-to-vigorous physical activity. The longer the distance and the greater the elevation gain and elevation loss are, the higher the levels of moderate-to-vigorous physical activity. Gender is not significantly related to moderate-to-vigorous physical activity.

Table 6.4 Multilevel regression model exploring the relationships among moderate-to-vigorous physical activity, biological characteristics of the nature-based tourists and hike features (n = 1489).

	Moderate-to-vigorous physical activity		
Parameter and fit statistic	Coefficient	Standard error	*P*-value
Fixed Effect			
Intercept	162.587	2.843	< 0.001
Age	-0.182	0.052	< 0.001
Gender	-0.540	1.430	0.706
Percent body fat	-0.329	0.130	0.011
Distance	10.054	0.395	< 0.001
Elevation gain	0.012	0.005	0.014
Elevation loss	0.035	0.004	< 0.001
Demanding of the ‘levadas’ and trails	-1.312	0.553	0.018
Random effect			
Level 2 variance (trails)	292.078	70.824	
Level 1 variance (tourists)	534.061	19.870	
Model fit			
Deviance		13685.191	

6.3.5. Mediation analysis

6.3.5.1. Participants, aged 18-59 years

Figure 6.5 depicts the mediation model for the causal relationship between moderate-to-vigorous physical activity and cardiorespiratory fitness. Table S6.15 (Appendix 3) presents the regression coefficients, standard errors, and model information. Table S6.16 (Appendix 3) gives the direct and indirect effects along with inferential tests. Moderate-to-vigorous physical activity has an indirect effect on cardiorespiratory fitness through habitual physical activity (indirect effect = -0.015, 95% CI: -0.023 to -0.008). That is, moderate-to-vigorous physical activity is positively associated with habitual physical activity (a = 0.003), which ‘positively’ influence cardiorespiratory fitness (b = -4.643). As a low ‘1-minute post-test heart rate’ means a better score in the 3-minute YMCA step test, high moderate-to-vigorous physical activity and high habitual physical activity are associated to a better cardiorespiratory fitness. The direct effect of moderate-to-vigorous physical activity on cardiorespiratory fitness is significant (direct effect = -0.034, 95% CI: -0.056 to -0.112).

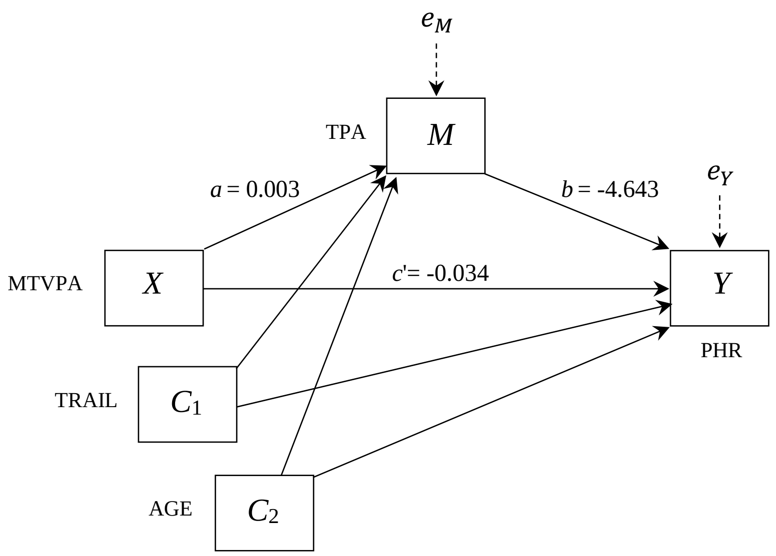

Figure 6.5 Simple mediation model for the causal relationship between moderate-to-vigorous physical activity (MTVPA) assessed during one-day hiking activity in ‘levadas’ and trails and cardiorespiratory fitness (PHR). The mediator is self-reported physical activity in the previous year (habitual physical activity). ‘Levadas’ and trails, and age of the nature-based tourists are covariates. The paths marked a, b and c’ are unstandardized regression coefficients.

The statistical diagram, regressions coefficients and direct and indirect effects for percent of body fat are provided in Figure S6.1 and Tables S6.17 and S6.18 (Appendix 3), respectively. A simple mediation from moderate-to-vigorous physical activity, passing through habitual physical activity is established (indirect effect = -0.003, 95% CI: -0.005 to -0.001). Participants who show high scores of moderate-to-vigorous physical activity have high levels of habitual physical activity (a = 0.003), which negatively influences percent body fat (*b* = -0.860). That is, higher levels of moderate-to-vigorous physical activity and habitual physical activity are associated with a lower percent of body fat and, therefore, with a satisfactory health. The direct effect of moderate-to-vigorous physical activity on percent of body fat is significant (direct effect = -0.018, 95% CI: -0.025 to -0.010).

6.3.5.2. Participants, aged 60 years and above

A causal flow from moderate-to-vigorous physical activity to aerobic endurance through habitual physical activity is claimed (indirect effect = 0.038, 95% CI: 0.005 to 0.078) (Figure S6.2 and Tables S6.19 and S6.20, Appendix 3). The direct effect is not significant. This means that moderate-to-vigorous physical activity is associated with high levels of habitual physical activity (*a* = 0.001), which positively influences aerobic endurance (*b* = 28.038).

Figure S6.3 displays the simple mediation model of the causal effect of moderate-to-vigorous physical activity on percent body fat and Tables S6.21 and S6.22 summarize the model coefficients and direct and indirect effects (Appendix 3). The indirect effect of moderate-to-vigorous physical activity on percent of body fat through physical activity (sport index) is not significant (indirect effect = -0.002, 95% CI: -0.004 to -0.000). The moderate-to-vigorous physical activity has a direct effect on percent of body fat (direct effect = -0.015, 95% CI: -0.026 to -0.005). The total effect of moderate-to-vigorous physical activity on percent of body fat is significant (total direct effect = -0.017, 95% CI: -0.028 to -0.007).

Table S6.23 presents the descriptive statistics for health-related physical fitness variables (Appendix 3).

6.4. Discussion

The relationship between objectively measured physical activity during the hike and physical well-being has been under-researched. In this study, 52.6 % of the nature-based tourists were within the range of 150 to 300 minutes of moderate-to-vigorous physical activity. Moreover, nature-based tourists attained at least 42 minutes at or above

70% of their maximal heart rate. The distance, elevation gain and elevation loss were positively associated, and age, percent body fat and perceiving the 'levadas' and trails as demanding were negatively associated with moderate-to-vigorous physical activity. We found that moderate-to-vigorous physical activity undertaken in the 'levadas' and trails had a causal effect on health-related physical fitness via self-reported physical activity in the past year.

We provided new and objective information about the 'levadas' and trails. Indeed, Madeira Island has a diverse range of 'levadas' and trails (for example, short/long, easy/difficult or mountain/sea-level). Our results regarding elevation gain, elevation loss, stride length, walking speed, levels of physical activity and heart rate training zones can now be included in the existent description of the Madeira Tourism Board and the Institute of Forests and Nature Conservation. This information will provide hikers with the key pieces of information required to make an informed decision about the suitability of the 'levadas' or trails for their needs/capability (The Irish Sports Council, 2008).

It is worth to know that a single day-hike in 'levadas' and trails is sufficient to fulfil the weekly '2018 Physical Activity Guidelines Advisory Committee' (2018 Physical Activity Guidelines Advisory Committee Scientific Report, 2018) and global WHO's recommendations on physical activity and health (WHO, 2010) for more than half of the nature-based tourists. Yet, for those who did not achieve these physical activity guidelines and recommendations, a two day-hike could be enough to achieve the health benefits. It is difficult to assess whether the present results compare to previous research. Anyhow, our findings are in harmony with recent evidence in other contexts. In one study, for example, spending at least 120 minutes a week in nature was associated with good health and wellbeing (White et al., 2019), and another observed that 87% of urban trail users fulfilled WHO's recommendations (Götschi & Hadden Loh, 2017). Other studies have shown that the largest gains in physical activity involved walking (Griffin et al., 2020) and that park users were 35% more likely to meet the physical activity guidelines, compared with those who indicated they did not regularly use a park (Hooper et al., 2020).

We quantified the time attained by nature-based tourists at or above 70% of their maximal heart rate. Overall, hiking in 'levadas' and trails offered an adequate training stimulus for aerobic fitness gains and associated health benefits. This compares well with Porcari et al. (1987) when reporting that most adults achieved the optimal training zone when walking a mile as fast as possible or during 30-minute walk on the maximal treadmill test. Brisk walking was also of sufficient intensity to elicit a training heart rate in all the women and 90% of the men with coronary artery disease (Quell et al., 2002).

The time attained by nature-based tourists at or above 70% of their maximal heart rate increased with age and was higher in women than in men. In regard to age-related differences, this may due to the fact that after the age of 30 years, VO_{2max} declines on average by about 10% per decade (Morris & Hardman, 1997) and time at a training heart rate zone increase for the same physical activity intensity level (Porcari et al., 1987). Increasing age was also related to lower fitness levels and walking as an activity for health may be most important to older people (Kelly et al., 2011). In older versus younger women, Jones, Waters, and Legge (2009) reported that when speed was held constant, the cost of walking was higher in the older women. The greater relative VO_{2max} of men compared with the women may also partially explain the gender-related differences in time at an optimal training zone (Porcari et al., 1987). In all, the evidence points to the idea that hiking may be a more relevant physical activity stimulus in older adults and women.

The negative association of age with moderate-to-vigorous physical activity found in the multilevel models, can at least in part reflect the intensity-threshold criteria used in the current study. Nowadays, there is a recommendation to use older adult-specific cut points (Barnett, van den Hoek, Barnett, & Cerin, 2016). Two aspects of such approach are pertinent here. First, adults have a lower resting metabolic rate and higher energy expenditure when walking at a given speed compared to younger adults (Martin, Rothstein, & Larish, 1992). Second, using cut points derived in young adults, older adults would be working at higher relative intensities than assumed and their time spent in moderate-to-vigorous physical activity would be underestimated (Barnett et al., 2016). In the current study, time spent in moderate-to-vigorous physical activity decreased from 166.3 min (aged 55-64 years) to 138.8 min (aged 65-74 years) and to 117.6 min (aged 75-84 years). This may be due to the use of a cut point of 2020 counts·min^{-1} (Troiano et al., 2008) to define the lower limit of moderate physical activity instead of using a vector magnitude of 1924 counts·min^{-1}, as suggested by Barnett et al. (2016).

An inverse association of percent body fat with physical activity has been observed by others (Hughey, Kaczynski, Clennin, & Reed, 2016; Hills, Byrne, Wearing, & Armstrong, 2006; Porcari et al., 1988). Excessive fatness seems to contribute to the decrement in work capacity directly, acting as inert, non-contributory load, and indirectly, through its interference with over-all maximum circulatory-respiratory function (Dempsey, Reddan, Balke, & Rankin, 1966). The negative association of perceived ‘levadas’ and trails with moderate-to-vigorous physical activity is somewhat contrary to what would expect given the percent slope and elevation gain of some trails. One the other hand, a perceived demanding ‘levada’ and trail can be associated with narrow and irregular paths or some risk of landslides and slippery which requires some care and, therefore, the need to reduce the stride length and slow down the walking speed.

In the present study, distance, elevation gain and elevation loss were positively linked to moderate-to-vigorous physical activity. The first two of these features have long been recognized as important measures of the ‘strenuousness’ of a trail [International Trail Running Association (iTRA), 2020] and are key elements of Naismith’s rule, an equivalence, in terms of time duration, between elevation gain and distance travelled (Scarf, 2007; Naismith, 1893). Walking or running on a slope increases the oxygen cost markedly (Perrey & Fabre, 2008; Morris & Hardman, 1997), elicited increased heart rate and ratings of perceived exertion (Manning et al., 2015), and increased the minimum cost of walking and running as a function of the incline (Minetti, Moia, Roi, Susta, & Ferretti, 2002). The positive association of elevation loss with moderate-to-vigorous physical activity is not straightforward to analyse. Navalta et al. (2004) reported that downhill walking at grades between -5% and -10% reduced the cardiovascular and metabolic demand during exercise in older and younger subjects. Morris and Hardman (1997) reported that walking downhill was similar in energy expenditure to walking on the level. On face of it, extreme declines of the Madeira trails, in some trails higher than -45º, can lead to a higher energy expenditure and, consequently, higher levels of moderate-to-vigorous physical activity.

The last issue is the mediation effect of habitual physical activity on the relationship between moderate-to-vigorous physical activity undertaken during the hike and health-related physical fitness. It is difficult to assess whether our results concur with previous findings because we are not aware of analogous studies. From the existing literature, we found that greenspace had a beneficial influence on physical well-being (Dzhambov et al., 2020; Mygind et al., 2019; Twohig-Bennett & Jones, 2018). Other studies shown that trail use was associated with healthier weight status (Hughey et al., 2016) and responsible behaviour and satisfaction among mountaineers (Esfahani, Musa, & Khoo, 2017). It is also well known that walking is beneficial through engendering improved fitness and/or greater physiological activity and energy turnover (Morris & Hardman, 1997). On the other hand, cardiorespiratory fitness has an inverse relationship with risk of premature death from all causes, and higher levels of cardiorespiratory fitness are associated with higher levels of habitual physical activity, which in turn are associated with many health benefits (ACSM, 2018). Our results are aligned with the literature and strengthened the positive relationship between nature-based tourism and physical well-being. Given that habitual physical activity mediated the relationship between moderate-to-vigorous physical activity and cardiorespiratory fitness, the hike activity should be performed along the year. Indeed, Morris and Hardman (1997) reported that we can achieve the beneficial effects of walking through (1) acute, short term effects of the exercise; and (2) chronic, cumulative adaptations depending on habitual activity over weeks and months.

6.4.1. Strengths and limitations

This is the first study to explore the association of objectively measured physical activity undertaken in ‘levadas’ and trails of Madeira Island and health-related physical fitness, including cardiorespiratory or aerobic fitness and percent body fat. Additionally, the elevation gain, elevation loss, stride length, walking speed and nature-based tourists’ perception of the ‘levadas’ and trails were provided. Such novel information is imperious to be able to assess the ‘levadas’ and trails and promote health and well-being, whilst simultaneously enhance the acceptance of the ‘levadas’ and trails by the local population. Two other strengths are the large sample size and the diverse range of ‘levadas’ and trails.

Limitations include the physical activity intensity-threshold criteria used in older adults. The cut points used in the current study were derived from adults, which may provide some underestimation of the time spent in moderate-to-vigorous physical activity. Another limitation is the over-representation of French participants. However, about one-third of the participants is from other European countries and we may be confident regarding the mainstreaming of the findings at least to the European mainland. An additional limitation is related to the assessment day within the vacation time. The assessment took place on different days and some fatigue when arriving to Madeira or at the end of the hiking week might limit the performance in motor tests. A further limitation is related to heart rate. We did not adjust the heart rate for body size and used the standard definition provided by Polar, i.e., 170 cm (height) and 70 kg (weight). Finally, habitual physical activity in the past year was self-reported and may be susceptible to inaccuracies.

6.4.2. Theoretical and practical implications

We built an extensive database containing information on the 'levadas' and trails of Madeira Island, physical activity and health-related physical fitness characteristics of the nature-based tourists. This is a baseline information that can assist health and tourism researchers to move forward with deep scientific knowledge on nature-based experiences.

From a practical perspective, nature-based tourists, and all 'levadas' and trail users now have reliable and high-quality information regarding 'levadas' and trails at their disposal to search and choose the ones more appropriate to their needs/capability. This is an important issue in terms of well-being benefits, safety, and enjoyment of the hike activity.

This study supported health benefits related to hike activity. Physical activity intensity and heart rate optimal zones give additional information on the aerobic stimulus to increase or maintain fitness (Collingwood et al., 2007). Health professionals should prescribe 'walking' in 'levadas' and trails as a way of increasing the physical activity levels of the local population. In doing so, they will attract new users and increase the extent and frequency of use by present hikers (Hill et al., 2009). In other words, promoting active living and related health benefits. This can also partially help to regain the 'therapeutic status' that Madeira Island attained in the second half of the 18th century.

Policy makers and tourism professionals can use the results of the current study to encourage physical activity and promote Madeira Island as a 'health tourism destination'. This could be done through promotional approaches, media campaigns or message-based strategies. For example, 'levadas and trails for health brochures'; 'a posting on levadas and trails markers regarding the physical benefits of the hike' (Collingwood et al., 2007); 'specialized guidebooks and magazines' (Fraiz, Carlos, & Araújo, 2020) with information of time spent in physical activity categories and heart rate zones; 'messages to address how nature-based tourists can find time and energy to be more physically active' (Leahy, Shugrue, Daigle, & Daniel 2009); 'audios and pictures in advertising and other travel brochures which encourage tourists to be active' (Lee et al., 2018). These strategies create ‘opportunities to attract visitors, grow regional economies and create jobs, while also delivering social, environmental and cultural benefits for local communities’ (Victorian Government, 2014).

6.5. Conclusions

This study described the ‘levadas’ and trails of Madeira Island. We first provided a pooled description of the 45 ‘levadas’ and trails and then specified 16 ‘levadas’ and trails in terms of distance, elevation gain, elevation loss, stride length and walking speed. The results revealed a heterogeneity of ‘levadas’ and trails, such as short/long, easy/difficult and mountain/sea level. This information extended the existent description of the Madeira Tourism Board and the Institute of Forests and Nature Conservation and get closer to other countries.

Time in each physical activity category and heart rate zone are unique. In a large sample size, we demonstrated that one-day hike in ‘levadas’ and trails is sufficient to achieve the weekly physical activity guidelines for approximately 53% of the participants. Moreover, hiking in ‘levadas’ and trails offered an adequate training stimulus for aerobic fitness. Participants attained, at least, 42 minutes at or above 70% of their maximal heart rate. We also observed that hiking may be a more relevant activity for older adults and women.

Variation in moderate-to-vigorous physical activity undertaken by nature-based tourists over the course of the hike was explained by distance, elevation gain, elevation loss, age, percent body fat and participants’ perception of demanding ‘levadas’ and trails. Based on these results, ‘levadas’ and trails users and mountain guides can make the correct choice or manage the hike in order do to obtain the best health benefits and hike more safely.

We also demonstrated that moderate-to-vigorous physical activity undertaken during the hike has a direct effect on health-related physical fitness and that habitual physical activity mediated this relationship. This emphasize the need to be active all over the year and strengthened the positive relationship between nature-based tourism and physical well-being. In closing, we suggest two sentences in the scope of this paper. One is ‘walking is the nearest activity to perfect exercise’ (Morris & Hardman, 1997), and the other ‘I have two doctors, my left leg and my right…’ [Trevelyan (1913) cited by Morris & Hardman (1997)].

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Capítulo 7

Conclusão, implicações e perspetivas futuras

7. Conclusão, implicações e perspetivas futuras

7.1. Conclusão

A associação dos cheiros naturais e sons naturais à paisagem visual e os benefícios da caminhada nas levadas e trilhos da Madeira na saúde mental e física foram demonstrados, na presente pesquisa. Em baixo, são apresentados os objetivos, os principais resultados e as conclusões.

Objetivo 1 Rever o conhecimento disponível sobre a associação do turismo de natureza ao bem-estar mental, físico e social do turista.

Este objetivo foi orientado para a revisão do conhecimento disponível sobre o turismo de natureza e a sua relação com o bem-estar mental, físico e social do turista. O turismo de natureza estava associado ao bem-estar mental, via restauração da atenção, promoção de afetos positivos e redução do stress. O turismo de natureza estava associado ao bem-estar físico através do aumento dos níveis de atividade e aptidão física, melhoria dos estilos e qualidade de vida e uma dieta saudável. A associação entre o turismo de natureza e bem-estar social foi materializada no reforço dos laços familiares e amizade. O turismo de natureza é benéfico ao bem-estar mental, físico e social.

Objetivo 2 Descrever a paisagem visual das levadas e trilhos da ilha da Madeira, percecionada pelos turistas de natureza.

A maioria dos turistas percecionou a paisagem visual como natural e com forte luminosidade. Os elementos dominantes e as formas da paisagem percecionados pelo turista foram a vegetação, as levadas e trilhos, a água, as montanhas, as arribas, as flores, a floresta Laurissilva, o mar, as quedas de água, a linha do horizonte e os campos cultivados. As cores dominantes da paisagem percecionada pelo turista foram o verde e o azul, seguidas do amarelo, laranja e branco. Cerca de metade dos turistas percecionou a qualidade da paisagem como muito boa e boa, no meio e fim da caminhada.

Objetivo 3 Identificar os sons e cheiros percecionados pelos turistas nas levadas e trilhos.

Os turistas identificaram os sons naturais, os sons da água e os sons humanos, ao longo das levadas e trilhos. Os cheiros naturais dominaram a perceção dos turistas. Os cheiros a resíduos, pessoas, animais e outros cheiros, como, por exemplo, os gases de escape e a poluição industrial, foram identificados com pouca frequência, nas levadas e trilhos.

Objetivo 4 Investigar a influência dos sons e cheiros na paisagem visual percecionada pelos turistas.

Os ruídos de tráfego, os cheiros a resíduos e outros cheiros, como, por exemplo, os cheiros de materiais de construção, estavam negativamente associados à qualidade da paisagem visual. Os cheiros naturais estavam associados a uma melhor qualidade da paisagem visual percecionada pelos turistas, no final das levadas e trilhos. Os turistas que percecionaram a paisagem visual como muita boa e boa, no meio da caminhada, foram mais prováveis de descrever a paisagem como muito boa e boa, no final da caminhada.

Objetivo 5 Avaliar o padrão dinâmico dos afetos principais ou emoções dos turistas durante a atividade de caminhada.

Os turistas iniciaram as levadas e trilhos com os afetos principais elevados e aumentaram os afetos do meio para o fim da caminhada. O aumento foi quantificado nos adjetivos bipolares ‘deprimido-feliz’, ‘triste-alegre’ e ‘descontente-contente’ (eixo horizontal do modelo circumplexo – ‘unpleasant-pleasant’); nos adjetivos bipolares ‘indiferente-envolvido’, ‘desinteressado-interessado’ e ‘pessimista-otimista’ (eixo oblíquo – ‘pleasant activation-unpleasant deactivation’); e nos adjetivos bipolares ‘tenso-sereno’, ‘nervoso - relaxado’ e ‘ansioso-calmo’ (eixo oblíquo – ‘unpleasant activation-pleasant deactivation’). Os turistas relataram ganhos à direita das escalas, por exemplo, feliz (‘unpleasant-pleasant’), otimista (‘pleasant activation-unpleasant deactivation’) e relaxado (‘unpleasant activation-pleasant deactivation’).

Objetivo 6 Explorar a associação das variáveis sociodemográficas dos turistas, de características demográficas dos guias de montanha, do envolvimento, das levadas e trilhos e da qualidade restaurativa percecionada, à mudança nos afetos principais ao longo de uma caminhada.

A idade e o sexo dos turistas, os cheiros naturais, a distância, as subidas acumuladas, as descidas acumuladas, a dificuldade e o distanciamento das preocupações do dia-a-dia (*being away*) foram os preditores significativos dos afetos principais, nas primeira e segunda metades das levadas e trilhos, em pelos, menos, uma subescala dos afetos principais. Os sons naturais, as subidas acumuladas e o envolvimento positivo com a natureza (*fascination*), foram os preditores dos afetos principais na primeira metade das levadas e trilhos. O sexo do guia de montanha e os elementos e formas da paisagem foram preditores significativos, na segunda metade. Os preditores explicaram 56,2% de variância nos afetos principais, na primeira metade das levadas e trilhos, e 34,5% na segunda metade. A qualidade restaurativa da paisagem e as características do envolvimento explicaram a maior percentagem de variância nos afetos principais. Os resultados revelaram que os preditores da mudança nos afetos principais diferem nas duas metades das levadas e trilhos e que o mesmo preditor apresenta associações distintas com os afetos principais, quando modelado na primeira ou segunda parte das levadas e trilhos.

Objetivo 7 Investigar se a distância psicológica do dia-a-dia e o envolvimento positivo com a natureza, dois conceitos dos ambientes restaurativos, medeiam a relação entre a paisagem visual percecionada e a mudança nos afetos principais.

A distância psicológica do dia-a-dia (*being away*) e o envolvimento positivo com a natureza (*fascination*) mediaram a relação causal entre a paisagem e os afetos principais. O envolvimento positivo com a natureza (ambiente) apresentou um efeito mais forte na análise de mediação do que a distância psicológica do dia-a-dia. Os turistas que reportaram valores elevados na qualidade da paisagem visual apresentaram níveis elevados de distância psicológica do dia-a-dia, os quais, por sua vez, experimentaram níveis elevados de envolvimento com a natureza, e que, por sua vez, se traduziram em valores elevados de valência positiva (‘valence’), ativação (‘activation’) e ‘pleasant activation-unpleasant deactivation’.

Objetivo 8 Descrever as levadas e os trilhos da ilha da Madeira e apresentar a intensidade da atividade física realizada pelos turistas, numa caminhada.

As levadas e trilhos foram descritos nas caraterísticas seguintes: distância, duração, subidas acumuladas, descidas acumuladas, comprimento da passada, atividade física, frequência cardíaca, zonas de frequência cardíaca, largura dos trilhos, trilho irregular, bermas desprotegidas, proteções degradadas, sinalização, arribas, deslizamento de terras, queda de rochas e exigência.

A distância média foi 11,78 km. Os turistas necessitaram, em média, de 6 horas para percorrer as levadas e os trilhos. O total médio de subidas acumuladas e de descidas acumuladas foi 482 m e 544 m, respetivamente. O comprimento médio da passada foi 62,9 cm. A maioria dos turistas realizou atividade física moderada-a-vigorosa e registaram maior tempo na zona de frequência cardíaca leve. Em termos de distância, o trilho mais curto foi o P21 (Jardim do Mar – Prazeres – Paul do Mar) com 7,66 km e o mais longo foi o P34 (Seixal – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela) com 16,11 km. Na duração, a levada mais curta foi o P09 (Levada do Norte) com 3,54 h e os trilhos mais longos foram o P13 (S. Roque do Faial – Penha d'Águia – S. Roque do Faial ou Santana) e o P19 (Encumeada – Pico Ruivo – Achada do Teixeira) com 7,67 h e 7,66 h, respetivamente. O total de subidas acumuladas foi menor na levada P04 (Ribeiro Frio – Portela) com 8 m, enquanto o mais elevado foi observado no trilho P13 (S. Roque do Faial – Penha d'Águia – S. Roque do Faial ou Santana) com 953,92 m. Cerca de metade dos turistas descreveu as levadas e trilhos como protegidos, boa sinalização, piso regular, sem queda de rochas ou deslizamento de terras e pouco exigentes.

Objetivo 9 Determinar se a atividade física realizada pelos turistas, nas levadas e trilhos, alcança as diretrizes globais de atividade física.

Cerca de metade dos turistas alcançou o intervalo de atividade física semanal recomendado pelas diretrizes Norte-Americanas e Organização Mundial de Saúde. Em média, os turistas realizaram 150 minutos ou mais, de atividade física moderada-a-vigorosa, nas levadas e trilhos P05 [Caldeirão Verde (Queimadas ou Pico das Pedras)], P10 [Larano (Porto da Cruz – Machico)], P13 (S. Roque do Faial – Penha d'Águia – S. Roque do Faial ou Santana), P14 [Levada do Moinho (Porto Moniz)], P15 [Levada Nova

(Calheta) – Paul do Mar ou Jardim do Mar], P19 (Encumeada – Pico Ruivo – Achada do Teixeira), P25 (Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos ou Feiteiras), P34 [Seixal (Cais) – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela] e P39 (Pico das Pedras – Caldeirão Verde – Ilha). Um menor tempo de atividade física moderada-a-vigorosa foi observado nas levadas e trilhos P03 [Ponta de S. Lourenço (Cais do Sardinha)], P09 [Levada do Norte (Estreito de Cª de Lobos – Cabo Girão)] e P21 (Jardim do Mar – Prazeres – Paul do Mar).

Objetivo 10 Investigar se a atividade física realizada pelos turistas é suficientemente intensa para promover a melhoria da aptidão física.

Os turistas alcançaram, pelo menos, 42 minutos na zona ótima de treino (homens, grupo etário 25-34 anos). O tempo médio na zona ótima aumentou com a idade e alcançou um máximo de 110 minutos (mulheres, grupo etário 65-74 anos). Em cada grupo etário, as mulheres apresentaram mais tempo na zona ótima de treino do que os homens. A caminhada nas levadas e trilhos promove a melhoria da aptidão física ou funcional.

Objetivo 11 Identificar os preditores da atividade física moderada-a-vigorosa realizada pelos turistas, nas levadas e trilhos da ilha da Madeira.

A idade, a percentagem de gordura corporal e a exigência das levadas e trilhos foram preditores significativos da atividade física moderada-a-vigorosa. Os turistas mais velhos apresentaram valores mais baixos, no tempo acumulado em atividade física moderada-a-vigorosa, do que os turistas mais novos. Valores percentuais elevados de gordura corporal e levadas e trilhos exigentes estavam associados a valores inferiores de atividade física moderada-a-vigorosa. A distância e o total de subidas acumuladas estavam positivamente associados à atividade física moderada-a-vigorosa. Quanto maior foi a distância das levadas e trilhos e maior o total de subidas acumuladas, mais elevados foram os valores registados de atividade física moderada-a-vigorosa.

Objetivo 12 Investigar se a atividade física habitual medeia a relação entre a atividade realizada nas levadas e trilhos e a aptidão relacionada à saúde.

A atividade física habitual teve um efeito mediador da relação entre a atividade física moderada-a-vigorosa realizada nas levadas e trilhos e a aptidão física relacionada à saúde. A atividade física moderada-a-vigorosa estava positivamente associada à atividade física habitual, a qual, por sua vez, teve efeitos positivos na resistência cardiorrespiratória, dos adultos e adultos idosos, e na redução da gordura corporal (adultos).

7.2. Implicações e perspetivas futuras

7.2.1. Artigo 1

‘Turismo de natureza e bem-estar mental, físico e social: uma revisão *scoping*’

O estado da arte sobre o turismo de natureza, a paisagem e a saúde irá beneficiar, entre outros, os académicos, os setores do turismo e viagens, os responsáveis pela saúde pública, os gestores da paisagem, as companhias de seguros e os ambientalistas. O artigo de revisão identificou alguns desafios. Uns foram superados pela presente pesquisa, outros, estão em aberto, como, por exemplo: (1) estudar a acessibilidade para as crianças, adultos, adultos idosos e pessoas com deficiência; (2) quantificar a associação da atividade turística em ambientes naturais à saúde social; (3) investigar o risco associado à atividade turística em ambientes naturais em indivíduos de diferentes idades, grupos socioeconómicos, estado de saúde e culturas; (4) explorar a longevidade dos efeitos do turismo de natureza na saúde e, em particular, na prevenção da doença cardiovascular; e (5) explorar a associação da atividade turística ao bem-estar mental, físico e social em diferentes ambientes naturais, condições climatéricas e estações do ano.

7.2.2. Artigo 2

‘Visual landscape, sounds and smells perceived by nature-based tourists’

O artigo sobre os sons e os cheiros da paisagem realçou a necessidade de futuros estudos incluírem escalas válidas, fiáveis e de uso simples. Investigações futuras devem privilegiar, também, mais avaliações no tempo para estudar a mudança, a estabilidade e a predição da qualidade da paisagem visual. Uma abordagem a três níveis, i.e., medidas repetidas (nível 1) ‘aninhadas’ aos turistas (nível 2) e estes, por sua vez, ‘aninhados’ aos trilhos (nível 3) poderia extrair mais informação da experiência dos turistas nas levadas e trilhos. Uma amostra equilibrada, em termos de nacionalidade, a definição do tipo/nível dos turistas e a inclusão de informação de especialistas, complementariam a presente pesquisa.

A base de dados poderá servir como orientação e *standard* através do qual o turista poderá interpretar ou atribuir um significado às suas próprias perceções. Os guias de montanha poderão aprimorar as experiências de audição e olfato dos turistas, ao longo das levadas e trilhos. Os turistas, guias de montanha e entidades responsáveis devem evitar o lixo nas levadas e trilhos. Os sons e os cheiros naturais deverão ser considerados um novo recurso turístico e ser incorporados na promoção do destino.

7.2.3. Artigo 3

‘Short-term change, prediction and mediation of emotions in nature-based tourism’

As experiências restaurativas são importantes na promoção de um destino turístico e na criação e cocriação de experiências. Os profissionais de turismo devem maximizar os ganhos nas subescalas dos afetos principais ‘activation’ e ‘unpleasant activation-pleasant deactivation’, na segunda metade das levadas e trilhos. De igual modo, devem promover um maior ganho na subescala ‘pleasant activation-unpleasant deactivation’, na primeira metade. Uma vez que os cheiros e sons da paisagem estão associados à mudança nos afetos principais, os profissionais de turismo devem maximizar estas características do envolvimento. Pelo contrário, as levadas e trilhos longos e difíceis devem ser evitados devido à associação negativa aos afetos principais. É, também, importante promover o distanciamento das preocupações do dia-a-dia e o envolvimento positivo com a natureza. Tais objetivos poderão ser conseguidos, através de um simples ‘mergulho’ em piscinas naturais, lagoas e praias recônditas ou através da autoexploração de picos, montanhas e miradoiros. Os profissionais de turismo devem, também, promover interações fortes dos mais jovens com o envolvimento. Investigação futura deve privilegiar: (1) estudos prospetivos e de intervenção, (2) medidas objetivas das emoções, (3) recolha de informação dos turistas antes e depois da visita e (4) controlo da duração da estada e o dia de avaliação.

7.2.4. Artigo 4

‘Nature-based tourism and physical health. The case of ‘levadas’ and trails of Madeira’

O conhecimento disponibilizado na descrição objetiva e percecionada das levadas e trilhos é fulcral na escolha de uma levada e/ou trilho. A comunidade local e o turista poderão escolher uma levada e/ou trilho ajustado às sua habilidades motoras, aptidão física e experiência. Tal informação é, também, importante, para o uso de equipamento adequado e caminhar com segurança. Face aos resultados encontrados, uma simples caminhada nas levadas e trilhos da Madeira poderá ser suficiente para alcançar a atividade física semanal, recomendada nas diretrizes globais de atividade física e promover a melhoria da aptidão física. Estes resultados reforçam as evidências recentes da associação das caminhadas à saúde e poderão atrair ambos, residentes e turistas. A Secretaria Regional da Saúde, a Secretaria Regional de Turismo e Cultura e todos os agentes turísticos passam a dispor de informação fulcral na promoção e *marketing* das levadas e trilhos.

7.3. Observações finais

O presente estudo emerge de um esforço multidisciplinar integrando especialistas em Geografia, Turismo e Paisagem, na primeira linha, e em Ciências do Desporto, Psicologia Ambiental e Estatística, no apoio incondicional a itens específicos. O conhecimento disponibilizado ajuda a interrelacionar o turismo de natureza, a paisagem e a saúde e, em particular, identificar o tipo de afinidades no contexto do turismo de natureza, em caminhadas por levadas e trilhos da ilha da Madeira.

Na bibliografia consultada, ao longo de todas as etapas e até à redação final desta tese, não foi encontrado nenhum trabalho, em Portugal, com estas características. O delineamento de pesquisa, as variáveis do estudo, as técnicas/métodos/procedimentos utilizados e a dimensão da amostra são novidade. De realçar, as escalas dos sons e cheiros, os afetos principais, a qualidade restaurativa percecionada, a medição objetiva da atividade física, via acelerometria, sensor de passada e frequência cardíaca e, por fim, a avaliação da aptidão física relacionada à saúde, mais especificamente, a aptidão cardiorrespiratória e a percentagem de gordura corporal dos turistas de natureza.

Da vasta panóplia de variáveis recolhidas, apenas algumas foram analisadas na presente tese. Isto significa que outras serão alvo de análise em publicações futuras. A análise de equações estruturais e a regressão logística multinível estão a ser utilizadas em artigos, em curso. Outras análises serão igualmente efetuadas face aos recursos existentes.

A opção por apresentar uma parte substancial dos dados em quadros e em anexo, teve por base um formato, tão próximo quanto possível, das linhas orientadoras de revistas internacionais da especialidade. O nosso objetivo é a submissão dos artigos.

A importância do presente estudo, no seu todo, pode ser associada, na sua vertente teórica, à extensa revisão bibliográfica e ao artigo de revisão. Na sua vertente prática, os resultados da pesquisa podem contribuir para a melhoria de estratégias no turismo pelos vários intervenientes, como por exemplo, a administração regional, as agências de promoção do destino e as empresas de animação turística. Essas estratégias podem versar a componente da saúde e do bem-estar associada às caminhadas nas levadas e trilhos da Madeira, recuperando o conceito de 'estância de saúde' para a ilha. Ainda, diferenciar com maior acuidade os percursos pedestres recomendados, entre caminhadas *soft* e *hard*.

Ao nível das implicações práticas, ficou igualmente evidente, a necessidade de intervenções nas levadas ou trilhos face à envolvência, como ruídos não naturais e maus cheiros.

Capítulo 8

Anexos

Anexos 1 Metodologia geral

Anexo 1.1

FCSH – Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa	**O impacto do turismo de natureza e da paisagem na saúde: o caso das levadas e trilhos na Madeira**

Nº de identificação (IDNR)						**Polar Nº**		

0. Breve descrição do projeto de investigação

Este projeto é intitulado 'O impacto do turismo de natureza e da paisagem na saúde: o caso das levadas e trilhos na Madeira' e é conduzido pela Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa, Faculdade de Ciências Sociais da Universidade da Madeira e Faculdade de Desporto da Universidade do Porto, com o apoio do Governo da Região Autónoma da Madeira, Portugal.

O objetivo principal do presente estudo é identificar os benefícios de saúde mental, física e social que emergem das caminhadas nas levadas e trilhos pelos turistas. Três objetivos adicionais são: (1) identificar as características da paisagem (identificadas pelos turistas) que atraem os utilizadores das levadas e trilhos; (2) identificar outras qualidades relevantes da paisagem, por exemplo, inclinação e extensão do trilho, alterações do declive ao longo do percurso e acessibilidade para os adultos idosos, pessoas com deficiência e crianças; e (3) fornecer dados úteis para a conservação da paisagem e desenvolvimento da indústria do turismo na Madeira. Os dados serão recolhidos em 720 turistas, 360 homens e 360 mulheres, avaliados/medidos em três levadas e trilhos muito utilizados na Madeira.

Os participantes são avaliados através de questionário e testes motores. O questionário inclui itens sobre as características sociodemográficas, comportamento/estilo de vida, bem-estar físico, mental e social, turismo de natureza, perceção da paisagem, sons e cheiros da paisagem e características específicas da atividade turística. Os testes motores avaliam a resistência cardiorrespiratória, a flexibilidade e o equilíbrio. A 1ª parte do questionário e os testes motores são preenchidos/efetuados na Universidade da Madeira/hotel, num total de 20 minutos. Os itens do questionário relativos à restauração da atenção, sentimentos presentes, sons e cheiros da paisagem são respondidos no início, meio e/ou fim da levada ou trilho, num total de 10 minutos. Os itens do questionário perceção da paisagem e características específicas da paisagem são preenchidos no final da atividade, num total de 10 minutos. Por favor, confie na sua intuição e responda o mais rápido possível ao questionário. Em contrapartida, o questionário poderá aumentar a sua compreensão acerca do ambiente que o(a) rodeia e ajudá-lo(a) a encontrar a atividade física que pode realizar sem qualquer risco. Os testes motores dar-lhe-ão uma indicação do seu estado de saúde. No final da avaliação motora ser-lhe-á entregue um relatório. A informação é confidencial e anónima. A informação não será revelada a qualquer indivíduo que não integre a equipa do projeto; no entanto, os dados recolhidos serão alvo de análise estatística para fins científicos e práticos, incluindo publicações e informação aos governantes e decisores locais. O seu direito à privacidade será mantido.

A participação é voluntária e poderá abandonar o questionário/testes motores a qualquer momento.

Obrigada por nos ajudar a melhorar o turismo na Ilha da Madeira!

Maria João de Gouveia Abreu Freitas, aluna de doutoramento, Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa. Email: mjgafreitas@gmail.com

Duarte Freitas, Ph.D., Universidade da Madeira. Email: dfreitas@staff.uma.pt

0.1. Consentimento informado

☐ Li e compreendo a informação acima apresentada. Tive a oportunidade de colocar questões e todas elas foram respondidas de forma satisfatória, por membros da equipa de investigação.

☐ Eu participo no estudo e autorizo a equipa de investigação a ter acesso às minhas respostas.

☐ Eu não quero participar no estudo.

Nome

Email (facultativo)

Data ___/___/___ **Assinatura** ____

FCSH FACULDADE DE CIÊNCIAS SOCIAIS E HUMANAS UNIVERSIDADE NOVA DE LISBOA

NÃO PREENCHER
(A PREENCHER PELA EQUIPA DE INVESTIGAÇÃO)

Nome

Nº de identificação (IDNR) | **Polar Nº** | **Morfologia e performance**

Data de nascimento	**Data de avaliação**
Dia - Mês - Ano	Dia - Mês - Ano
Idade	**Sexo** ☐ Feminino ☐ Masculino

16. Aptidão física relacionada com a saúde

16.1. Morfologia

		1.ª Avaliação	2.ª Avaliação	3.ª Avaliação		Média
Altura	HT	,	,	,	5 mm	,
Peso	WT	,	,	,	1 kg	,
IMC	BMI	,				
Perímetros						
Cintura	WACI	,	,	,	5 mm	,
Pregas de adiposidade subcutânea					10%	
Abdominal	ABSK	,	,	,		,
Peitoral	CHSK	,	,	,		,
Subescapular	SSSK	,	,	,		,
Suprailíaca	SISK	,	,	,		,
Tricipital	TRSK	,	,	,		,

16.2. Composição corporal

% de gordura		,
Massa gorda	MG	,
Massa isenta de gordura	MIG	,

16.3. Força muscular

		1.ª Avaliação	2.ª Avaliação
Dinamometria de mão	HGR	,	,

Intervalo etário: 20-59 anos

16.4. Performance

16.4.1. Três minutos YMCA *step test* (*3-minute YMCA step test*)

FC repouso (pré-teste)	RHR	
FC 1.º minuto	HR1	
FC 2 minutos	HR2	
FC 3 minutos	HR3	
FC 1.º minuto após o exercício	PHR	

85% FC máxima (220 – idade × 0,85) ,

Teste completo: ☐ Sim ☐ Não

☐ Sem problemas
☐ A FC em exercício excedeu 85% da FC máxima
☐ Reporte de limitações (fraquezas)
☐ Interrupção do teste por falta de segurança
☐ Incapaz de manter o ritmo correto
☐ Reporte de fadiga

16.4.2. Flexibilidade (ACSM, 2001)

		1.ª Avaliação	2.ª Avaliação
Sit and reach (ponto zero = 26cm)	SAR	,	,

Intervalo etário: ≥ 60 anos

16.5. Aptidão funcional (Rikli e Jones, 1999)		
16.5.1. Andar 6 minutos	6MW	___ , _ Nº voltas
16.5.2. Dois minutos *step test*	2MST	___
		+/- 1.ª Avaliação +/- 2.ª Avaliação
16.5.3. Sentar e alcançar o pé	CSAR	_ __ , _ _ __ , _
16.5.4. Levantar e caminhar	8FUG	__ , __ __ , __

17. Equilíbrio [Fullerton Advanced Balance (SF-FAB) Scale]

17.1. Transposição de um banco de 15 cm de altura

- ☐ 0 Incapaz de subir para o banco sem perda de equilíbrio ou assistência manual
- ☐ 1 Capaz de subir o banco com a perna que segue à frente, mas a perna seguinte contacta com o banco ou na fase de troca de apoios demonstra oscilação em ambas as direções
- ☐ 2 Capaz de subir o banco com a perna que segue à frente, mas a perna seguinte contacta com o banco ou na fase de troca de apoios demonstra oscilação numa direção
- ☐ 3 Capaz de transpor o banco em ambas direções mas requer supervisão próxima numa ou em ambas as direções
- ☐ 4 Capaz de transpor o banco corretamente em ambas as direções em segurança e de forma independente

17.2. Caminhar sobre uma linha reta colocada no chão

- ☐ 0 Incapaz de realizar 10 passos autonomamente — Interrupções
- ☐ 1 Capaz de completar 10 passos com mais de cinco interrupções
- ☐ 2 Capaz de completar 10 passos com três a cinco interrupções
- ☐ 3 Capaz de completar 10 passos com uma a duas interrupções
- ☐ 4 Capaz de completar 10 passos com autonomia e sem interrupções

17.3. Ficar em equilíbrio sobre uma perna

- ☐ 0 Incapaz de tentar ou necessita de assistência para evitar uma queda
- ☐ 1 Capaz de levantar a perna com autonomia, mas incapaz de a manter a posição por mais de 5 segundos
- ☐ 2 Capaz de levantar a perna com autonomia e manter a posição por mais de 5 segundos e menos de 12 segundos
- ☐ 3 Capaz de levantar a perna com autonomia e manter a posição por 12 ou mais segundos e menos de 20 segundos
- ☐ 4 Capaz de levantar a perna com autonomia e manter a posição por 20 segundos

17.4. Permanecer em pé numa superfície de esponja com os olhos fechados e braços cruzados

- ☐ 0 Incapaz de subir para a esponja ou manter posição correta com autonomia de olhos abertos
- ☐ 1 Capaz de subir para a esponja com autonomia e manter-se na posição correta mas incapaz de fechar os olhos
- ☐ 2 Capaz de subir para a esponja com autonomia e manter-se na posição correta com os olhos fechados por menos de 10 segundos
- ☐ 3 Capaz de subir para a esponja com autonomia e manter-se na posição correta com os olhos fechados por mais de 10 segundos mas menos de 20 segundos
- ☐ 4 Capaz de subir para a esponja com autonomia e manter-se na posição correta com os olhos fechados por 20 segundos

Intervalo etário: ≤19 anos

18. Equilíbrio e força abdominal (Eurofit)	
18.1. Equilíbrio flamingo	__ n
18.2. Sit ups 30s	__ n

FACULDADE DE CIÊNCIAS SOCIAIS E HUMANAS
UNIVERSIDADE NOVA DE LISBOA

O impacto do turismo de natureza e da paisagem na saúde: o caso das levadas e trilhos na Madeira

Nº de identificação (IDNR)					**Polar Nº**			**Início**	**SCAS**

Percurso pedonal recomendado		
Designação	**Data**	**Hora de partida**
PR nº _____	____/____ /____	____:____ h

5. Sentimentos presentes

Descreva como se sente 'AGORA, NESTE PRECISO MOMENTO'.

Cada escala, em baixo, vai de um sentimento a outro, por exemplo, de deprimido a feliz. Se se sente muito feliz, faça um círculo à volta do número 9, no extremo direito da escala. Se, pelo contrário, se sente muito deprimido, faça um círculo à volta do número 1, no extremo esquerdo da escala. Se não se sente deprimido nem feliz, faça um círculo no número 5, no meio da escala. Na maioria dos casos, terá a necessidade de percorrer a escala. Deve indicar 'quanto', circundando um dos números de 1 a 9.

5.1. Indiferente — nem — Envolvido
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.2. Tenso — nem — Sereno
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.3. Deprimido — nem — Feliz
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.4. Triste — nem — Alegre
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.5. Nervoso — nem — Relaxado
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.6. Desinteressado — nem — Interessado
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.7. Apático — nem — Enérgico
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.8. Passivo — nem — Ativo
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.9. Pessimista — nem — Otimista
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.10. Ansioso — nem — Calmo
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.11. Sonolento — nem — Vígil
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

5.12. Descontente — nem — Contente
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

Anexo 1.2

Nº de identificação (IDNR)					**Polar Nº**			**Meio**	**PRS, som, cheiro e SCAS**

6. Bem-estar mental

Estamos interessados na forma como 'vivencia' este lugar. Para nos ajudar a entender a sua experiência no lugar, apresentamos várias afirmações para as quais solicitamos a sua opinião. As afirmações podem ser usadas para descrever muitos lugares. Leia com atenção cada afirmação e, depois, pergunte a si próprio 'como quantifico a minha experiência aqui?'

Tenha em atenção as pessoas, as coisas e as atividades que se reúnem neste lugar ao escolher a resposta.

Para indicar a sua resposta, faça um círculo em apenas <u>um</u> dos números da escala, à direita da afirmação. Uma amostra da escala é apresentada em baixo. Assim, por exemplo, se pensa que a afirmação não se aplica de modo nenhum à sua experiência neste lugar, faça um círculo no '0' [de modo nenhum (nunca)]. Se pensa que se aplica bastante, faça um círculo no '6' (bastante).

0 —— 1 —— 2 —— 3 —— 4 —— 5 —— 6 —— 7 —— 8 —— 9 —— 10

de modo nenhum (nunca) — muito pouco — um pouco — bastante — muito — completamente

6.1.	Este lugar é um refúgio de distrações indesejadas	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10
6.2.	Este lugar é fascinante	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10
6.3.	Vivencio poucas exigências de concentração quando estou aqui	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10
6.4.	O que se passa aqui mantém efetivamente o meu interesse	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10
6.5.	Passar algum tempo aqui permite-me quebrar a rotina do dia-a-dia	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10
6.6.	Este lugar desperta a minha curiosidade	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10
6.7.	Este é um lugar para ficar longe das coisas que normalmente exigem a minha atenção	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10
6.8.	Há muito a explorar e a descobrir aqui	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10
6.9.	Estar aqui ajuda-me a parar de pensar sobre as coisas que devem ser feitas	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10
6.10.	A minha atenção é atraída para muitas coisas interessantes aqui	0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10

7.	**Qualidade do som da paisagem** (a paisagem e os seus sons)					
7.1.	**Tipos de sons** **Em que medida ouve os 5 tipos de sons seguintes?**					
		não ouço nada	um pouco	moderada-mente	muito	domina completa-mente
7.1.1.	Ruído de tráfego (ex.: carros, autocarros, comboios, aviões,…)	☐	☐	☐	☐	☐
7.1.2.	Outros ruídos (ex.: construção civil, indústria, máquinas, sirenes, música,…)	☐	☐	☐	☐	☐
7.1.3.	Sons humanos (ex.: conversa, risos, crianças brincando, passos,…)	☐	☐	☐	☐	☐
7.1.4.	Sons naturais (ex.: sussurro do vento nas árvores, canto dos pássaros,…)	☐	☐	☐	☐	☐
7.1.5.	Água (ex.: levadas, cursos de água, quedas de água, mar,…)	☐	☐	☐	☐	☐

7.2. Em geral, como é que descreve o som do envolvimento?

muito bom	bom	nem bom, nem mau	mau	muito mau
☐	☐	☐	☐	☐

7.3. A forma como experimenta o som do envolvimento. O som do envolvimento é:

		concordo completa-mente	concordo, em geral	não concordo, nem discordo	discordo, em geral	discordo completa-mente
7.3.1.	Agradável	☐	☐	☐	☐	☐
7.3.2.	Caótico	☐	☐	☐	☐	☐
7.3.3.	Emocionante	☐	☐	☐	☐	☐
7.3.4.	Rotineiro	☐	☐	☐	☐	☐
7.3.5.	Calmo	☐	☐	☐	☐	☐
7.3.6.	Irritante	☐	☐	☐	☐	☐
7.3.7.	Agitado	☐	☐	☐	☐	☐
7.3.8.	Monótono	☐	☐	☐	☐	☐

7.4. Em geral, em que medida o som do envolvimento é apropriado ao presente lugar?

perfeito	muito	moderado	um pouco	nada
☐	☐	☐	☐	☐

7.5. Em geral, como é que descreve o envolvimento visual?

muito bom	bom	nem bom, nem mau	mau	muito mau
☐	☐	☐	☐	☐

7.6. Em geral, em que medida o envolvimento visual é apropriado ao presente lugar?

perfeito	muito	moderado	um pouco	nada
☐	☐	☐	☐	☐

8. Qualidade do cheiro da paisagem (a paisagem e os seus cheiros)

8.1. Tipos de fragrâncias e odores
Em que medida cheira os 5 tipos de fragrâncias e odores seguintes?

	não cheiro nada	um pouco	moderadamente	muito	domina completamente
8.1.1. Cheiro de resíduos (ex.: lixo, sacos de plástico, fumo de cigarros, folhas queimadas, …)	☐	☐	☐	☐	☐
8.1.2. Cheiro de pessoas (ex.: odor corporal, fezes, flatulência ou gases intestinais, urina, vómitos, …)	☐	☐	☐	☐	☐
8.1.3. Cheiro de animais (ex.: fezes de animais, animais em decomposição, odores de animais,…)	☐	☐	☐	☐	☐
8.1.4. Cheiro a natureza (ex.: ar fresco, ar oceânico (maresia), flores, árvores, água, cursos de água, quedas de água, vento, madeira, terra, rocha, flora local, feno, vegetação aromática,…)	☐	☐	☐	☐	☐
8.1.5. Outros cheiros (ex.: gás de escape, materiais de construção, poluição industrial,…)	☐	☐	☐	☐	☐

8.2. Em geral, como é que descreve o cheiro do envolvimento?

muito bom	bom	nem bom, nem mau	mau	muito mau
☐	☐	☐	☐	☐

8.3. A forma como experimenta o cheiro do envolvimento. O cheiro do envolvimento é:

	concordo completamente	concordo, em geral	não concordo nem discordo	discordo, em geral	discordo completamente
8.3.1. Amargo	☐	☐	☐	☐	☐
8.3.2. Seco	☐	☐	☐	☐	☐
8.3.3. Leve	☐	☐	☐	☐	☐
8.3.4. Doce	☐	☐	☐	☐	☐
8.3.5. Fresco	☐	☐	☐	☐	☐
8.3.6. Agradável	☐	☐	☐	☐	☐
8.3.7. Excitante	☐	☐	☐	☐	☐
8.3.8. Tranquilizante	☐	☐	☐	☐	☐
8.3.9. Irritante	☐	☐	☐	☐	☐

8.4. Em geral, em que medida o cheiro do envolvimento é apropriado ao presente lugar?

perfeito	muito	moderado	um pouco	nada
☐	☐	☐	☐	☐

9. Sentimentos presentes

Descreva como se sente ‘AGORA, NESTE PRECISO MOMENTO’.

Cada escala, em baixo, vai de um sentimento a outro, por exemplo, de deprimido a feliz. Se se sente muito feliz, faça um círculo à volta do número 9, no extremo direito da escala. Se, pelo contrário, se sente muito deprimido, faça um círculo à volta do número 1, no extremo esquerdo da escala. Se não se sente deprimido nem feliz, faça um círculo no número 5, no meio da escala. Na maioria dos casos, terá a necessidade de percorrer a escala. Deve indicar ‘quanto’, circundando um dos números de 1 a 9.

9.1.	Indiferente	nem	Envolvido
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.2.	Tenso	nem	Sereno
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.3.	Deprimido	nem	Feliz
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.4.	Triste	nem	Alegre
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.5.	Nervoso	nem	Relaxado
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.6.	Desinteressado	nem	Interessado
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.7.	Apático	nem	Enérgico
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.8.	Passivo	nem	Ativo
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.9.	Pessimista	nem	Otimista
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.10.	Ansioso	nem	Calmo
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.11.	Sonolento	nem	Vígil
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		
9.12.	Descontente	nem	Contente
	1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9		

Anexo 1.3

FCSH FACULDADE DE CIÊNCIAS SOCIAIS E HUMANAS UNIVERSIDADE NOVA DE LISBOA

O impacto do turismo de natureza e da paisagem na saúde: o caso das levadas e trilhos na Madeira

Nº de identificação (IDNR)					Polar Nº			Fim	SCAS, som, cheiro e turismo

10. Sentimentos presentes

Hora de chegada ____:____ h

Descreva como se sente 'AGORA, NESTE PRECISO MOMENTO'.

Cada escala, em baixo, vai de um sentimento a outro, por exemplo, de deprimido a feliz. Se se sente muito feliz, faça um círculo à volta do número 9, no extremo direito da escala. Se, pelo contrário, se sente muito deprimido, faça um círculo à volta do número 1, no extremo esquerdo da escala. Se não se sente deprimido nem feliz, faça um círculo no número 5, no meio da escala. Na maioria dos casos, terá a necessidade de percorrer a escala. Deve indicar 'quanto', circundando um dos números de 1 a 9.

10.1. Indiferente — nem — Envolvido
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.2. Tenso — nem — Sereno
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.3. Deprimido — nem — Feliz
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.4. Triste — nem — Alegre
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.5. Nervoso — nem — Relaxado
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.6. Desinteressado — nem — Interessado
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.7. Apático — nem — Enérgico
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.8. Passivo — nem — Ativo
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.9. Pessimista — nem — Otimista
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.10. Ansioso — nem — Calmo
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.11. Sonolento — nem — Vígil
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

10.12. Descontente — nem — Contente
1 – – 2 – – 3 – – 4 – – 5 – – 6 – – 7 – – 8 – – 9

11. Qualidade do som da paisagem (a paisagem e os seus sons)

11.1. Tipos de sons

Em que medida ouve os 5 tipos de sons seguintes?

	não ouço nada	um pouco	moderada-mente	muito	domina completa-mente
11.1.1. Ruído de tráfego (ex.: carros, autocarros, comboios, aviões,…)	☐	☐	☐	☐	☐
11.1.2. Outros ruídos (ex.: construção civil, indústria, máquinas, sirenes, música,…)	☐	☐	☐	☐	☐
11.1.3. Sons humanos (ex.: conversa, risos, crianças brincando, passos,…)	☐	☐	☐	☐	☐
11.1.4. Sons naturais (ex.: sussurro do vento nas árvores, canto dos pássaros,…)	☐	☐	☐	☐	☐
11.1.5. Água (ex.: levadas, cursos de água, quedas de água, mar,…)	☐	☐	☐	☐	☐

11.2. Em geral, como é que descreve o som do envolvimento?

muito bom	bom	nem bom, nem mau	mau	muito mau
☐	☐	☐	☐	☐

11.3. A forma como experimenta o som do envolvimento. O som do envolvimento é:

	concordo completamente	concordo, em geral	não concordo, nem discordo	discordo, em geral	discordo completamente
11.3.1. Agradável	☐	☐	☐	☐	☐
11.3.2. Caótico	☐	☐	☐	☐	☐
11.3.3. Emocionante	☐	☐	☐	☐	☐
11.3.4. Rotineiro	☐	☐	☐	☐	☐
11.3.5. Calmo	☐	☐	☐	☐	☐
11.3.6. Irritante	☐	☐	☐	☐	☐
11.3.7. Agitado	☐	☐	☐	☐	☐
11.3.8. Monótono	☐	☐	☐	☐	☐

11.4. Em geral, em que medida o som do envolvimento é apropriado ao presente lugar?

perfeito	muito	moderado	um pouco	nada
☐	☐	☐	☐	☐

11.5. Em geral, como é que descreve o envolvimento visual?

muito bom	bom	nem bom, nem mau	mau	muito mau
☐	☐	☐	☐	☐

11.6. Em geral, em que medida o envolvimento visual é apropriado ao presente lugar?

perfeito	muito	moderado	um pouco	nada
☐	☐	☐	☐	☐

12. Qualidade do cheiro da paisagem (a paisagem e os seus cheiros)

12.1. Tipos de fragrâncias e odores
Em que medida cheira os 5 tipos de fragrâncias e odores seguintes?

	não cheiro nada	um pouco	moderadamente	muito	domina completamente
12.1.1. Cheiro de resíduos (ex.: lixo, sacos de plástico, fumo de cigarros, folhas queimadas, …)	☐	☐	☐	☐	☐
12.1.2. Cheiro de pessoas (ex.: odor corporal, fezes, flatulência ou gases intestinais, urina, vómitos, …)	☐	☐	☐	☐	☐
12.1.3. Cheiro de animais (ex.: fezes de animais, animais em decomposição, odores de animais,…)	☐	☐	☐	☐	☐
12.1.4. Cheiro a natureza (ex.: ar fresco, ar oceânico (maresia), flores, árvores, água, cursos de água, quedas de água, vento, madeira, terra, rocha, flora local, feno, vegetação aromática,…)	☐	☐	☐	☐	☐
12.1.5. Outros cheiros (ex.: gás de escape, materiais de construção, poluição industrial,…)	☐	☐	☐	☐	☐

12.2. Em geral, como é que descreve o cheiro do envolvimento?

muito bom	bom	nem bom, nem mau	mau	muito mau
☐	☐	☐	☐	☐

12.3. A forma como experimenta o cheiro do envolvimento. O cheiro do envolvimento é:	concordo completa-mente	concordo, em geral	não concordo nem discordo	discordo, em geral	discordo completamente
12.3.1. Amargo	☐	☐	☐	☐	☐
12.3.2. Seco	☐	☐	☐	☐	☐
12.3.3. Leve	☐	☐	☐	☐	☐
12.3.4. Doce	☐	☐	☐	☐	☐
12.3.5. Fresco	☐	☐	☐	☐	☐
12.3.6. Agradável	☐	☐	☐	☐	☐
12.3.7. Excitante	☐	☐	☐	☐	☐
12.3.8. Tranquilizante	☐	☐	☐	☐	☐
12.3.9. Irritante	☐	☐	☐	☐	☐

12.4. Em geral, em que medida o cheiro do envolvimento é apropriado ao presente lugar?

perfeito	muito	moderado	um pouco	nada
☐	☐	☐	☐	☐

13. Perceção da paisagem (aspetos físicos, biológicos, sensoriais e estéticos observados ao longo do percurso)

13.1. Tipo de paisagem (marcar um **X** na escala)

Natural ├─┴─┴─┴─┴─┴─┴─┤ Cultural

13.2. Luminosidade (marcar um **X** na escala)

Muito fraca ├─┴─┴─┴─┴─┴─┴─┤ Muito forte

13.3. Elemento(s) e/ou forma(s) dominante(s) da paisagem (um ou mais)

- ☐ Água
- ☐ Vale(s)
- ☐ Flores
- ☐ Campos cultivados
- ☐ Povoamentos
- ☐ Arriba(s)/falésia(s)
- ☐ Caldeira(s)/lago(s)
- ☐ Floresta (☐ Laurissilva)
- ☐ Habitações/construções
- ☐ Estradas/estruturas viárias
- ☐ Linha do horizonte/profundidade
- ☐ Trilhos (☐ pedonais; ☐ todo o terreno)
- ☐ Mar
- ☐ Quedas de água
- ☐ Ribeiro(s)
- ☐ Levada(s)
- ☐ Praia(s)
- ☐ Animais
- ☐ Montanha(s)
- ☐ Vegetação
- Outros: ________
  ____
  ____
  ____

13.4. Cor(es) predominante(s) na paisagem (marcar um **X**, ou mais, na régua)

branco ├── vermelho ┼── laranja ┼── amarelo ┼── verde ┼── azul ┼── anil ┼── violeta ┤

outra(s):____________________________

13.5. Elementos perturbadores da paisagem

	nada de acordo ①	②	③	④	total acordo ⑤		nada de acordo ①	②	③	④	total acordo ⑤
Congestionamento dos trilhos	☐	☐	☐	☐	☐	Maus cheiros	☐	☐	☐	☐	☐
Erosão/degradação do suporte físico	☐	☐	☐	☐	☐	Restos de alimentos	☐	☐	☐	☐	☐
Lixo (lenços de papel, cigarros,…)	☐	☐	☐	☐	☐	'WC' na natureza	☐	☐	☐	☐	☐
Desflorestação/deterioração da flora	☐	☐	☐	☐	☐	Animais mortos	☐	☐	☐	☐	☐
Ausência/pouca vida selvagem	☐	☐	☐	☐	☐	Outro: _________	☐	☐	☐	☐	☐
Proteções (varandas, cabos…)	☐	☐	☐	☐	☐						

13.6. Riscos do percurso

	nada de acordo ①	②	③	④	total acordo ⑤		nada de acordo ①	②	③	④	total acordo ⑤
Fácil, sem riscos consideráveis	☐	☐	☐	☐	☐	Trilho longo	☐	☐	☐	☐	☐
Fraca sinalização/informação insuficiente	☐	☐	☐	☐	☐	Abismos	☐	☐	☐	☐	☐

Riscos do percurso	nada de acordo ① ② ③ ④ ⑤ total acordo		nada de acordo ① ② ③ ④ ⑤ total acordo
Bermas desprotegidas	☐ ☐ ☐ ☐ ☐	Declives acentuados	☐ ☐ ☐ ☐ ☐
Proteções degradadas	☐ ☐ ☐ ☐ ☐	Ar rarefeito	☐ ☐ ☐ ☐ ☐
Túneis claustrofóbicos	☐ ☐ ☐ ☐ ☐	Fraca manutenção	☐ ☐ ☐ ☐ ☐
Trilho muito irregular	☐ ☐ ☐ ☐ ☐	Muito estreito	☐ ☐ ☐ ☐ ☐
Deslizamento de terra	☐ ☐ ☐ ☐ ☐	Monótono	☐ ☐ ☐ ☐ ☐
Escorregadio	☐ ☐ ☐ ☐ ☐	Exigente	☐ ☐ ☐ ☐ ☐
Queda de pedras	☐ ☐ ☐ ☐ ☐		

14. Bem-estar social

Ao longo desta levada ou trilho:	de modo algum (não)	muito pouco	algum	muito	a quase totalidade (muitíssimo)
14.1. Conheceu ou interagiu com outras pessoas?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14.2. Houve um sentido de unidade e comunhão entre as pessoas?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14.3. As pessoas ajudaram-se e apoiaram-se umas às outras?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14.4. Houve um sentimento forte de pertença a este lugar?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14.5. As pessoas cumprimentavam-se quando se cruzavam?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14.6. Andar neste lugar deu-lhe um sentido de comunidade?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14.7. Sentiu-se seguro ao andar neste lugar?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14.8. Avisou alguém ou recebeu informação sobre galhos de árvore caídos, buracos, poças, lama, pedras escorregadias, aves ou outras formas de vida rara e/ou qualquer coisa de interesse?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14.9. Acelerou ou abrandou o passo para andar ao lado de alguém ou vice-versa?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

15. Atividade turística (esta levada ou trilho, em particular)

15.1. Custo da atividade

☐ Barato ☐ Razoável ☐ Caro ☐ Sem custos

15.2. Disponibilidade para pagar uma sobretaxa -*willing to pay*- a aplicar na minimização dos impactos da sua atividade turística na natureza (esta levada ou trilho, em particular)

☐ Nenhuma ☐ Disponível ☐ Concordo, mas não estou disponível ☐ Não sei

(A sua resposta não tem qualquer encargo/custo adicional à presente atividade e é muito importante na planificação/gestão deste tipo de atividades, no futuro)

15.3. Quais são as iniciativas/estratégias que devem ser desenvolvidas para melhorar esta atividade?

____

Apenas para verificar. Respondeu a todas as questões e preencheu todas as escalas?

☐ Sim ☐ Não

Se não, pretende ignorar essas questões/escalas?

☐ Sim Se não, preencha, por favor, essas escalas

Obrigada pela sua participação.

Anexo 1.4

O impacto do turismo de natureza e da paisagem na saúde: o caso das levadas e trilhos na Madeira

Nº de identificação (IDNR)					**Polar Nº**			**Perfil e estilo de vida**

1. Características sociodemográficas

1.1. Data de nascimento

Dia __ __ - Mês __ __ - Ano __ __ __ __

1.2. Data de avaliação

Dia __ __ - Mês __ __ - Ano __ __ __ __

1.3. Idade __ __

1.4. Sexo ☐ Feminino ☐ Masculino

1.5. País de origem

____

1.6. Local de residência

☐ Cidade ☐ Periferia da cidade ☐ Rural

1.7. Estado civil

☐ Casado ☐ Viúvo ☐ Divorciado
☐ União de facto ☐ Separado ☐ Solteiro

1.8. Habilitações literárias

☐ Nenhuma instrução concluída ☐ Ensino secundário
☐ Ensino básico ☐ Ensino superior

1.9. Profissão

Anterior ________________________
____

Atual ________________________
____

1.9.1. Situação profissional

☐ Trabalho remunerado;
____% de ocupação
☐ Estudante
☐ Dona de casa
☐ Reformado
☐ Invalidez
☐ Desempregado
☐ Outro

2. Comportamento/estilo de vida

2.1. Sinais ou sintomas de doença cardiovascular, pulmonar e metabólica

☐ Fumador; nº médio de cigarros por dia =_______; nº de anos a fumar _______

☐ Doenças respiratórias ☐ Hipertensão ☐ Diabetes
☐ Doenças cardiovasculares ☐ Doenças músculo-esqueléticas

2.2. Tem dificuldades nos itens seguintes?

Na escala de 1 (nenhuma dificuldade) a 5 (muito difícil), faça um círculo no número que melhor descreve a sua condição atual.

	nenhuma dificuldade	um pouco difícil	moderada-mente difícil	difícil	muito difícil
Ver (acuidade visual para a leitura)	1	2	3	4	5
Ver (para se deslocar/andar)	1	2	3	4	5
Ouvir (audição)	1	2	3	4	5
Cheirar (olfato)	1	2	3	4	5
Lembrar as coisas	1	2	3	4	5
Deslocar/andar autónomo	1	2	3	4	5

2.3. Morfologia

Altura (cm) __ __ __ , __

Peso (kg) __ __ __ , __

NÃO PREENCHER; a preencher pela equipa de investigação

IMC (kg/m^2) __ __ , __

% de gordura __ __ , __ __

2.4. Hoje, antes de iniciar a atividade (marcar um X na régua)

Nenhuma — Total

A minha capacidade de andar a pé era: 0 20 40 60 80 100

Tinha dores/desconforto: 0 20 40 60 80 100

Tinha dores de cabeça: 0 20 40 60 80 100

3. Bem-estar físico

3.1. Estado de saúde

3.1.1. Em geral, diria que a minha saúde é:

ótima	muito boa	boa	razoável	fraca
☐	☐	☐	☐	☐
1	2	3	4	5

As questões que se seguem são sobre as atividades que realiza no seu dia-a-dia. Será que a sua saúde o limita nestas atividades? Se sim, quanto?

	sim, muito limitado	sim, um pouco limitado	não, nada limitado
3.1.2. Atividades moderadas, tais como deslocar uma mesa, aspirar a casa e jogar *bowling* ou golfe	☐ 1	☐ 2	☐ 3
3.1.3. Subir vários lanços de escadas	☐ 1	☐ 2	☐ 3

Durante as últimas 4 semanas teve, no seu trabalho ou atividades diárias, algum dos problemas apresentados a seguir, como consequência do seu estado de saúde física?

	sim	não
3.1.4. Fez menos do que gostaria de ter feito	☐ 1	☐ 2
3.1.5. Sentiu-se limitado no tipo de trabalho ou outras atividades	☐ 1	☐ 2

Durante as últimas 4 semanas teve, com o seu trabalho ou com as suas atividades diárias, algum dos problemas apresentados a seguir devido a quaisquer problemas emocionais (tal como sentir-se deprimido ou ansioso)?

	sim	não
3.1.6. Fez menos do que gostaria de ter feito	☐ 1	☐ 2
3.1.7. Não executou o seu trabalho ou outras atividades tão cuidadosamente como era costume	☐ 1	☐ 2

3.1.8. Durante as últimas 4 semanas, de que forma é que a dor interferiu com o seu trabalho normal (tanto profissional como doméstico)?

absolutamente nada	um pouco	moderadamente	muito	muitíssimo
☐	☐	☐	☐	☐
1	2	3	4	5

As perguntas que se seguem pretendem avaliar a forma como se sentiu, nas últimas 4 semanas. Quanto tempo?

	sempre	a maior parte do tempo	bastante tempo	um bom bocado de tempo	algum tempo	nunca
3.1.9. Sentiu-se calmo e tranquilo?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
3.1.10. Sentiu-se com muita energia?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
3.1.11. Sentiu-se triste e em baixo?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

3.1.12. Durante as últimas 4 semanas, até que ponto é que a sua saúde física ou problemas emocionais limitaram a sua atividade social (tal como visitas a amigos ou familiares próximos)?

sempre	a maior parte do tempo	algum tempo	pouco tempo	nunca
☐	☐	☐	☐	☐
1	2	3	4	5

3.2. Atividade física habitual (último ano)

(De 3.2.1 a 3.2.7, considere as atividades domésticas ou estudar como trabalho se essa é a sua atividade diária principal)

3.2.1. No trabalho, costuma sentar-se?

nunca	raramente	algumas vezes	frequentemente	sempre
☐	☐	☐	☐	☐
5	4	3	2	1

3.2.2. No trabalho, mantém-se de pé?

nunca	raramente	algumas vezes	frequentemente	sempre
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.3. No trabalho, anda a pé?

nunca	raramente	algumas vezes	frequentemente	sempre
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.4. No trabalho, pega em cargas pesadas?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.5. Depois do trabalho sente-se cansado?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.6. Durante o trabalho transpira?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.7. Em comparação com outros colegas da sua idade, pensa que o seu trabalho é fisicamente

muito mais leve	mais leve	tão pesado	mais pesado	muito mais pesado
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.8. Pratica algum desporto? sim ☐ não ☐

Se respondeu afirmativamente:

– Qual é o desporto que pratica frequentemente?______________________________ ☐☐☐

	<1	1 - 2	2 - 3	3 - 4	>4
– Quantas horas por semana?	☐	☐	☐	☐	☐
	<1	1 - 3	4 - 6	7 - 9	>9
– Quantos meses por ano?	☐	☐	☐	☐	☐

Se pratica um 2º desporto:

– Qual é o desporto? ____ ☐☐☐

	<1	1 - 2	2 - 3	3 - 4	>4
– Quantas horas por semana?	☐	☐	☐	☐	☐
	<1	1 - 3	4 - 6	7 - 9	>9
– Quantos meses por ano?	☐	☐	☐	☐	☐

3.2.9. Em comparação com outros colegas da sua idade, pensa que a sua atividade física durante os tempos livres é

muito menor	menor	igual	maior	muito maior
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.10. Durante os tempos livres transpira?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.11. Durante os tempos livres pratica desporto?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.12. Durante os tempos livres vê televisão?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
5	4	3	2	1

3.2.13. Durante os tempos livres anda a pé?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.14. Durante os tempos livres anda de bicicleta?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.15. Quantos minutos anda a pé e/ou bicicleta por dia para ir e voltar do trabalho, escola e compras?

<5	5 - 15	15 - 30	30 - 45	> 45
☐	☐	☐	☐	☐

3.2.16. Durante os tempos livres efetua atividades de *bricolage* (faça-você-mesmo)?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.17. Durante os tempos livres trabalha no jardim?

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
☐	☐	☐	☐	☐
1	2	3	4	5

3.2.18. Em média, quantas horas dorme, por dia?

≤5	6	7	8	≥9
☐	☐	☐	☐	☐

4. Turismo de natureza

4.1. Na infância, passei algum tempo em contacto com a natureza

nunca	1-2 vezes/semestre	1-2 vezes/mês	1-3 vezes/semana	+3 vezes/semana
☐	☐	☐	☐	☐

4.2. Anos de prática de turismo de natureza ou visitas a ambientes naturais

☐ < 1 ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ > 20

4.3. Frequência com que pratica turismo de natureza ou visitas a ambientes naturais, por ano

☐ 1.ª vez ☐ 1-2 ☐ 3-4 ☐ 5-6 ☐ 7-8 ☐ ≥ 9

4.4. Duração da prática de turismo de natureza ou visitas a ambientes naturais (em geral)

< 15 m	15 - < 30 m	0,5 - < 1 h	1 - < 1,5 h	1,5 - < 2 h	≥ 2 h
☐	☐	☐	☐	☐	☐

4.5. Intensidade da atividade de turismo de natureza ou visitas a ambientes naturais (em geral)

☐ leve ☐ moderada ☐ vigorosa

Appendix 1 Visual landscape, sounds and smells perceived by nature-based tourists

Table S4.1 Multilevel ordinal logistic regression models exploring the relationship of tourists' perceived visual landscape with sounds, smells and socio-demographic characteristics: models 1 (null) to 3.

	Null model		Model 2		Model 3	
Model Term	Coefficient	SE	Coefficient	SE	Coefficient	SE
Fixed effects						
Threshold (1)	–1.927	0.113	–0.968	0.168	–1.053	0.168
Threshold (2)	0.036	0.097	1.749	0.171	1.821	0.173
Tourists' perceived visual landscape (T0)			0.919***	0.092	0.946***	0.093
Sounds						
Traffic noise			–0.342***	0.064	–0.216**	0.067
Other noise			–0.184*	0.072	–0.129	0.074
Human beings			–0.099	0.055	–0.080	0.056
Natural			0.266***	0.060	0.115	0.063
Water			0.134**	0.049	0.072	0.050
Smells						
Waste					–0.287**	0.106
People					0.101	0.104
Animal					0.122	0.116
Nature					0.427***	0.054
Other					–0.372***	0.092
Random effect						
Levada/trail variance (level 2)	0.177	0.075	0.169	0.075	0.145	0.068
Model fit						
Deviance (-2 log L)	2683.25		2390.24		2292.73	

Notes: Tourists' perceived visual landscape (dependent variable), 0 for 'very bad, bad, and neither good, nor bad'; 1 for 'good'; 2 for 'very good'. Types of sounds and smells are treated as continuous variables and are mean-centred. Model 1 is the so-called 'the intercept-only model'. Model 2 includes the tourists' perceived visual landscape in the middle of the 'levadas' and trails, and types of sounds. Model 3 adds to model 2 the types of smells.

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.

Appendix 2 Short-term change, prediction, and mediation of emotions in nature-based tourism

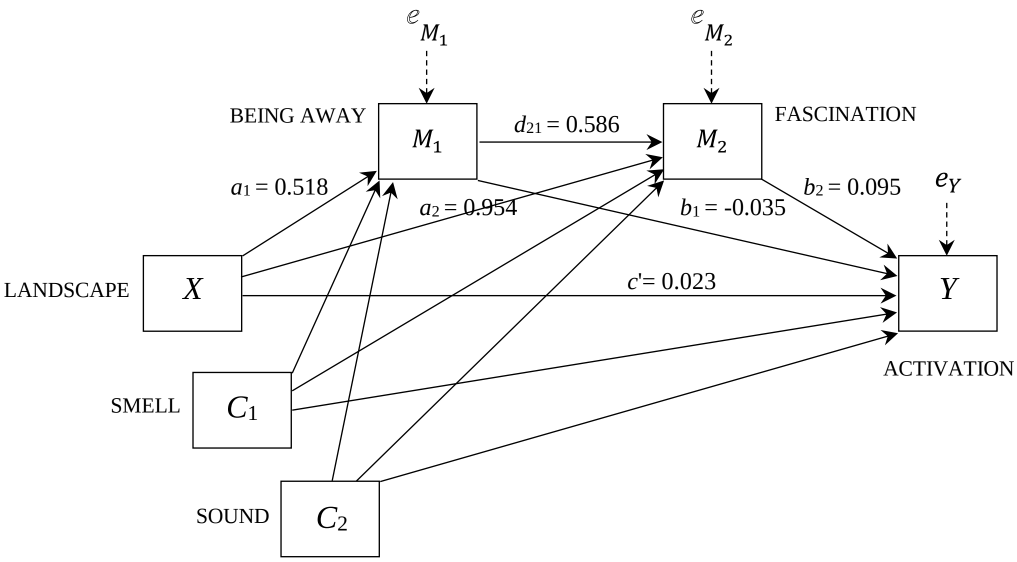

Figure S5.1 Serial multiple mediator model for the causal relationship between visual landscape and activation. Being away and fascination are mediators. Nature smells and nature sounds are covariates. The paths marked a_1, a_2, d_{21}, b_1, b_2 and c' are unstandardized regression coefficients.

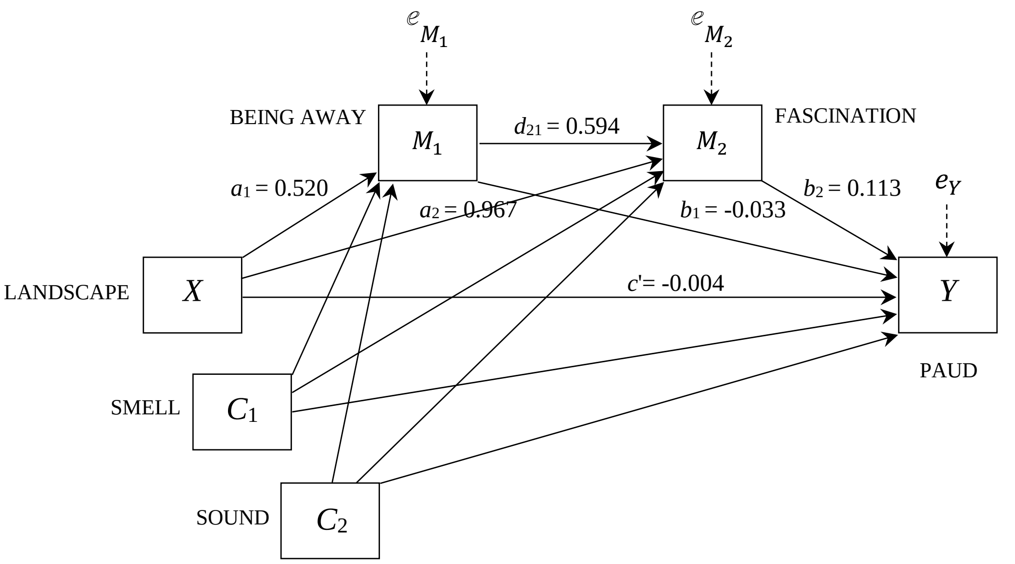

Figure S5.2 Serial multiple mediator model for the causal relationship between visual landscape and pleasant activation-unpleasant deactivation (paud). Being away and fascination are mediators. Nature smells and nature sounds are covariates. The paths marked a_1, a_2, d_{21}, b_1, b_2 and c' are unstandardized regression coefficients.

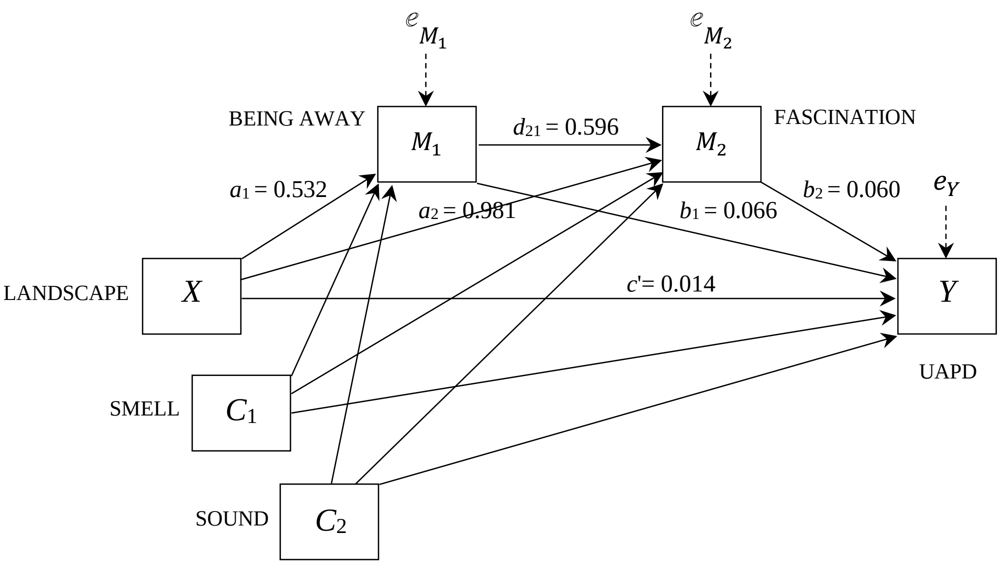

Figure S5.3 Serial multiple mediator model for the causal relationship between visual landscape and unpleasant activation-pleasant deactivation (uapd). Being away and fascination are mediators. Nature smells and nature sounds are covariates. The paths marked a_1, a_2, d_{21}, b_1, b_2 and c' present unstandardized regression coefficients.

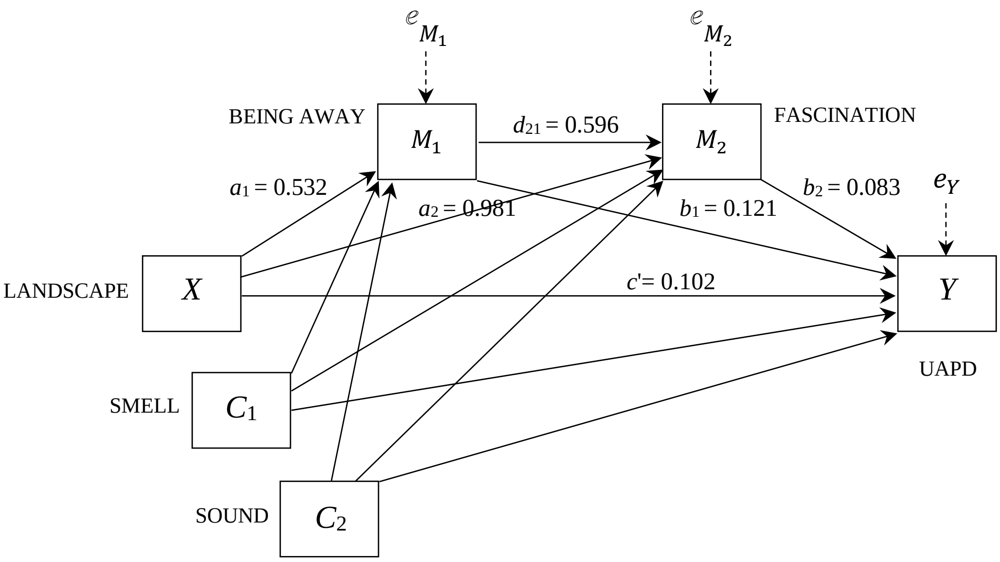

Figure S5.4 Serial multiple mediator model for the causal relationship between visual landscape and pleasant activation-unpleasant deactivation (paud) (change from T1 to T2). Being away and fascination are mediators. Nature smells and nature sounds are covariates. The paths marked a_1, a_2, d_{21}, b_1, b_2 and c' are unstandardized regression coefficients.

Table S5.1 Means and standard deviations on all three assessment points for affect indices and change from the beginning to the middle (ΔT1-T2), from the middle to the end (ΔT2-T3) and from the beginning to the end (ΔT1-T3). Being away and fascination (means and standard deviations) were assessed at the middle of the hiking activity.

Variable	One-day hiking activity						
	Time point			Pairwise comparisons†	Change††		
	Beginning (T1)	Middle (T2)	End (T3)		ΔT1-T2	ΔT2-T3	ΔT1-T3
SCAS							
Valence	7.536±1.25	7.755±1.29	7.942±1.10	1 < 2 and 3; 2 < 3	0.219±1.36	0.187±1.07	0.410±1.27
Activation	7.082±1.33	7.346±1.36	7.312±1.30	1 < 2 and 3	0.265±1.44	-0.034±1.40	0.230±1.45
Paud	7.374±1.15	7.408±1.21	7.512±1.09	1 and 2 < 3	0.034±1.26	0.104±1.06	0.140±1.23
Uapd	7.057±1.53	7.730±1.37	7.891±1.13	1 < 2 and 3; 2 < 3	0.673±1.60	0.161±1.22	0.830±1.56
PRS							
Being away	-	7.101±1.57	-	-	-	-	-
Fascination	-	7.074±1.99	-	-	-	-	-

SCAS, Swedish Core Affect Scale (Västfjäll & Gärling, 2007; Västfjäll et al., 2002). Paud, pleasant activation-unpleasant deactivation; Uapd, unpleasant activation-pleasant deactivation. Core affect was measured on a 9-point scale, ranging from one (left-end adjective) to 9 (right-end adjective).

PRS, Perceived Restorativeness Scale (PRS) (Hartig, Kaiser, & Bowler, 1997; Hartig, Korpela, Evans, & Gärling, 1997). The nature-based restorative experience was measured on 11-point scale, ranging from zero (not at all) to 10 (completely).

†One-way repeated measures ANOVA. 1, beginning (T1); 2, middle (T2); 3, end (T3) of the 'levadas' and trails.

††To avoid negative values, the difference of scores were calculated as T2-T1, T3-T2 and T3-T1.

Table S5.2 Descriptive statistics for mountain guides, environmental characteristics, and hike features.

Variable					Ordinal scale				
	Mean±sd	Min	Max	*f* (%)	1	2	3	4	5
Mountain guide									
Age	43.60±9.6	29	71						
Gender									
Female				15 (28.3)					
Male				38 (71.7)					
Environmental characteristics									
Colours[†]	2.03±1.1	1	9						
Elements and forms[††]	7.67±3.2	1	19						
Nature smells	3.67±1.1				48 (3.6)	174 (12.9)	296 (22.0)	482 (35.8)	340 (25.3)
Nature sounds	3.93±1.0				36 (2.7)	115 (8.5)	211 (15.7)	530 (39.4)	451 (33.5)
Vegetation zones[†††]		1	8						
Hike features									
Distance (km)	11.85±3.6	3.0	24.4						
Ascent (m)	483.8±334.0	0.1	13.2						
Descent (m)	552.2±343.4	0.1	17.0						
Difficulty	2.57±1.2				292 (21.7)	362 (26.9)	392 (29.1)	222 (16.5)	73 (5.4)

Mean±sd, mean ± standard deviation. Min, Minimum. Max, maximum. *f*, frequency. Ordinal scale: sounds and smells, 1 representing ‘do not hear/smell at all’ and 5 ‘dominates completely’; difficulty, 1 indicating ‘easy’ and 5 ‘difficult’.

[†]The most reported colours were green (90.9%), blue (38.9%), yellow (20.7%), orange (10.8%), white (10.6%), red (8.4%) and others (7.0%).

[††]The most reported elements and forms were vegetation (71.5%), trails (62.8%), water (68.5%), mountain (60.7%), cliffs (56.6%), ‘levadas’ (55.6%), flowers (54.6%), forest (52.5%), sea (46.0%), waterfalls (39.9%), sky line (25.6%), and others (21.1%).

[†††]Vegetation zones: (1) coastal, (2) transitional, (3) Laurel forest, (4) high mountain, (5) combination of zones 1 and 2; (6) combination of zones 1, 2 and 3; (7) combination of zones 1, 2, 3 and 4; and (8) combinations of zones 3 and 4. [Adapted from Packham (2004) and Ribeiro (1985)].

Table S5.3 Hierarchical multiple regression with change in valence from T1 to T2 and from T2 to T3 as dependent variables and socio-demographic characteristics of the nature-based tourists and mountain guides, environmental characteristics, hike features and perceived restorative quality as independent variables.

	Step 1				Step 2				Step 3				Step 4				Step 5				Step 6			
Valence (T1-T2)[†] (n = 1130)	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*
Valence T1	-0.613	0.025	-0.603	0.000	-0.610	0.025	-0.599	0.000	-0.609	0.025	-0.599	0.000	-0.608	0.024	-0.598	0.000	-0.611	0.024	-0.601	0.000	-0.646	0.022	-0.635	0.000
Age (tourists)					0.002	0.002	0.020	0.433	0.002	0.002	0.021	0.405	0.003	0.002	0.036	0.144	0.004	0.002	0.046	0.064	0.005	0.002	0.052	0.023
Gender (tourists)					-0.173	0.057	-0.073	0.003	-0.174	0.057	-0.073	0.002	-0.134	0.056	-0.057	0.017	-0.152	0.057	-0.064	0.007	-0.100	0.051	-0.042	0.051
Country																								
United Kingdom					0.233	0.105	0.055	0.233	0.222	0.106	0.052	0.037	0.300	0.105	0.071	0.004	0.400	0.110	0.095	0.000	0.139	0.101	0.033	0.167
Germany					0.322	0.111	0.072	0.322	0.346	0.125	0.077	0.006	0.385	0.122	0.086	0.002	0.387	0.122	0.086	0.002	0.216	0.111	0.048	0.051
Other					0.059	0.086	0.017	0.059	0.061	0.086	0.018	0.474	0.003	0.084	0.001	0.972	0.054	0.086	0.016	0.528	-0.088	0.078	-0.025	0.259
Education																								
High					0.001	0.071	0.000	0.992	-0.002	0.071	-0.001	0.973	-0.020	0.069	-0.007	0.770	-0.034	0.069	-0.012	0.621	-0.009	0.062	-0.003	0.885
Mountain guide																								
Age									-0.002	0.003	-0.016	0.507	-0.002	0.003	-0.018	0.464	0.000	0.003	0.003	0.904	0.004	0.003	0.027	0.233
Gender									0.028	0.096	0.008	0.772	0.057	0.094	0.016	0.545	0.044	0.096	0.012	0.649	0.042	0.087	0.012	0.631
Environmental characteristics																								
Colours													0.072	0.025	0.069	0.005	0.055	0.026	0.052	0.035	0.034	0.023	0.032	0.151
Elements and forms													0.004	0.009	0.011	0.639	0.008	0.009	0.021	0.380	0.006	0.008	0.015	0.485
Nature sounds													0.104	0.029	0.092	0.000	0.111	0.029	0.099	0.000	0.064	0.026	0.057	0.015
Nature smells													0.137	0.027	0.129	0.000	0.137	0.027	0.129	0.000	0.071	0.024	0.067	0.004
Vegetation zones													-0.033	0.014	-0.055	0.022	-0.050	0.018	-0.083	0.005	-0.015	0.016	-0.025	0.359
Hike features																								
Distance																	-0.031	0.017	-0.049	0.069	-0.028	0.015	-0.044	0.069
Ascent																	0.022	0.022	0.032	0.317	0.021	0.020	0.031	0.287
Descent																	0.061	0.019	0.091	0.001	0.053	0.017	0.079	0.002
Difficulty																	-0.045	0.025	-0.043	0.076	-0.055	0.023	-0.053	0.016
Perceived restorative quality																								
Being away																					0.115	0.020	0.151	0.000
Fascination																					0.148	0.016	0.249	0.000
R^2		0.363				0.377				0.377				0.417				0.426				0.535		
ΔR^2						0.014^{**}				0.000				0.040^{***}				0.009^{**}				0.109^{***}		
Valence (T2-T3) (n = 1120)																								
Valence T2	-0.392	0.022	-0.473	0.000	-0.397	0.022	-0.479	0.000	-0.398	0.022	-0.480	0.000	-0.409	0.023	-0.494	0.000	-0.415	0.023	-0.501	0.000	-0.436	0.026	-0.527	0.000
Age (tourists)					0.002	0.002	0.031	0.279	0.002	0.002	0.036	0.211	0.002	0.002	0.034	0.237	0.002	0.002	0.031	0.286	0.002	0.002	0.038	0.187
Gender (tourists)					-0.033	0.047	-0.019	0.475	-0.036	0.047	-0.021	0.437	-0.040	0.047	-0.023	0.391	-0.041	0.047	-0.024	0.385	-0.035	0.047	-0.020	0.462
Country																								
United Kingdom					0.002	0.084	0.001	0.982	-0.025	0.085	-0.008	0.769	0.011	0.086	0.004	0.895	0.016	0.090	0.005	0.855	-0.017	0.091	-0.005	0.856
Germany					0.105	0.090	0.032	0.244	0.185	0.101	0.057	0.068	0.185	0.101	0.057	0.068	0.180	0.101	0.055	0.074	0.165	0.101	0.051	0.103
Other					-0.018	0.069	-0.007	0.798	-0.012	0.069	-0.005	0.865	-0.022	0.069	-0.009	0.755	0.000	0.071	0.000	1.000	-0.017	0.072	-0.007	0.813
Education																								
High					-0.050	0.058	-0.025	0.383	-0.058	0.058	-0.028	0.316	-0.060	0.058	-0.029	0.298	-0.065	0.057	-0.032	0.261	-0.070	0.057	-0.034	0.222
Mountain guide																								
Age									-0.004	0.003	-0.038	0.171	-0.004	0.003	-0.039	0.163	-0.003	0.003	-0.030	0.293	-0.003	0.003	-0.028	0.313
Gender									0.116	0.077	0.046	0.132	0.112	0.077	0.045	0.144	0.149	0.079	0.060	0.059	0.151	0.079	0.060	0.055
Environmental characteristics																								
Colours													-0.003	0.021	-0.004	0.880	-0.010	0.021	-0.013	0.649	-0.009	0.021	-0.012	0.662
Elements and forms													0.016	0.007	0.058	0.035	0.017	0.007	0.064	0.021	0.017	0.007	0.063	0.023
Nature sounds													0.030	0.022	0.042	0.181	0.034	0.022	0.048	0.129	0.036	0.022	0.051	0.106
Nature smells													0.039	0.022	0.055	0.078	0.038	0.022	0.055	0.081	0.037	0.022	0.053	0.092
Vegetation zones													0.005	0.012	0.011	0.684	0.019	0.015	0.043	0.209	0.020	0.015	0.045	0.190
Hike features																								
Distance																	-0.019	0.007	-0.080	0.009	-0.019	0.007	-0.084	0.006
Ascent																	-0.010	0.009	-0.041	0.272	-0.010	0.009	-0.039	0.287
Descent																	0.013	0.008	0.055	0.091	0.014	0.008	0.056	0.084
Difficulty																	-0.036	0.021	-0.048	0.082	-0.037	0.021	-0.049	0.080
Perceived restorative quality																								
Being away																					0.046	0.019	0.083	0.014
Fascination																					-0.008	0.015	-0.018	0.597
R^2		0.224				0.227				0.230				0.242				0.250				0.255		
ΔR^2						0.004				0.003				0.012^{**}				0.008^{*}				0.005^{*}		

[†]T1, T2 and T3, beginning, middle and end of the 'levadas' or trails, respectively; *B*, unstandardized coefficients; *SE B*, standard error of *B*; *β*, standardized coefficients; variables entered into the model at step 1: valence at T1 (change from T1-T2) or T2 (change from T2-T3); variables entered into the model at step 2: age, gender, country and education level of the tourists; variables entered into the model at step 3: age and gender of the mountain guides; variables entered into the model at step 4: colours, elements and forms of the landscape, nature sounds and nature smells at T2 (change from T1 to T2) and T3 (change from T2 to T3), and vegetation zones; variables entered into the model at step 5: distance, ascent and descent and difficulty of the 'levadas' and trails; variables entered into the model at step 6: being away and fascination. ; ΔR^2, R^2 change; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{**}p < 0.001$.

Table S5.4 Hierarchical multiple regression with change in activation from T1 to T2 and from T2 to T3 as dependent variables and socio-demographic characteristics of the tourists and mountain guides, environmental characteristics, hike features and perceived restorative quality as independent variables.

	Step 1				Step 2				Step 3				Step 4				Step 5				Step 6			
Activation (T1-T2) (n = 1248)	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*
Activation T1	-0.617	0.024	-0.598	0.000	-0.631	0.025	-0.612	0.000	-0.631	0.025	-0.611	0.000	-0.637	0.024	-0.617	0.000	-0.643	0.024	-0.623	0.000	-0.655	0.023	-0.635	0.000
Age (tourists)					0.005	0.002	0.052	0.034	0.005	0.002	0.053	0.031	0.007	0.002	0.068	0.005	0.007	0.002	0.076	0.002	0.008	0.002	0.082	0.000
Gender (tourists)					-0.136	0.061	-0.052	0.026	-0.137	0.061	-0.052	0.025	-0.109	0.061	-0.041	0.073	-0.121	0.061	-0.046	0.048	-0.070	0.057	-0.027	0.221
Country																								
United Kingdom					0.109	0.112	0.023	0.332	0.098	0.113	0.021	0.387	0.150	0.112	0.032	0.184	0.217	0.118	0.046	0.067	0.015	0.112	0.003	0.897
Germany					0.099	0.120	0.020	0.410	0.141	0.134	0.028	0.294	0.177	0.132	0.035	0.181	0.166	0.133	0.033	0.211	0.003	0.125	0.001	0.981
Other					0.054	0.089	0.014	0.547	0.055	0.090	0.015	0.536	0.005	0.088	0.001	0.958	0.041	0.091	0.011	0.656	-0.074	0.086	-0.019	0.391
Education																								
High					-0.127	0.075	-0.041	0.089	-0.131	0.075	-0.042	0.081	-0.134	0.074	-0.043	0.069	-0.140	0.074	-0.045	0.057	-0.112	0.069	-0.036	0.105
Mountain guide																								
Age									-0.001	0.003	-0.007	0.775	-0.002	0.003	-0.011	0.636	0.000	0.004	-0.002	0.948	0.003	0.003	0.019	0.405
Gender									0.067	0.101	0.017	0.505	0.071	0.100	0.018	0.479	0.047	0.102	0.012	0.644	0.010	0.096	0.003	0.913
Environmental characteristics																								
Colours													0.048	0.027	0.042	0.077	0.040	0.028	0.035	0.149	0.021	0.026	0.018	0.418
Elements and forms													0.001	0.010	0.001	0.955	0.003	0.010	0.008	0.743	-0.001	0.009	-0.003	0.882
Nature sounds													0.114	0.031	0.091	0.000	0.118	0.031	0.094	0.000	0.073	0.029	0.059	0.013
Nature smells													0.126	0.029	0.107	0.000	0.129	0.029	0.109	0.000	0.068	0.028	0.058	0.013
Vegetation zones													-0.019	0.015	-0.029	0.212	-0.034	0.019	-0.051	0.078	0.000	0.018	0.000	0.996
Hike features																								
Distance																	-0.019	0.018	-0.026	0.310	-0.014	0.017	-0.020	0.400
Ascent																	0.035	0.024	0.046	0.138	0.037	0.022	0.048	0.099
Descent																	0.019	0.020	0.026	0.342	0.012	0.019	0.017	0.511
Difficulty																	-0.043	0.026	-0.038	0.106	-0.055	0.025	-0.049	0.027
Perceived restorative quality																								
Being away																					0.051	0.022	0.061	0.021
Fascination																					0.169	0.018	0.258	0.000
R^2	0.358				0.367				0.367				0.395				0.398				0.474			
ΔR^2					0.009*				0.000				0.028***				0.003				0.076***			
Activation (T2-T3) (n = 1250)																								
Activation T2	-0.531	0.027	-0.493	0.000	-0.546	0.027	-0.507	0.000	-0.549	0.027	-0.510	0.000	-0.566	0.027	-0.526	0.000	-0.575	0.027	-0.534	0.000	-0.573	0.029	-0.532	0.000
Age (tourists)					0.009	0.003	0.090	0.001	0.009	0.003	0.094	0.000	0.009	0.002	0.098	0.000	0.010	0.003	0.101	0.000	0.010	0.003	0.102	0.000
Gender (tourists)					-0.050	0.064	-0.020	0.430	-0.053	0.064	-0.021	0.408	-0.056	0.064	-0.022	0.384	-0.061	0.064	-0.024	0.343	-0.060	0.064	-0.023	0.353
Country																								
United Kingdom					0.005	0.116	0.001	0.963	-0.018	0.117	-0.004	0.875	0.036	0.117	0.008	0.762	0.014	0.123	0.003	0.911	0.011	0.124	0.002	0.932
Germany					-0.219	0.126	-0.045	0.082	-0.064	0.140	-0.013	0.649	-0.086	0.139	-0.018	0.537	-0.090	0.139	-0.018	0.517	-0.090	0.140	-0.018	0.519
Other					-0.092	0.093	-0.025	0.324	-0.091	0.093	-0.025	0.328	-0.105	0.093	-0.029	0.256	-0.135	0.095	-0.037	0.158	-0.134	0.096	-0.037	0.163
Education																								
High					-0.033	0.078	-0.011	0.674	-0.043	0.078	-0.014	0.583	-0.048	0.078	-0.016	0.533	-0.058	0.077	-0.019	0.456	-0.060	0.078	-0.020	0.440
Mountain guide																								
Age									0.001	0.004	0.008	0.756	0.001	0.004	0.010	0.709	0.003	0.004	0.020	0.445	0.003	0.004	0.019	0.471
Gender									0.282	0.105	0.075	0.008	0.260	0.105	0.070	0.013	0.299	0.107	0.080	0.005	0.299	0.108	0.080	0.005
Environmental characteristics																								
Colours													0.004	0.029	0.004	0.887	0.003	0.029	0.003	0.910	0.004	0.029	0.004	0.884
Elements and forms													0.010	0.010	0.026	0.302	0.011	0.010	0.029	0.263	0.011	0.010	0.029	0.262
Nature sounds													0.043	0.030	0.041	0.159	0.048	0.030	0.047	0.111	0.049	0.030	0.047	0.109
Nature smells													0.104	0.030	0.102	0.000	0.104	0.030	0.102	0.000	0.104	0.030	0.102	0.000
Vegetation zones													0.026	0.016	0.040	0.118	0.030	0.020	0.046	0.142	0.029	0.021	0.045	0.154
Hike features																								
Distance																	-0.002	0.009	-0.007	0.813	-0.002	0.010	-0.007	0.797
Ascent																	-0.017	0.013	-0.045	0.188	-0.017	0.013	-0.045	0.189
Descent																	0.022	0.011	0.061	0.039	0.022	0.011	0.061	0.039
Difficulty																	-0.091	0.028	-0.084	0.001	-0.090	0.028	-0.083	0.001
Perceived restorative quality																								
Being away																					0.012	0.025	0.015	0.630
Fascination																					-0.010	0.020	-0.016	0.606
R^2	0.243				0.253				0.258				0.278				0.288				0.288			
ΔR^2					0.011**				0.005*				0.020***				0.010**				0.000			

†T1, T2 and T3, beginning, middle and end of the 'levadas' or trails, respectively; *B*, unstandardized coefficients; *SE B*, standard error of *B*; *β*, standardized coefficients; variables entered into the model at step 1: activation at T1 (change from T1-T2) or T2 (change from T2-T3); variables entered into the model at step 2: age, gender, country and education level of the tourists; variables entered into the model at step 3: age and gender of the mountain guides; variables entered into the model at step 4: colours, elements and forms of the landscape, nature sounds and nature smells at T2 (change from T1 to T2) and T3 (change from T2 to T3), and vegetation zones; variables entered into the model at step 5: distance, ascent and descent and difficulty of the 'levadas' and trails; variables entered into the model at step 6: being away and fascination. ; ΔR^2, R^2 change; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{**}p < 0.001$.

Table S5.5 Hierarchical multiple regression with change in pleasant activation-unpleasant deactivation (paud) from T1 to T2 and from T2 to T3 as dependent variables and socio-demographic characteristics of the nature-based tourists and mountain guides, environmental characteristics, hike features and perceived restorative quality as independent variables.

	Step 1				Step 2				Step 3				Step 4				Step 5				Step 6			
Paud (T1-T2) (n = 1273)	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*
Paud T1	-0.585	0.026	-0.540	0.000	-0.598	0.026	-0.552	0.000	-0.596	0.026	-0.550	0.000	-0.598	0.025	-0.552	0.000	-0.602	0.025	-0.556	0.000	-0.641	0.023	-0.592	0.000
Age (tourists)					0.005	0.002	0.053	0.034	0.005	0.002	0.056	0.027	0.006	0.002	0.071	0.004	0.007	0.002	0.081	0.001	0.008	0.002	0.093	0.000
Gender (tourists)					-0.236	0.058	-0.098	0.000	-0.239	0.058	-0.099	0.000	-0.189	0.057	-0.078	0.001	-0.205	0.057	-0.085	0.000	-0.150	0.051	-0.062	0.003
Country																								
United Kingdom					0.191	0.107	0.044	0.075	0.159	0.109	0.036	0.144	0.219	0.107	0.050	0.041	0.318	0.112	0.072	0.005	0.048	0.102	0.011	0.634
Germany					0.038	0.114	0.008	0.739	0.087	0.127	0.019	0.496	0.105	0.124	0.023	0.396	0.098	0.124	0.021	0.432	-0.100	0.111	-0.021	0.372
Other					0.044	0.085	0.012	0.608	0.047	0.085	0.013	0.585	-0.011	0.083	-0.003	0.899	0.024	0.086	0.007	0.776	-0.111	0.077	-0.032	0.148
Education																								
High					-0.011	0.071	-0.004	0.880	-0.021	0.071	-0.007	0.767	-0.025	0.069	-0.009	0.712	-0.034	0.069	-0.012	0.624	-0.002	0.061	-0.001	0.979
Mountain guide																								
Age									-0.006	0.003	-0.047	0.058	-0.007	0.003	-0.055	0.021	-0.005	0.003	-0.040	0.098	-0.001	0.003	-0.011	0.618
Gender									0.044	0.096	0.012	0.644	0.050	0.094	0.014	0.595	0.014	0.096	0.004	0.887	-0.025	0.086	-0.007	0.772
Environmental characteristics																								
Colours													0.081	0.025	0.079	0.001	0.070	0.026	0.067	0.006	0.045	0.023	0.043	0.050
Elements and forms													0.011	0.009	0.030	0.209	0.015	0.009	0.039	0.104	0.010	0.008	0.027	0.217
Nature sounds													0.060	0.029	0.053	0.038	0.065	0.029	0.057	0.026	0.012	0.026	0.010	0.652
Nature smells													0.169	0.027	0.157	0.000	0.171	0.027	0.159	0.000	0.106	0.024	0.099	0.000
Vegetation zones													-0.034	0.014	-0.056	0.017	-0.059	0.018	-0.096	0.001	-0.017	0.016	-0.028	0.286
Hike features																								
Distance																	-0.015	0.017	-0.024	0.369	-0.010	0.015	-0.016	0.499
Ascent																	0.046	0.022	0.065	0.038	0.044	0.020	0.062	0.027
Descent																	0.033	0.019	0.049	0.078	0.025	0.017	0.036	0.143
Difficulty																	-0.053	0.025	-0.052	0.032	-0.055	0.022	-0.053	0.013
Perceived restorative quality																								
Being away																					0.105	0.020	0.138	0.000
Fascination																					0.176	0.015	0.296	0.000
R^2		0.292				0.306				0.308				0.353				0.359				0.492		
ΔR^2						0.014^{***}				0.002				0.045^{***}				0.006^{*}				0.132^{***}		
Paud (T2-T3) (n = 1272)																								
Paud T2	-0.438	0.022	-0.490	0.000	-0.449	0.023	-0.502	0.000	-0.449	0.023	-0.502	0.000	-0.467	0.023	-0.522	0.000	-0.471	0.023	-0.526	0.000	-0.475	0.025	-0.531	0.000
Age (tourists)					0.007	0.002	0.093	0.000	0.007	0.002	0.094	0.000	0.007	0.002	0.097	0.000	0.007	0.002	0.098	0.000	0.007	0.002	0.100	0.000
Gender (tourists)					-0.076	0.050	-0.039	0.125	-0.078	0.050	-0.039	0.118	-0.080	0.050	-0.041	0.105	-0.082	0.050	-0.041	0.102	-0.081	0.050	-0.041	0.106
Country																								
United Kingdom					-0.052	0.091	-0.015	0.564	-0.064	0.092	-0.018	0.485	-0.009	0.092	-0.003	0.919	-0.014	0.097	-0.004	0.883	-0.020	0.098	-0.006	0.836
Germany					-0.205	0.097	-0.054	0.035	-0.164	0.109	-0.043	0.132	-0.183	0.108	-0.048	0.090	-0.173	0.108	-0.045	0.109	-0.177	0.109	-0.046	0.103
Other					-0.066	0.073	-0.023	0.363	-0.065	0.073	-0.023	0.370	-0.082	0.072	-0.028	0.257	-0.083	0.074	-0.029	0.262	-0.087	0.075	-0.030	0.246
Education																								
High					-0.006	0.060	-0.003	0.917	-0.010	0.061	-0.004	0.873	-0.007	0.060	-0.003	0.914	-0.012	0.060	-0.005	0.845	-0.012	0.060	-0.005	0.846
Mountain guide																								
Age									-0.001	0.003	-0.011	0.659	-0.002	0.003	-0.015	0.548	-0.001	0.003	-0.006	0.812	-0.001	0.003	-0.006	0.822
Gender									0.065	0.083	0.022	0.430	0.061	0.082	0.021	0.458	0.097	0.084	0.033	0.248	0.097	0.084	0.033	0.251
Environmental characteristics																								
Colours													-0.011	0.022	-0.013	0.613	-0.018	0.022	-0.021	0.428	-0.018	0.022	-0.021	0.429
Elements and forms													0.017	0.008	0.056	0.029	0.018	0.008	0.060	0.020	0.018	0.008	0.059	0.021
Nature sounds													0.023	0.023	0.029	0.318	0.026	0.023	0.033	0.258	0.027	0.023	0.033	0.255
Nature smells													0.086	0.023	0.108	0.000	0.085	0.023	0.107	0.000	0.085	0.023	0.107	0.000
Vegetation zones													-0.002	0.013	-0.004	0.884	0.006	0.016	0.013	0.685	0.007	0.016	0.014	0.663
Hike features																								
Distance																	-0.011	0.007	-0.040	0.152	-0.011	0.007	-0.040	0.150
Ascent																	-0.013	0.010	-0.046	0.173	-0.013	0.010	-0.045	0.178
Descent																	0.018	0.008	0.066	0.026	0.018	0.008	0.066	0.026
Difficulty																	-0.035	0.021	-0.041	0.104	-0.035	0.022	-0.042	0.103
Perceived restorative quality																								
Being away																					0.006	0.019	0.010	0.754
Fascination																					0.002	0.015	0.003	0.913
R^2		0.240				0.252				0.252				0.272				0.277				0.277		
ΔR^2						0.012^{**}				0.000				0.020^{***}				0.006				0.000		

†T1, T2 and T3, beginning, middle and end of the 'levadas' or trails, respectively; *B*, unstandardized coefficients; *SE B*, standard error of *B*; *β*, standardized coefficients; variables entered into the model at step 1: paud at T1 (change from T1-T2) or T2 (change from T2-T3); variables entered into the model at step 2: age, gender, country and education level of the tourists; variables entered into the model at step 3: age and gender of the mountain guides; variables entered into the model at step 4: colours, elements and forms of the landscape, nature sounds and nature smells at T2 (change from T1 to T2) and T3 (change from T2 to T3), and vegetation zones; variables entered into the model at step 5: distance, ascent and descent and difficulty of the 'levadas' and trails; variables entered into the model at step 6: being away and fascination. ; ΔR^2, R^2 change; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{**}p < 0.001$.

Table S5.6 Hierarchical multiple regression with change in unpleasant activation-pleasant deactivation (uapd) from T1 to T2 and from T2 to T3 as dependent variables and socio-demographic characteristics of the nature-based tourists and mountain guides, environmental characteristics, hike features and perceived restorative quality as independent variables.

	Step 1				Step 2				Step 3				Step 4				Step 5				Step 6			
Uapd (T1-T2) (n = 1209)	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*	*B*	*SE B*	*β*	*P*
Uapd T1	-0.697	0.022	-0.683	0.000	-0.696	0.022	-0.682	0.000	-0.696	0.022	-0.682	0.000	-0.697	0.022	-0.683	0.000	-0.700	0.022	-0.686	0.000	-0.713	0.021	-0.699	0.000
Age (tourists)					0.000	0.003	0.004	0.851	0.000	0.003	0.004	0.851	0.002	0.003	0.020	0.366	0.003	0.003	0.030	0.174	0.005	0.002	0.041	0.055
Gender (tourists)					-0.046	0.066	-0.015	0.492	-0.046	0.067	-0.015	0.488	-0.013	0.066	-0.004	0.844	-0.038	0.065	-0.013	0.557	0.019	0.062	0.006	0.760
Country																								
United Kingdom					0.059	0.120	0.011	0.623	0.054	0.122	0.010	0.658	0.083	0.121	0.015	0.491	0.219	0.126	0.041	0.083	-0.058	0.122	-0.011	0.631
Germany					-0.016	0.127	-0.003	0.897	-0.023	0.142	-0.004	0.872	-0.011	0.140	-0.002	0.936	-0.021	0.139	-0.004	0.882	-0.197	0.132	-0.034	0.135
Other					0.111	0.097	0.025	0.256	0.113	0.098	0.026	0.246	0.063	0.096	0.014	0.513	0.126	0.098	0.028	0.199	-0.019	0.093	-0.004	0.841
Education																								
High					-0.033	0.081	-0.009	0.685	-0.035	0.082	-0.010	0.668	-0.049	0.080	-0.014	0.537	-0.067	0.079	-0.018	0.399	-0.048	0.075	-0.013	0.520
Mountain guide																								
Age									-0.002	0.004	-0.011	0.613	-0.002	0.004	-0.013	0.541	0.001	0.004	0.006	0.795	0.002	0.004	0.014	0.504
Gender									-0.025	0.110	-0.006	0.820	-0.041	0.108	-0.009	0.700	-0.061	0.110	-0.014	0.579	-0.086	0.104	-0.019	0.408
Environmental characteristics																								
Colours													0.072	0.030	0.053	0.015	0.050	0.030	0.037	0.093	0.036	0.028	0.027	0.203
Elements and forms													-0.007	0.010	-0.015	0.493	-0.001	0.010	-0.002	0.923	-0.004	0.010	-0.009	0.667
Nature sounds													0.062	0.034	0.042	0.069	0.070	0.034	0.047	0.039	0.031	0.032	0.021	0.327
Nature smells													0.194	0.031	0.141	0.000	0.193	0.031	0.141	0.000	0.136	0.030	0.099	0.000
Vegetation zones													0.013	0.017	0.017	0.433	-0.011	0.021	-0.014	0.604	0.018	0.020	0.023	0.364
Hike features																								
Distance																	-0.048	0.020	-0.058	0.014	-0.044	0.018	-0.053	0.017
Ascent																	0.047	0.026	0.052	0.072	0.042	0.024	0.047	0.084
Descent																	0.066	0.022	0.076	0.003	0.061	0.021	0.069	0.004
Difficulty																	-0.101	0.028	-0.077	0.000	-0.100	0.027	-0.076	0.000
Perceived restorative quality																								
Being away																					0.165	0.024	0.172	0.000
Fascination																					0.084	0.019	0.111	0.000
R^2		0.466				0.467				0.468				0.496				0.507				0.562		
ΔR^2						0.001				0.000				0.028^{***}				0.012^{***}				0.055^{***}		
Uapd (T2-T3) (n =1185)																								
Uapd T2	-0.463	0.021	-0.551	0.000	-0.464	0.021	-0.553	0.000	-0.465	0.021	-0.553	0.000	-0.473	0.021	-0.563	0.000	-0.476	0.021	-0.567	0.000	-0.493	0.022	-0.586	0.000
Age (tourists)					0.002	0.002	0.024	0.358	0.002	0.002	0.025	0.341	0.002	0.002	0.028	0.280	0.001	0.002	0.018	0.495	0.002	0.002	0.024	0.358
Gender (tourists)					-0.164	0.049	-0.083	0.001	-0.165	0.049	-0.083	0.001	-0.150	0.049	-0.076	0.002	-0.141	0.049	-0.071	0.004	-0.130	0.049	-0.066	0.009
Country																								
United Kingdom					-0.013	0.088	-0.004	0.886	-0.019	0.089	-0.005	0.832	0.016	0.089	0.005	0.860	-0.024	0.093	-0.007	0.795	-0.065	0.094	-0.019	0.488
Germany					-0.068	0.094	-0.018	0.468	-0.042	0.106	-0.011	0.691	-0.060	0.105	-0.016	0.568	-0.076	0.105	-0.021	0.467	-0.096	0.105	-0.026	0.359
Other					-0.062	0.071	-0.022	0.383	-0.061	0.072	-0.022	0.392	-0.087	0.071	-0.031	0.220	-0.057	0.073	-0.020	0.432	-0.075	0.073	-0.027	0.306
Education																								
High					0.032	0.060	0.014	0.590	0.031	0.060	0.013	0.609	0.032	0.060	0.014	0.592	0.035	0.059	0.015	0.560	0.032	0.059	0.014	0.583
Mountain guide																								
Age									0.000	0.003	-0.004	0.875	-0.001	0.003	-0.009	0.712	-0.001	0.003	-0.012	0.636	-0.001	0.003	-0.012	0.646
Gender									0.043	0.081	0.015	0.590	0.048	0.080	0.017	0.550	0.112	0.082	0.039	0.170	0.114	0.082	0.040	0.164
Environmental characteristics																								
Colours													0.026	0.022	0.030	0.248	0.021	0.022	0.025	0.341	0.022	0.022	0.025	0.325
Elements and forms													0.015	0.008	0.049	0.055	0.015	0.008	0.051	0.046	0.015	0.008	0.048	0.057
Nature sounds													-0.018	0.023	-0.022	0.443	-0.014	0.023	-0.017	0.557	-0.011	0.023	-0.013	0.641
Nature smells													0.079	0.023	0.099	0.001	0.077	0.023	0.097	0.001	0.074	0.023	0.093	0.001
Vegetation zones													-0.020	0.013	-0.040	0.111	0.015	0.016	0.030	0.339	0.017	0.016	0.033	0.291
Hike features																								
Distance																	-0.031	0.007	-0.115	0.000	-0.031	0.007	-0.117	0.000
Ascent																	-0.014	0.010	-0.049	0.146	-0.014	0.010	-0.049	0.147
Descent																	-0.003	0.008	-0.011	0.717	-0.003	0.008	-0.010	0.735
Difficulty																	-0.041	0.022	-0.048	0.057	-0.041	0.022	-0.049	0.055
Perceived restorative quality																								
Being away																					0.045	0.019	0.073	0.020
Fascination																					-0.008	0.015	-0.016	0.605
R^2		0.303				0.311				0.311				0.325				0.341				0.345		
ΔR^2						0.008^{*}				0.000				0.014^{***}				0.016^{***}				0.004^{*}		

†T1, T2 and T3, beginning, middle and end of the 'levadas' or trails, respectively; *B*, unstandardized coefficients; *SE B*, standard error of *B*; *β*, standardized coefficients; variables entered into the model at step 1: uapd at T1 (change from T1-T2) or T2 (change from T2-T3); variables entered into the model at step 2: age, gender, country and education level of the tourists; variables entered into the model at step 3: age and gender of the mountain guides; variables entered into the model at step 4: colours, elements and forms of the landscape, nature sounds and nature smells at T2 (change from T1 to T2) and T3 (change from T2 to T3), and vegetation zones; variables entered into the model at step 5: distance, ascent and descent and difficulty of the 'levadas' and trails; variables entered into the model at step 6: being away and fascination. ; ΔR^2, R^2 change; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{**}p < 0.001$

Table S5.7 Mediation of the effect of visual landscape on valence through being away and fascination, controlling for nature sounds and nature smells (n = 1130).

Antecedent†	Consequent††											
		M_1 (being away)				M_2 (fascination)				Y (valence ΔT3-T1)		
		Coeff.	SE	P		Coeff.	SE	P		Coeff.	SE	P
X (visual landscape)	a_1	0.506	0.062	< 0.001	a_2	0.994	0.062	< 0.001	c'	0.032	0.053	0.544
M_1 (being away)					d_{21}	0.589	0.029	0.001	b_1	0.015	0.026	0.574
M_2 (fascination)									b_2	0.090	0.023	< 0.001
C_1 (nature smells)	f_1	0.161	0.044	< 0.001		0.067	0.043	0.116		0.036	0.033	0.272
C_2 (nature sounds)	f_2	0.074	0.046	0.104		0.084	0.044	0.060		0.025	0.034	0.462
Constant	i_{M1}	3.942	0.307	< 0.001	i_{M2}	-2.115	0.321	< 0.001	i_Y	-0.587	0.252	0.020
		$R^2 = 0.090$				$R^2 = 0.465$				$R^2 = 0.039$		
		$F(3, 1126) = 36.952, p < 0.001$				$F(4, 1125) = 244.514, p < 0.001$				$F(5, 1124) = 9.205, p < 0.001$		

†Predictor or independent variable; ††dependent or outcome variable; *C*, constant; Coeff, regression coefficient; SE, standard error; P, *p*-value. [adapted from Hayes (2018)].

Table S5.8 Direct and indirect effects of the causal relationship between visual landscape and valence through being away and fascination, controlling for nature sounds and nature smells (n = 1130).

Parameters	Point estimate†	BootSE	BootLLCI	BootULCI
Visual landscape T2 → being away → valence (ΔT3-T1)	0.007	0.014	-0.020	0.036
Visual landscape T2 → fascination → valence (ΔT3-T1)	0.090	0.024	0.043	0.140
Visual landscape T2 → being away → fascination → valence (ΔT3-T1)	0.027	0.008	0.012	0.045
Total indirect effect	0.124	0.028	0.071	0.180
Direct effect	0.032	0.053	-0.072	0.136

†Effect; BootSE, bootstrap standard error; BootLLCI, bootstrap lower limit confidence interval (95%); BootULCI, bootstrap upper limit confidence interval (95%); number of bootstrap samples for percentile bootstrap confidence intervals: 5000.

Table S5.9 Mediation of the effect of visual landscape on activation through being away and fascination, controlling for nature sounds and nature smells (n = 1262).

Antecedent†	Consequent††											
		M_1 (being away)				M_2 (fascination)				Y (activation ΔT3-T1)		
		Coeff.	SE	P		Coeff.	SE	P		Coeff.	SE	P
X (visual landscape)	a_1	0.518	0.059	< 0.001	a_2	0.954	0.059	< 0.001	c'	0.023	0.064	0.722
M_1 (being away)					d_{21}	0.586	0.028	0.001	b_1	-0.035	0.031	0.259
M_2 (fascination)									b_2	0.095	0.028	0.001
C_1 (nature smells)	f_1	0.157	0.042	< 0.001		0.080	0.041	0.051		0.012	0.040	0.761
C_2 (nature sounds)	f_2	0.069	0.044	0.116		0.072	0.043	0.095		0.031	0.042	0.460
Constant	i_{M1}	3.943	0.292	< 0.001	i_{M2}	-1.921	0.306	< 0.001	i_Y	-0.439	0.303	0.148
		$R^2 = 0.090$				$R^2 = 0.456$				$R^2 = 0.016$		
		$F(3, 1258) = 41.494, p < 0.001$				$F(4, 1257) = 262.905, p < 0.001$				$F(5, 1256) = 4.081, p = 0.001$		

†Predictor or independent variable; ††dependent or outcome variable; *C*, constant; Coeff, regression coefficient; SE, standard error; P, *p*-value. [adapted from Hayes (2018)].

Table S5.10 Direct and indirect effects of the causal relationship between visual landscape and activation through being away and fascination, controlling for nature sounds and nature smells (n = 1262).

Parameters	Point estimate†	BootSE	BootLLCI	BootULCI
Visual landscape T2 → being away → activation (ΔT3-T1)	-0.018	0.018	-0.053	0.016
Visual landscape T2 → fascination → activation (ΔT3-T1)	0.090	0.030	0.033	0.149
Visual landscape T2 → being away → fascination → activation (ΔT3-T1)	0.029	0.010	0.010	0.050
Total indirect effect	0.101	0.032	0.039	0.163
Direct effect	0.023	0.064	-0.102	0.147

†Effect; BootSE, bootstrap standard error; BootLLCI, bootstrap lower limit confidence interval (95%); BootULCI, bootstrap upper limit confidence interval (95%); number of bootstrap samples for percentile bootstrap confidence intervals: 5000.

Table S5.11 Mediation of the effect of visual landscape on pleasant activation-unpleasant deactivation (paud) through being away and fascination, controlling for nature sounds and nature smells (n = 1281).

Antecedent†	Consequent††											
		M_1 (being away)				M_2 (fascination)				Y (paud ΔT3-T1)		
		Coeff.	SE	P		Coeff.	SE	P		Coeff.	SE	P
X (visual landscape)	a_1	0.520	0.059	< 0.001	a_2	0.967	0.059	< 0.001	c'	-0.004	0.054	0.939
M_1 (being away)					d_{21}	0.594	0.028	< 0.001	b_1	-0.033	0.027	0.221
M_2 (fascination)									b_2	0.113	0.023	< 0.001
C_1 (nature smells)	f_1	0.145	0.042	0.001		0.060	0.041	0.142		0.053	0.034	0.119
C_2 (nature sounds)	f_2	0.077	0.044	0.077		0.081	0.043	0.059		0.034	0.035	0.343
Constant	i_{M1}	3.935	0.292	< 0.001	i_{M2}	-1.996	0.306	< 0.001	i_Y	-0.726	0.257	0.005
		$R^2 = 0.088$				$R^2 = 0.455$				$R^2 = 0.034$		
		$F(3, 1277) = 41.227, p < 0.001$				$F(4, 1276) = 266.694, p < 0.001$				$F(5, 1275) = 8.928, p = 0.001$		

†Predictor or independent variable; ††dependent or outcome variable; C, constant; Coeff, regression coefficient; SE, standard error; P, p-value. [adapted from Hayes (2018)].

Table S5.12 Direct and indirect effects of the causal relationship between visual landscape and pleasant activation-unpleasant deactivation (paud) through being away and fascination, controlling for nature sounds and nature smells (n = 1281).

Parameters	Point estimate†	BootSE	BootLLCI	BootULCI
Visual landscape T2 → being away → paud (ΔT3-T1)	-0.017	0.014	-0.046	0.010
Visual landscape T2 → fascination → paud (ΔT3-T1)	0.109	0.024	0.063	0.160
Visual landscape T2 → being away → fascination → paud (ΔT3-T1)	0.035	0.009	0.019	0.053
Total indirect effect	0.127	0.027	0.076	0.183
Direct effect	-0.004	0.054	-0.110	0.102

†Effect; BootSE, bootstrap standard error; BootLLCI, bootstrap lower limit confidence interval (95%); BootULCI, bootstrap upper limit confidence interval (95%); number of bootstrap samples for percentile bootstrap confidence intervals: 5000.

Table S5.13 Mediation of the effect of visual landscape on unpleasant activation-pleasant deactivation (uapd) through being away and fascination, controlling for nature sounds and nature smells (n = 1220).

Antecedent†	Consequent††											
		M_1 (being away)				M_2 (fascination)				Y (uapd ΔT3-T1)		
		Coeff.	SE	P		Coeff.	SE	P		Coeff.	SE	P
X (visual landscape)	a_1	0.532	0.061	< 0.001	a_2	0.981	0.060	< 0.001	c'	0.014	0.071	0.845
M_1 (being away)					d_{21}	0.596	0.028	< 0.001	b_1	0.066	0.035	0.056
M_2 (fascination)									b_2	0.060	0.031	0.052
C_1 (nature smells)	f_1	0.176	0.043	< 0.001		0.054	0.042	0.194		0.070	0.044	0.116
C_2 (nature sounds)	f_2	0.055	0.045	0.219		0.102	0.043	0.019		0.006	0.046	0.903
Constant	i_{M1}	3.856	0.300	< 0.001	i_{M2}	-2.103	0.308	< 0.001	i_Y	-0.312	0.336	0.353
		$R^2 = 0.094$				$R^2 = 0.471$				$R^2 = 0.023$		
		$F(3, 1216) = 42.244$, $p < 0.001$				$F(4, 1215) = 270.128$, $p < 0.001$				$F(5, 1214) = 5.609$, $p = 0.001$		

†Predictor or independent variable; ††dependent or outcome variable; *C*, constant; Coeff, regression coefficient; SE, standard error; P, *p*-value. [adapted from Hayes (2018)].

Table S5.14 Direct and indirect effects of the causal relationship between visual landscape and unpleasant activation-pleasant deactivation (uapd) through being away and fascination, controlling for nature sounds and nature smells (n = 1220).

Parameters	Point estimate†	BootSE	BootLLCI	BootULCI
Visual landscape T2 → being away → uapd (ΔT3-T1)	0.035	0.020	-0.003	0.075
Visual landscape T2 → fascination → uapd (ΔT3-T1)	0.058	0.031	-0.001	0.118
Visual landscape T2 → being away → fascination → uapd (ΔT3-T1)	0.019	0.010	-0.0003	0.041
Total indirect effect	0.113	0.035	0.044	0.181
Direct effect	0.014	0.071	-0.126	0.154

†Effect; BootSE, bootstrap standard error; BootLLCI, bootstrap lower limit confidence interval (95%); BootULCI, bootstrap upper limit confidence interval (95%); number of bootstrap samples for percentile bootstrap confidence intervals: 5000.

Table S5.15 Mediation of the effect of visual landscape on unpleasant activation-pleasant deactivation (uapd) (change from T1 to T2) through being away and fascination, controlling for nature sounds and nature smells (n = 1220).

Antecedent†	Consequent††											
		M_1 (being away)				M_2 (fascination)				Y (uapd ΔT2-T1)		
		Coeff.	SE	P		Coeff.	SE	P		Coeff.	SE	P
X (visual landscape)	a_1	0.532	0.061	< 0.001	a_2	0.981	0.060	< 0.001	c'	0.102	0.073	0.167
M_1 (being away)					d_{21}	0.596	0.028	< 0.001	b_1	0.121	0.036	0.001
M_2 (fascination)									b_2	0.083	0.032	0.008
C_1 (nature smells)	f_1	0.176	0.043	< 0.001		0.054	0.042	0.194		0.085	0.046	0.064
C_2 (nature sounds)	f_2	0.055	0.045	0.219		0.102	0.043	0.019		0.010	0.048	0.837
Constant	i_{M1}	3.856	0.300	< 0.001	i_{M2}	-2.103	0.308	< 0.001	i_Y	-1.500	0.346	< 0.001
		$R^2 = 0.094$				$R^2 = 0.471$				$R^2 = 0.057$		
		$F(3, 1126) = 42.244$, $p < 0.001$				$F(4, 1125) = 270.128$, $p < 0.001$				$F(5, 1124) = 14.659$, $p < 0.001$		

†Predictor or independent variable; ††dependent or outcome variable; *C*, constant; Coeff, regression coefficient; SE, standard error; P, *p*-value. [adapted from Hayes (2018)].

Table S5.16 Direct and indirect effects of the causal relationship between visual landscape and unpleasant activation-pleasant deactivation (uapd) (change from T1 to T2) through being away and fascination, controlling for nature sounds and nature smells (n = 1220).

Parameters	Point estimate†	BootSE	BootLLCI	BootULCI
Visual landscape T2 → being away → uapd (ΔT2-T1)	0.064	0.023	0.024	0.112
Visual landscape T2 → fascination → uapd (ΔT2-T1)	0.082	0.032	0.020	0.149
Visual landscape T2 → being away → fascination → uapd (ΔT2-T1)	0.026	0.011	0.006	0.050
Total indirect effect	0.172	0.037	0.101	0.247
Direct effect	0.102	0.073	-0.042	0.246

†Effect; BootSE, bootstrap standard error; BootLLCI, bootstrap lower limit confidence interval (95%); BootULCI, bootstrap upper limit confidence interval (95%); number of bootstrap samples for percentile bootstrap confidence intervals: 5000.

Appendix 3 Nature-based tourism and physical health. The case of ‘levadas’ and trails of Madeira

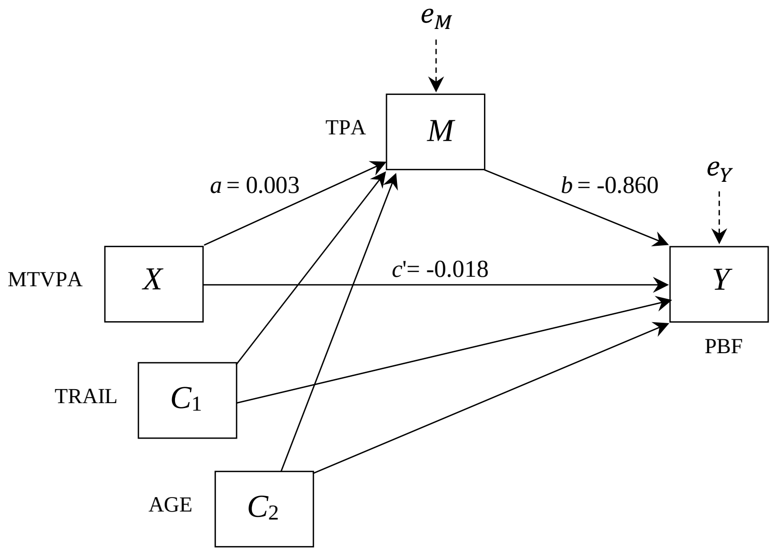

Figure S6.1 Simple mediation model for the causal relationship between moderate-to-vigorous physical activity (MTVPA) assessed during one-day hiking activity in 'levadas' and trails and percent body fat (PBF) (aged 18-59 years). The mediator is self-reported physical activity in the previous year (habitual physical activity). 'Levadas' and trails, and age of the nature-based tourists are covariates. The paths marked *a*, *b* and *c*' are unstandardized regression coefficients.

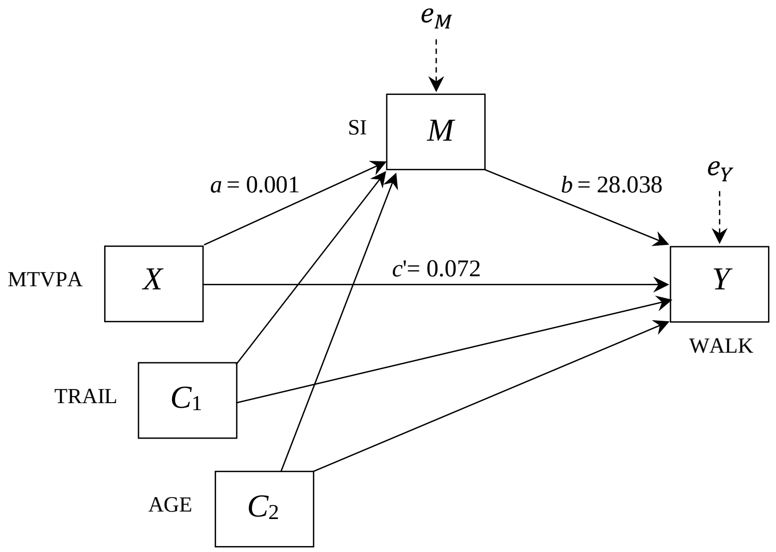

Figure S6.2 Simple mediation model for the causal relationship between moderate-to-vigorous physical activity (MTVPA) assessed during one-day hiking activity in 'levadas' and trails and aerobic endurance (WALK). The mediator is self-reported physical activity [sport index (SI)] in the previous year (habitual physical activity). 'Levadas' and trails, and age of the nature-based tourists are covariates. The paths marked *a*, *b* and *c*' are unstandardized regression coefficients.

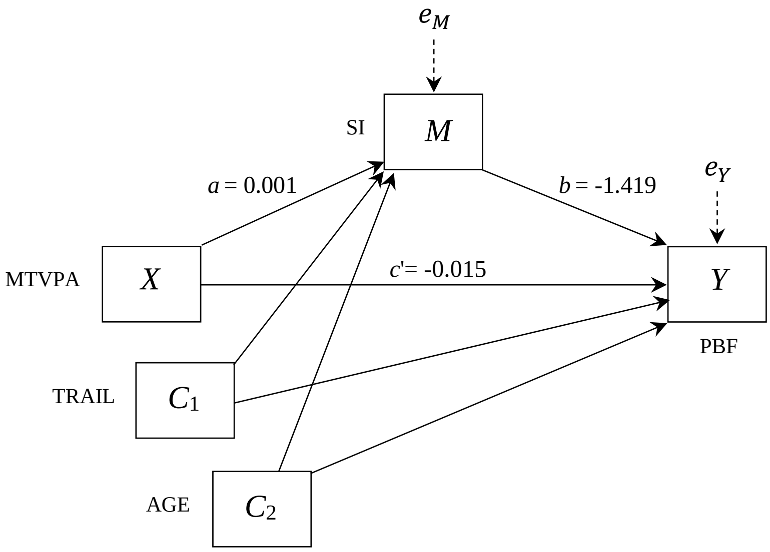

Figure S6.3 Simple mediation model for the causal relationship between moderate-to-vigorous physical activity (MTVPA) assessed during one-day hiking activity in ‘levadas’ and trails and percent body fat (PBF) (aged 60 years and above). The mediator is self-reported physical activity [sport index (SI)] in the previous year (habitual physical activity). ‘Levadas’ and trails, and age of the nature-based tourists are covariates. The paths marked *a*, *b* and *c*’ are unstandardized regression coefficients.

Table S6.1 Descriptive statistics (means. standard deviations and minimum and maximum values) for P01 and P02[†].

Variable	Females			Males			Total		
	n	$\bar{x} \pm$ sd	min-max	n	$\bar{x} \pm$ sd	min-max	n	$\bar{x} \pm$ sd	min-max
P01									
Distance (km)	76	10.69±0.5	9.2-11.3	40	10.56±0.5	9.2-11.2	116	10.64±0.5	9.2-11.3
Duration (h)	76	5.33±0.6	3.5-6.4	40	5.23±0.5	3.5-6.2	116	5.29±0.5	3.5-6.4
Elevation gain (m)	76	141.84±43.2	120.0-350.0	40	142.1±49.1	120.0-350.0	116	141.93±45.1	120.0-350.0
Elevation loss (m)	76	250.32±110.4	110.0-350.0	40	271.15±103.0	110.0-350.0	116	257.50±107.9	110.0-350.0
Stride length (cm)	73	61.49±11.7	38.3-89.6	36	65.25±12.1	37.3-89.7	109	62.73±11.9	37.3-89.7
Walking speed (km/h)	76	3.81±0.8	2.3-5.9	40	3.90±0.8	2.4-5.9	116	3.84±0.8	2.3-5.9
Physical activity (min)									
Light (100-2019 counts·min^{-1})	76	57.40±23.1	23.4-157.3	40	53.02±20.2	25.5-103.1	116	55.89±22.2	23.4-157.3
Moderate (2020-5998 counts·min^{-1})	76	130.23±17.3	56.8-160.3	40	128.97±16.2	81.8-149.7	116	129.80±16.8	56.8-160.3
Vigorous (≥ 5999 counts·min^{-1})	76	2.47±3.6	0.1-22.0	40	4.88±5.6	0.1-23.9	116	3.30±4.5	0.1-23.9
Heart rate (bpm)									
Average	76	97.53±10.9	70.0-118.5	40	89.36±9.9	72.2-106.5	116	94.71±11.2	70.0-118.5
Maximum	76	145.66±15.0	116.0-179.0	39	131.87±13.8	105.0-160.0	115	140.98±15.9	105.0-179.0
Minimum	76	67.58±10.3	40.0-88.0	39	62.69±8.1	49.0-81.0	115	65.92±9.9	40.0-88.0
Heart rate zones (min)									
Very light (50-60% HRmax)[††]	76	113.89±60.0	6.0-256.6	40	140.32±57.8	12.1-242.7	116	123.00±60.3	6.0-256.6
Light (60-70% HRmax)	76	102.53±64.4	4.3-267.6	40	68.28±55.8	3.4-225.4	116	90.72± 63.5	3.4-267.6
Moderate (70-80% HRmax)	76	40.21±46.4	0.0-153.4	40	17.65±31.3	0.0-143.5	116	32.43±43.1	0.0-153.4
Hard (80-90% HRmax)	76	7.31±12.5	0.0-92.9	40	3.60±10.4	0.0-59.6	116	6.03±11.9	0.0-92.9
Maximum (90-100% HRmax)	76	2.21±5.2	0.0-33.1	40	0.24±0.8	0.0-5.0	116	1.53±4.3	0.0-33.1
P02									
Distance (km)	92	9.79±0.2	9.1-10.4	63	9.76±0.2	9.0-10.3	155	9.77±0.2	9.0-10.4
Duration (h)	92	5.56±0.8	3.4-7.2	63	5.62±0.8	3.4-7.2	155	5.58±0.8	3.4-7.2
Elevation gain (m)	92	602.87±95.3	540.0-790.0	63	601.25±93.1	540.0-790.0	155	602.21±94.1	540.0-790.0
Elevation loss (m)	92	719.99±100.0	530.0-795.0	63	724.86±97.6	530.0-795.0	155	721.97±98.8	530.0-795.0
Stride length (cm)	84	60.25±11.2	32.6-82.5	61	61.01±10.7	39.2-76.6	145	60.57±11.0	32.6-82.5
Walking speed (km/h)	91	3.64±0.9	1.9-7.0	63	3.67±0.8	2.2-5.6	154	3.65±0.8	1.9-7.0
Physical activity (min)									
Light (100-2019 counts·min^{-1})	92	51.46±21.2	13.5-108.4	63	50.77±26.8	14.7-160.8	155	51.18±23.6	13.5-160.8
Moderate (2020-5998 counts·min^{-1})	92	136.01±15.1	102.3-170.9	63	132.50±18.1	65.4-164.4	155	134.59±16.4	65.4-170.9
Vigorous (≥ 5999 counts·min^{-1})	92	5.11±4.6	0.3-23.5	63	10.46±10.9	0.2-44.4	155	7.28±8.2	0.2-44.4
Heart rate (bpm)									
Average	91	110.72±12.2	78.0-140.2	62	104.67±13	74.2-134.4	153	108.27±12.8	74.2-140.2
Maximum	91	162.07±14.0	121.0-198.0	62	157.84±16.7	118.0-199.0	153	160.35±15.2	118.0-199.0
Minimum	91	67.36±10.0	40.0-89.0	62	65.47±10.1	46.0-94.0	153	66.59±10.0	40.0-94.0
Heart rate zones (min)									
Very light (50-60% HRmax)	91	91.12±47.1	0.2-201.9	62	104.57±57.6	3.9-219.9	153	96.57±51.9	0.2-219.9
Light (60-70% HRmax)	91	90.24±40.6	0.1-202.1	62	95.08±45.2	6.6-193.0	153	92.20±42.4	0.1-202.1
Moderate (70-80% HRmax)	91	59.10±36.5	4.8-226.9	62	55.29±38.9	2.2-170.3	153	57.56±37.4	2.2-226.9
Hard (80-90% HRmax)	91	37.30±26.7	0.0-156.3	62	26.42±20.4	0.0-87.8	153	32.89±24.9	0.0-156.3
Maximum (90-100% HRmax)	91	17.07±20.8	0.0-104.0	62	11.11±15.7	0.0-70.3	153	14.66±19.1	0.0-104.0

[†]P01, 25 Fontes (Rabaçal or 'Garagem'); P02, Pico Ruivo (Pico Areeiro or Achada do Teixeira); [††]HRmax, maximum heart rate.

Table S6.2 Descriptive statistics (means. standard deviations and minimum and maximum values) for P03 and P04[†].

Variable	Females			Males			Total		
	n	$\bar{x} \pm$ sd	min-max	n	$\bar{x} \pm$ sd	min-max	n	$\bar{x} \pm$ sd	min-max
P03									
Distance (km)	39	8.07±0.4	7.5-9.5	21	8.26±0.6	7.6-9.5	60	8.14±0.5	7.5-9.5
Duration (h)	39	4.88±0.6	3.5-5.4	21	4.92±0.6	3.5-5.4	60	4.89±0.6	3.5-5.4
Elevation gain (m)	39	448.05±15.8	430.0-486.0	21	451.52±20.2	430.0-487.0	60	449.27±17.4	430.0-487.0
Elevation loss (m)	39	456.64±15.4	421.0-475.0	21	451.24±16.5	421.0-475.0	60	454.75±15.9	421.0-475.0
Stride length (cm)	34	59.23±10.8	40.3-80.3	19	62.20±7.5	47.5-73.4	53	60.30±9.8	40.3-80.3
Walking speed (km/h)	39	3.54±0.7	2.3-5.2	21	3.72±0.6	2.8-4.7	60	3.60±0.7	2.3-5.2
Physical activity (min)									
Light (100-2019 counts·min^{-1})	39	45.07±14.7	21.7-89.4	21	42.53±14.1	24.4-76.6	60	44.18±14.4	21.7-89.4
Moderate (2020-5998 counts·min^{-1})	39	105.66±16.7	69.9-140.3	21	109.36±15.1	70.4-129.3	60	106.96±16.1	69.9-140.3
Vigorous (≥ 5999 counts·min^{-1})	39	3.58±4.4	0.3-22.8	21	6.22±5.5	0.7-22.1	60	4.51±4.9	0.3-22.8
Heart rate (bpm)									
Average	39	102.26±11.0	80.9-126.4	21	96.08±9.5	80.4-114.6	60	100.09±10.9	80.4-126.4
Maximum	39	157.08±15.3	115.0-186.0	21	152.81±11.0	125.0-172.0	60	155.58±14.0	115.0-186.0
Minimum	39	64.15±9.4	48.0-90.0	21	64.81±7.8	49.0-81.0	60	64.38±8.8	48.0-90.0
Heart rate zones (min)									
Very light (50-60% HRmax) [††]	39	90.71±34.2	30.9-152.8	21	103.93±42.0	9.6-165.3	60	95.33±37.3	9.6-165.3
Light (60-70% HRmax)	39	75.49±31.4	21.7-154.9	21	66.79±32.9	13.8-129.9	60	72.45± 31.9	13.8-154.9
Moderate (70-80% HRmax)	39	39.51±25.8	3.1-109.9	21	31.54±21.0	1.8-87.5	60	36.72± 24.3	1.8-109.9
Hard (80-90% HRmax)	39	19.17±12.2	0.0-48.7	21	13.73±12.4	0.0-49.0	60	17.27±12.5	0.0-49.0
Maximum (90-100% HRmax)	39	6.12±8.3	0.0-27.5	21	3.54±5.7	0.0-23.2	60	5.22±7.6	0.0-27.5
P04									
Distance (km)	24	10.96±0.1	10.4-11.1	10	11.00±0.0	11.0-11.0	34	10.97±0.1	10.4-11.1
Duration (h)	24	4.33±0.4	3.6-5.1	10	4.36±0.4	4.1-5.0	34	4.34±0.4	3.6-5.1
Elevation gain (m)	11	7.73±6.1	5.0-25.0	4	8.75±7.5	5.0-20.0	15	8.00±6.2	5.0-25.0
Elevation loss (m)	24	244.29±11.4	235.0-266.0	10	242.50±10.8	235.0-261.0	34	243.76±11.1	235.0-266.0
Stride length (cm)	22	59.17±12.0	34.8-81.3	10	64.96±10.2	46.6-80.3	32	60.98±11.6	34.8-81.3
Walking speed (km/h)	24	3.66±0.8	2.2-5.2	10	3.93±0.8	2.8-5.4	34	3.74±0.8	2.2-5.4
Physical activity (min)									
Light (100-2019 counts·min^{-1})	22	45.97±25.4	16.1-134.5	10	47.02±37.6	17.6-147.6	32	46.30±29.1	16.1-147.6
Moderate (2020-5998 counts·min^{-1})	22	132.98±29.4	44.5-204.8	10	133.76±43.9	31.4-209.8	32	133.23±33.8	31.4-209.8
Vigorous (≥ 5999 counts·min^{-1})	22	2.33±4.5	0.1-21.5	10	2.08±2.6	0.1-7.1	32	2.25±4.0	0.1-21.5
Heart rate (bpm)									
Average	24	93.48±11.1	77.8-122.1	10	88.62±14.2	70.5-104.4	34	92.05±12.1	70.5-122.1
Maximum	24	122.88±10.4	106.0-146.0	10	123.30±29.3	94.0-197.0	34	123.00±17.6	94.0-197.0
Minimum	24	63.50±14.9	40.0-105.0	10	69.80±13.4	50.0-91.0	34	65.35±14.5	40.0-105.0
Heart rate zones (min)									
Very light (50-60% HRmax)	24	103.48±56.0	0.0-181.1	10	117.71±90.4	0.6-253.1	34	107.67±66.8	0.0-253.1
Light (60-70% HRmax)	24	52.50±54.2	0.2-148.2	10	59.35±70.8	0.0-189.5	34	54.51±58.6	0.0-189.5
Moderate (70-80% HRmax)	24	16.03±38.4	0.0-176.2	10	10.72±29.5	0.0-94.1	34	14.47±35.7	0.0-176.2
Hard (80-90% HRmax)	24	1.14±3.4	0.0-15.9	10	0.00±0.0	0.0-0.0	34	0.80± 2.9	0.0-15.9
Maximum (90-100% HRmax)	24	0.06±0.3	0.0-1.3	10	0.00±0.0	0.0-0.0	34	0.04±0.2	0.0-1.3

[†]P03, Ponta de São Lourenço (Cais do Sardinha); P04, Ribeiro Frio – Portela; [††]HRmax, maximum heart rate.

Table S6.3 Descriptive statistics (means. standard deviations and minimum and maximum values) for P05 and P08[†].

Variable	Females			Males			Total		
	n	x̄ ± sd	min-max	n	x̄ ± sd	min-max	n	x̄ ± sd	min-max
P05									
Distance (km)	26	15.47±2.2	12.0-17.9	16	15.27±1.9	12.0-17.2	42	15.39±2.0	12.0-17.9
Duration (h)	26	6.10±1.1	4.1-7.1	16	6.13±1.2	4.1-7.2	42	6.11±1.2	4.1-7.2
Elevation gain (m)	26	39.12±8.5	25.0-55.0	16	40.13±8.0	25.0-50.0	42	39.50±8.2	25.0-55.0
Elevation loss (m)	26	44.46±7.1	30.0-50.0	16	44.31±5.6	35.0-50.0	42	44.40±6.5	30.0-50.0
Stride length (cm)	24	58.15±13.9	20.1-84.1	16	63.35±12.5	44.0-85.1	40	60.23±13.4	20.1-85.1
Walking speed (km/h)	26	3.56±0.8	2.4-5.5	16	4.01±1.1	2.7-6.1	42	3.73±0.9	2.4-6.1
Physical activity (min)									
Light (100-2019 counts·min^{-1})	24	79.21±38.9	29.5-185.6	16	69.68±12.0	52.6-94.6	40	75.40±31.1	29.5-185.6
Moderate (2020-5998 counts·min^{-1})	24	155.14±32.6	78.0-215.0	16	161.48±30.1	122.8-214.7	40	157.68±31.4	78.0-215.0
Vigorous (≥ 5999 counts·min^{-1})	24	4.79±6.9	0.3-24.0	16	3.02±2	0.3-7.4	40	4.08±5.5	0.3-24.0
Heart rate (bpm)									
Average	26	98.48±9.5	77.8-121.7	16	88.23±9.2	68.2-105.3	42	94.57±10.5	68.2-121.7
Maximum	26	140.19±17.0	117.0-191.0	16	126.69±16.5	105.0-169.0	42	135.05±17.9	105.0-191.0
Minimum	26	67.92±9.5	53.0-88.0	16	63.38±9.2	41.0-77.0	42	66.19±9.5	41.0-88.0
Heart rate zones (min)									
Very light (50-60% HRmax)[††]	26	152.07±95.5	3.8-300.7	16	163.84±102.3	3.2-299.8	42	156.55±97.1	3.2-300.7
Light (60-70% HRmax)	26	102.91±83.4	1.3-248.1	16	59.54±61.6	0.0-181.8	42	86.39±78.0	0.0-248.1
Moderate (70-80% HRmax)	26	34.28±62.2	0.0-211.2	16	23.76±63.3	0.0-246.4	42	30.27±62.1	0.0-246.4
Hard (80-90% HRmax)	26	3.36±8.0	0.0-37.0	16	1.76±3.3	0.0-12.0	42	2.75±6.6	0.0-37.0
Maximum (90-100% HRmax)	26	0.57±2.0	0.0-7.5	16	0.04±0.1	0.0-0.5	42	0.37±1.6	0.0-7.5
P08									
Distance (km)	55	8.59±1.6	7.0-12.5	31	8.32±1.3	7.6-12.1	86	8.49±1.5	7.0-12.5
Duration (h)	55	6.70±0.9	5.4-8.5	31	6.76±0.9	5.4-8.5	86	6.72±0.9	5.4-8.5
Elevation gain (m)	55	545.78±63.7	495.0-707.0	31	551.65±70.4	495.0-707.0	86	547.90±65.8	495.0-707.0
Elevation loss (m)	55	691.75±91.9	435.0-799.0	31	723.10±63.5	435.0-799.0	86	703.05±83.8	435.0-799.0
Stride length (cm)	54	61.66±9.8	41.4-83.9	29	65.71±8.7	47.8-78.3	83	63.08±9.6	41.4-83.9
Walking speed (km/h)	55	3.73±0.6	2.4-5.4	31	3.84±0.8	2.8-6.3	86	3.77±0.7	2.4-6.3
Physical activity (min)									
Light (100-2019 counts·min^{-1})	55	54.47±15.9	32.5-107.3	31	47.00±11.6	24.4-88.5	86	51.78±14.9	24.4-107.3
Moderate (2020-5998 counts·min^{-1})	55	131.57±15.0	95.1-159.3	31	129.35±15.4	98.5-158.9	86	130.77±15.1	95.1-159.3
Vigorous (≥ 5999 counts·min^{-1})	55	5.43±5.2	0.0-23.0	31	11.71±11.3	0.8-41.5	86	7.69±8.4	0.0-41.5
Heart rate (bpm)									
Average	55	102.48±11.4	80.6-124.9	31	96.90±13.1	71.7-120.8	86	100.47±12.3	71.7-124.9
Maximum	55	166.16±14.9	129.0-199.0	31	161.39±19.1	128.0-199.0	86	164.44±16.6	128.0-199.0
Minimum	55	62.95±9.7	40.0-89.0	31	62.61±10.7	40.0-88.0	86	62.83±10.0	40.0-89.0
Heart rate zones (min)									
Very light (50-60% HRmax)	55	126.65±60.0	18.2-261.2	31	117.08±56.5	17.9-207.1	86	123.20±58.6	17.9-261.2
Light (60-70% HRmax)	55	81.57±51.8	3.0-208.4	31	70.23±49.1	15.7-164.3	86	77.48±50.9	3.0-208.4
Moderate (70-80% HRmax)	55	39.16±26.9	0.0-143.5	31	36.72±27.1	10.5-131.6	86	38.28±26.8	0.0-143.5
Hard (80-90% HRmax)	55	21.09±13.1	0.0-49.5	31	16.63±13.8	0.0-44.7	86	19.48±13.4	0.0-49.5
Maximum (90-100% HRmax)	55	11.70±11.9	0.0-46.1	31	7.59±10.7	0.0-32.1	86	10.22±11.6	0.0-46.1

[†]P05. Caldeirão Verde (Queimadas or Pico das Pedras); P08. Arco de S. Jorge – Quinta do Furão; [††]HRmax. maximum heart rate.

Table S6.4 Descriptive statistics (means. standard deviations and minimum and maximum values) for P09 and P10[†].

Variable	Females			Males			Total		
	n	x̄ ± sd	min-max	n	x̄ ± sd	min-max	n	x̄ ± sd	min-max
P09									
Distance (km)	21	9.32±1.4	8.2-12.0	12	8.51±0.2	8.1-8.7	33	9.03±1.2	8.1-12.0
Duration (h)	21	3.62±0.7	3.1-5.2	12	3.42±0.6	3.2-5.2	33	3.54±0.6	3.1-5.2
Elevation gain (m)	21	51.52±43.1	15.0-130.0	12	28.00±3.9	20.0-30.0	33	42.97±36.0	15.0-130.0
Elevation loss (m)	21	96.52±12.4	80.0-116.0	12	95.50±5.3	83.0-100.0	33	96.15±10.3	80.0-116.0
Stride length (cm)	19	60.49±13.5	35.9-85.8	12	63.40±10.5	42.8-76.8	31	61.62±12.4	35.9-85.8
Walking speed (km/h)	21	3.84±0.9	2.3-6.6	12	3.96±0.6	2.7-4.6	33	3.88±0.8	2.3-6.6
Physical activity (min)									
Light (100-2019 counts·min^{-1})	21	35.46±16.9	11.9-72.1	12	28.41±8.9	17.6-46.1	33	32.90±14.7	11.9-72.1
Moderate (2020-5998 counts·min^{-1})	21	113.38±33.4	56.1-182.0	12	109.26±25.4	89.2-187.4	33	111.88±30.3	56.1-187.4
Vigorous (≥ 5999 counts·min^{-1})	21	0.58±0.6	0.1-2.2	12	1.25±1.5	0.1-5.1	33	0.82±1.1	0.1-5.1
Heart rate (bpm)									
Average	21	93.90±11.6	72.6-115.7	12	81.85±9.8	62.7-98.2	33	89.52±12.3	62.7-115.7
Maximum	21	134.95±20.1	101.0-166.0	12	113.42±17.1	89.0-155.0	33	127.12±21.5	89.0-166.0
Minimum	21	67.62±9.3	51.0-87.0	12	61.00±6.6	48.0-71.0	33	65.21±8.9	48.0-87.0
Heart rate zones (min)									
Very light (50-60% HRmax) [††]	21	78.84±42.7	8.7-148.0	12	75.06±55.6	5.2-159.8	33	77.47±47.0	5.2-159.8
Light (60-70% HRmax)	21	59.58±51.3	0.1-158.3	12	27.40±39.1	0.0-94.7	33	47.88±49.2	0.0-158.3
Moderate (70-80% HRmax)	21	17.14±29.3	0.0-116.7	12	3.62±7.8	0.0-27.0	33	12.22±24.6	0.0-116.7
Hard (80-90% HRmax)	21	2.92±4.3	0.0-15.7	12	0.87±3.0	0.0-10.5	33	2.17±4.0	0.0-15.7
Maximum (90-100% HRmax)	21	0.81±2.1	0.0-6.4	12	0.06±0.2	0.0-0.8	33	0.54±1.7	0.0-6.4
P10									
Distance (km)	40	14.03±1.9	12.1-20.5	34	13.78±2.1	12.1-20.6	74	13.91±2.0	12.1-20.6
Duration (h)	40	6.15±0.8	4.5-9.1	34	6.13±1.0	4.5-9.1	74	6.14±0.9	4.5-9.1
Elevation gain (m)	40	369.15±167.4	182.0-927.0	34	349.18±181.4	186.0-922.0	74	359.97±173.1	182.0-927.0
Elevation loss (m)	40	430.63±56.6	377.0-656.0	34	429.53±60.8	378.0-657.0	74	430.12±58.1	377.0-657.0
Stride length (cm)	39	60.73±12.2	38.4-81.1	34	64.2±10.4	42.8-81.4	73	62.35±11.5	38.4-81.4
Walking speed (km/h)	40	3.84±0.8	2.4-5.7	34	3.95±0.7	2.5-5.2	74	3.89±0.8	2.4-5.7
Physical activity (min)									
Light (100-2019 counts·min^{-1})	40	53.20±18.9	23.4-103.9	34	44.06±18.0	22.5-125.2	74	49.00±18.9	22.5-125.2
Moderate (2020-5998 counts·min^{-1})	40	179.72±25.5	146.5-268.4	34	178.10±31.8	83.5-264.3	74	178.97±28.4	83.5-268.4
Vigorous (≥ 5999 counts·min^{-1})	40	3.83±5.2	0.2-22.3	34	4.82±7.0	0.5-34.4	74	4.29±6.1	0.2-34.4
Heart rate (bpm)									
Average	40	94.36±9.7	79.0-112.6	34	90.32±12.9	68.2-119.7	74	92.51±11.4	68.2-119.7
Maximum	40	144.35±16.6	118.0-193.0	34	135.15±21.3	102.0-180.0	74	140.12±19.3	102.0-193.0
Minimum	40	65.00±8.1	50.0-80.0	34	64.68±8.7	49.0-88.0	74	64.85±8.3	49.0-88.0
Heart rate zones (min)									
Very light (50-60% HRmax)	40	140.94±53.3	13.8-226.3	34	132.65±80.9	10.4-272.2	74	137.13±67.0	10.4-272.2
Light (60-70% HRmax)	40	86.08±67.0	15.8-222.0	34	68.66±69.3	0.3-222.4	74	78.08±68.2	0.3-222.4
Moderate (70-80% HRmax)	40	26.87±31.7	0.0-155.1	34	20.91±34.3	0.0-154.2	74	24.13±32.8	0.0-155.1
Hard (80-90% HRmax)	40	7.46±8.8	0.0-36.0	34	4.37±8.5	0.0-37.0	74	6.04±8.7	0.0-37.0
Maximum (90-100% HRmax)	40	1.68±3.9	0.0-16.3	34	1.23±3.0	0.0-10.5	74	1.47±3.5	0.0-16.3

[†]P09, Levada do Norte (Estreito de Cª de Lobos – Cabo Girão); P10, Larano (Porto da Cruz – Machico); [††]HRmax, maximum heart rate.

Table S6.5 Descriptive statistics (means. standard deviations and minimum and maximum values) for P13 and P14[†].

Variable	Females			Males			Total		
	n	$\bar{x} \pm$ sd	min-max	n	$\bar{x} \pm$ sd	min-max	n	$\bar{x} \pm$ sd	min-max
P13									
Distance (km)	57	10.69±1.4	9.1-12.8	48	10.97±1.6	9.2-12.9	105	10.82±1.5	9.1-12.9
Duration (h)	57	7.74±0.9	5.6-9.2	48	7.58±1.0	6.0-9.2	105	7.67±0.9	5.6-9.2
Elevation gain (m)	57	943.26±129.4	840.0-1140.0	48	966.58±137.4	840.0-1140.0	105	953.92±133.0	840.0-1140.0
Elevation loss (m)	57	878.47±74.9	810.0-995.0	48	892.77±76.3	810.0-995.0	105	885.01±75.5	810.0-995.0
Stride length (cm)	57	62.90±10.2	34.9-84.9	47	62.87±7.8	44.5-77.3	104	62.88±9.2	34.9-84.9
Walking speed (km/h)	57	3.95±0.9	2.0-6.1	48	3.90±0.8	2.7-5.8	105	3.93±0.8	2.0-6.1
Physical activity (min)									
Light (100-2019 counts·min^{-1})	57	67.04±15.9	40.8-106.4	48	58.93±14.3	36.1-93.7	105	63.33±15.7	36.1-106.4
Moderate (2020-5998 counts·min^{-1})	57	180.61±32.7	127.5-245.4	48	182.70±31.5	113.9-235.8	105	181.56±32.0	113.9-245.4
Vigorous (≥ 5999 counts·min^{-1})	57	7.11±6.8	0.8-37.1	48	9.61±8.6	1.1-40.4	105	8.25±7.7	0.8-40.4
Heart rate (bpm)									
Average	57	109.43±12.1	79.7-134.1	48	104.10±14.0	72.0-135.5	105	106.99±13.2	72.0-135.5
Maximum	57	163.98±13.9	130.0-199.0	48	159.17±17.6	125.0-192.0	105	161.78±15.8	125.0-199.0
Minimum	57	68.72±8.9	53.0-92.0	48	65.71±11.2	40.0-94.0	105	67.34±10.1	40.0-94.0
Heart rate zones (min)									
Very light (50-60% HRmax) [††]	57	129.61±47.5	3.8-205.0	48	136.39±67.2	7.5-276.0	105	132.71±57.2	3.8-276.0
Light (60-70% HRmax)	57	113.75±40.6	39.1-195.2	48	109.56±46.2	35.6-229.1	105	111.83±43.1	35.6-229.1
Moderate (70-80% HRmax)	57	68.53±34.0	6.7-169.5	48	68.92±38.4	6.8-169.6	105	68.71±35.9	6.7-169.6
Hard (80-90% HRmax)	57	43.54±24.8	0.0-118.6	48	29.39±30.6	0.0-149.0	105	37.07±28.4	0.0-149.0
Maximum (90-100% HRmax)	57	22.15±24.7	0.0-84.7	48	10.32±15.4	0.0-57.3	105	16.74±21.7	0.0-84.7
P14									
Distance (km)	75	14.71±1.1	12.4-16.3	44	14.36±1.1	12.4-15.7	119	14.58±1.1	12.4-16.3
Duration (h)	75	5.42±0.9	3.6-7.2	44	5.15±0.9	4.0-7.2	119	5.32±0.9	3.6-7.2
Elevation gain (m)	75	232.39±113.2	119.0-477.0	44	268.02±117.4	116.0-477.0	119	245.56±115.6	116.0-477.0
Elevation loss (m)	75	553.63±277.8	230.0-875.0	44	458.61±255.3	230.0-875.0	119	518.50±272.5	230.0-875.0
Stride length (cm)	73	67.89±11.4	44.9-91.9	44	65.35±11.6	40.6-86.0	117	66.94±11.5	40.6-91.9
Walking speed (km/h)	75	4.42±1.0	2.7-7.4	44	4.16±0.9	2.5-6.1	119	4.32±0.9	2.5-7.4
Physical activity (min)									
Light (100-2019 counts·min^{-1})	75	41.81±17.4	18.3-111.1	44	37.97±10.5	19.8-59.8	119	40.39±15.3	18.3-111.1
Moderate (2020-5998 counts·min^{-1})	75	160.65±36.6	86.1-227.8	44	149.49±30.8	97.8-227.3	119	156.52±34.9	86.1-227.8
Vigorous (≥ 5999 counts·min^{-1})	75	3.07±4.8	0.1-36.5	44	3.20±3.8	0.0-16.9	119	3.12±4.4	0.0-36.5
Heart rate (bpm)									
Average	75	98.83±10.1	73.6-126.1	44	93.82±12.0	67.6-120.1	119	96.98±11.0	67.6-126.1
Maximum	75	149.99±12.5	115.0-182.0	44	137.70±15.1	114.0-181.0	119	145.45±14.7	114.0-182.0
Minimum	75	67.04±8.6	47.0-91.0	44	66.14±10.0	43.0-84.0	119	66.71±9.1	43.0-91.0
Heart rate zones (min)									
Very light (50-60% HRmax)	75	120.98±70.9	0.3-277.3	44	106.00±63.7	1.7-241.5	119	115.44±68.4	0.3-277.3
Light (60-70% HRmax)	75	93.36±61.2	4.0-224.0	44	83.08±66.1	1.1-249.3	119	89.56±63.0	1.1-249.3
Moderate (70-80% HRmax)	75	36.52±47.4	0.0-214.3	44	33.81±46.0	0.0-189.3	119	35.52±46.7	0.0-214.3
Hard (80-90% HRmax)	75	13.04±23.9	0.0-164.7	44	6.42±9.3	0.0-38.4	119	10.59±20.0	0.0-164.7
Maximum (90-100% HRmax)	75	4.14±7.0	0.0-38.3	44	1.60±3.7	0.0-14.4	119	3.20±6.1	0.0-38.3

[†]P13, S. Roque do Faial – Penha d'Águia – S. Roque do Faial or Santana; P14, Levada do Moinho (Porto Moniz); [††]HRmax, maximum heart rate.

Table S6.6 Descriptive statistics (means. standard deviations and minimum and maximum values) for P15 and P19[†].

Variable	Females			Males			Total		
	n	$\bar{x}$ ± sd	min-max	n	$\bar{x}$ ± sd	min-max	n	$\bar{x}$ ± sd	min-max
P15									
Distance (km)	24	11.12±1.4	10.1-14.8	14	11.53±1.8	10.3-14.8	38	11.27±1.6	10.1-14.8
Duration (h)	24	5.70±0.8	5.0-7.5	14	5.90±0.9	5.0-7.5	38	5.78±0.8	5.0-7.5
Elevation gain (m)	24	38.63±35.2	10.0-134.0	14	55.07±42.4	15.0-136.0	38	44.68±38.3	10.0-136.0
Elevation loss (m)	24	630.71±30.8	600.0-716.0	14	643.71±35.4	610.0-716.0	38	635.50±32.7	600.0-716.0
Stride length (cm)	23	64.10±9.8	46.5-80.0	13	64.32±9.2	50.8-75.9	36	64.18±9.4	46.5-80.0
Walking speed (km/h)	24	4.04±0.6	3.0-5.1	14	3.90±0.4	3.0-4.5	38	3.99±0.5	3.0-5.1
Physical activity (min)									
Light (100-2019 counts·min^{-1})	18	41.58±15.8	25.6-95.2	13	37.83±10.0	21.1-51.6	31	40.01±13.6	21.1-95.2
Moderate (2020-5998 counts·min^{-1})	18	158.57±35.3	94.1-230.0	13	169.56±37.2	135.7-241.6	31	163.18±35.9	94.1-241.6
Vigorous (≥ 5999 counts·min^{-1})	18	3.55±5.3	0.2-23.4	13	4.83±3.8	0.6-12.8	31	4.09±4.7	0.2-23.4
Heart rate (bpm)									
Average	24	88.55±8.7	71.8-101.4	14	85.49±10.5	69.0-107.0	38	87.42±9.4	69.0-107.0
Maximum	24	132.29±12.9	108.0-156.0	14	128.21±15.0	99.0-157.0	38	130.79±13.7	99.0-157.0
Minimum	24	61.17±8.8	40.0-74.0	14	62.50±7.5	51.0-77.0	38	61.66±8.2	40.0-77.0
Heart rate zones (min)									
Very light (50-60% HRmax) [††]	24	130.62±58.0	26.6-203.7	14	146.70±77.3	12.2-276.0	38	136.54±65.2	12.2-276.0
Light (60-70% HRmax)	24	67.29±53.7	1.3-195.8	14	50.04±59.1	1.5-177.1	38	60.94±55.6	1.3-195.8
Moderate (70-80% HRmax)	24	15.46±19.3	0.0-66.3	14	9.89±19.9	0.0-72.9	38	13.41±19.4	0.0-72.9
Hard (80-90% HRmax)	24	1.46±2.9	0.0-10.7	14	2.67±8.4	0.0-31.8	38	1.90±5.5	0.0-31.8
Maximum (90-100% HRmax)	24	0.03±0.1	0.0-0.4	14	0.07±0.3	0.0-1.0	38	0.04±0.2	0.0-1.0
P19									
Distance (km)	20	15.24±0.2	14.6-15.5	16	15.28±0.2	14.9-16.0	36	15.26±0.2	14.6-16.0
Duration (h)	19	7.57±0.4	7.1-8.4	16	7.76±0.5	7.2-8.4	35	7.66±0.4	7.1-8.4
Elevation gain (m)	20	915.55±269.8	730.0-1320.0	16	883.25±259.4	730.0-1320.0	36	901.19±261.9	730.0-1320.0
Elevation loss (m)	20	1127.70±262.2	726.0-1300.0	16	1157.06±251.9	726.0-1300.0	36	1140.75±254.4	726.0-1300.0
Stride length (cm)	19	63.91±11.2	40.2-85.1	15	65.34±10.3	45.9-79.5	34	64.54±10.7	40.2-85.1
Walking speed (km/h)	19	4.02±1.0	2.4-6.3	16	3.83±0.8	2.6-5.2	35	3.94±0.9	2.4-6.3
Physical activity (min)									
Light (100-2019 counts·min^{-1})	20	79.54±24.7	42.5-159.3	16	70.46±34.3	26.4-139.9	36	75.51±29.3	26.4-159.3
Moderate (2020-5998 counts·min^{-1})	20	215.56±22.2	171.2-250.8	16	217.32±26.9	168.1-259.6	36	216.34±24.1	168.1-259.6
Vigorous (≥ 5999 counts·min^{-1})	20	6.02±12.2	0.7-57.2	16	11.74±11.6	0.8-40.3	36	8.56±12.1	0.7-57.2
Heart rate (bpm)									
Average	19	111.73±12.0	91.4-140.8	16	104.60±12.9	83.1-123.9	35	108.47±12.8	83.1-140.8
Maximum	19	157.84±11.5	138.0-178.0	16	148.25±11.3	127.0-168.0	35	153.46±12.2	127.0-178.0
Minimum	19	71.37±8.0	56.0-84.0	16	68.81±12.1	48.0-93.0	35	70.20±10.0	48.0-93.0
Heart rate zones (min)									
Very light (50-60% HRmax)	19	111.63±70.7	3.0-211.1	16	116.82±64.1	1.3-221.0	35	114.00±66.8	1.3-221.0
Light (60-70% HRmax)	19	137.44±57.7	4.5-255.9	16	145.21±66.1	54.1-274.0	35	140.99±60.9	4.5-274.0
Moderate (70-80% HRmax)	19	91.19±44.4	24.1-168.0	16	92.87±64.1	29.1-242.9	35	91.96±53.4	24.1-242.9
Hard (80-90% HRmax)	19	51.74±39.8	3.2-179.6	16	42.63±36.9	0.0-129.7	35	47.58±38.2	0.0-179.6
Maximum (90-100% HRmax)	19	24.12±38.3	0.0-150.2	16	8.24±17.1	0.0-67.5	35	16.86±31.1	0.0-150.2

[†]P15, Levada Nova (Calheta) – Paul do Mar or Jardim do Mar; P19, Encumeada – Pico Ruivo – Achada do Teixeira; [††]HRmax, maximum heart rate.

Table S6.7 Descriptive statistics (means. standard deviations and minimum and maximum values) for P21 and P25[†].

Variable	Females			Males			Total		
	n	$\bar{x} \pm$ sd	min-max	n	$\bar{x} \pm$ sd	min-max	n	$\bar{x} \pm$ sd	min-max
P21									
Distance (km)	85	7.58±2.5	4.8-13.8	47	7.81±2.8	4.8-14.3	132	7.66±2.6	4.8-14.3
Duration (h)	85	5.52±1.2	2.5-7.5	47	5.55±1.3	2.5-7.5	132	5.53±1.2	2.5-7.5
Elevation gain (m)	85	507.79±171.1	40.0-619.0	47	513.62±165.3	40.0-620.0	132	509.86±168.4	40.0-620.0
Elevation loss (m)	85	596.51±30.8	550.0-647.0	47	596.72±33.4	550.0-641.0	132	596.58±31.7	550.0-647.0
Stride length (cm)	80	60.40±11.4	24.6-82.5	43	63.42±6.2	48.0-75.1	123	61.46±10.0	24.6-82.5
Walking speed (km/h)	85	3.68±0.8	2.3-6.1	47	3.82±0.6	2.3-5.2	132	3.73±0.7	2.3-6.1
Physical activity (min)									
Light (100-2019 counts·min^{-1})	83	56.02±20.3	12.8-121.9	47	50.86±14.5	14.8-88.5	130	54.16±18.5	12.8-121.9
Moderate (2020-5998 counts·min^{-1})	83	118.71±42.7	39.3-228.2	47	116.77±41.3	52.9-218.8	130	118.01±42.1	39.3-228.2
Vigorous (≥ 5999 counts·min^{-1})	83	2.77±3.3	0.0-15.8	47	6.83±11.8	0.0-73.3	130	4.23±7.8	0.0-73.3
Heart rate (bpm)									
Average	85	108.97±12.7	79.1-138.5	47	100.25±13.5	73.8-131.5	132	105.87±13.6	73.8-138.5
Maximum	85	157.41±19.9	112.0-199.0	47	145.62±18.7	113.0-190.0	132	153.21±20.2	112.0-199.0
Minimum	85	70.67±9.4	41.0-98.0	47	66.60±10.5	40.0-94.0	132	69.22±10.0	40.0-98.0
Heart rate zones (min)									
Very light (50-60% HRmax) [††]	85	91.72±56.8	0.0-209.4	47	112.59±66.8	0.3-248.2	132	99.15±61.1	0.0-248.2
Light (60-70% HRmax)	85	87.40±51.3	5.1-231.9	47	72.51±40.5	4.7-163.4	132	82.10±48.1	4.7-231.9
Moderate (70-80% HRmax)	85	47.30±32.8	1.6-189.7	47	42.02±33.8	2.4-153.8	132	45.42±33.1	1.6-189.7
Hard (80-90% HRmax)	85	30.72±23.2	0.0-92.7	47	20.95±16.1	0.0-59.1	132	27.24±21.4	0.0-92.7
Maximum (90-100% HRmax)	85	19.56±23.0	0.0-132.1	47	6.29±9.3	0.0-34.6	132	14.83±20.3	0.0-132.1
P25									
Distance (km)	82	13.58±1.3	13.0-18.0	61	13.42±0.9	13.0-18.0	143	13.51±1.1	13.0-18.0
Duration (h)	82	6.99±0.8	5.5-8.4	61	6.75±0.7	5.5-8.3	143	6.89±0.8	5.5-8.4
Elevation gain (m)	82	862.17±20.1	770.0-885.0	61	858.92±22.7	770.0-885.0	143	860.78±21.3	770.0-885.0
Elevation loss (m)	82	267.70±163.3	206.0-844.0	61	247.07±120.4	206.0-824.0	143	258.90±146.4	206.0-844.0
Stride length (cm)	80	61.83±13.0	24.6-88.8	59	62.94±12.3	32.3-87.6	139	62.30±12.7	24.6-88.8
Walking speed (km/h)	82	3.78±0.9	1.2-6.0	61	3.79±0.9	1.8-6.4	143	3.78±0.9	1.2-6.4
Physical activity (min)									
Light (100-2019 counts·min^{-1})	82	70.74±27.0	30.0-159.6	61	67.65±29.9	27.0-151.0	143	69.42±28.2	27.0-159.6
Moderate (2020-5998 counts·min^{-1})	82	188.50±39.2	80.0-298.9	61	178.75±31.8	99.8-296.3	143	184.34±36.4	80.0-298.9
Vigorous (≥ 5999 counts·min^{-1})	82	4.05±7.1	0.1-42.3	61	6.06±10.1	0.1-46.9	143	4.91±8.5	0.1-46.9
Heart rate (bpm)									
Average	82	107.06±11.3	78.7-127.3	61	96.73±14.8	65.1-126.2	143	102.65±13.8	65.1-127.3
Maximum	82	155.27±14.2	122.0-185.0	61	145.98±21.5	66.0-181.0	143	151.31±18.2	66.0-185.0
Minimum	82	66.41±10.8	40.0-108.0	61	65.62±12.3	41.0-96.0	143	66.08±11.4	40.0-108.0
Heart rate zones (min)									
Very light (50-60% HRmax)†	82	112.01±58.0	0.0-246.6	61	115.16±74.5	0.0-282.7	143	113.36±65.3	0.0-282.7
Light (60-70% HRmax)	82	112.38±52.4	29.0-238.4	61	95.32±68.7	0.0-287.0	143	105.11±60.3	0.0-287.0
Moderate (70-80% HRmax)	82	81.45±49.7	0.0-302.2	61	51.00±52.8	0.0-204.2	143	68.46±53.0	0.0-302.2
Hard (80-90% HRmax)	82	40.41±32.1	0.0-173.1	61	23.47±32.1	0.0-115.3	143	33.18±33.1	0.0-173.1
Maximum (90-100% HRmax)	82	20.18±28.9	0.0-93.2	61	7.45±16.6	0.0-92.7	143	14.75±25.2	0.0-93.2

[†]P21, Jardim do Mar – Prazeres – Paul do Mar; P25, Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos or Feiteiras; [††]HRmax, maximum heart rate.

Table S6.8 Descriptive statistics (means. standard deviations and minimum and maximum values) for P34 and P39†.

Variable	Females			Males			Total		
	n	x̄ ± sd	min-max	n	x̄ ± sd	min-max	n	x̄ ± sd	min-max
P34									
Distance (km)	29	15.36±4.1	10.1-20.2	24	17.02±4.1	10.0-20.2	53	16.11±4.2	10.0-20.2
Duration (h)	29	7.35±1.3	5.1-9.1	24	7.78±1.1	5.4-9.2	53	7.54±1.3	5.1-9.2
Elevation gain (m)	29	909.86±363.7	282.0-1245.0	24	1004.71±357.8	280.0-1245.0	53	952.81±360.7	280.0-1245.0
Elevation loss (m)	29	1016.62±481.1	335.0-1570.0	24	1133.71±382.6	336.0-1564.0	53	1069.64±439.1	335.0-1570.0
Stride length (cm)	27	64.34±10.9	41.2-83.3	24	64.03±8.0	54.4-81.2	51	64.19±9.5	41.2-83.3
Walking speed (km/h)	29	4.04±0.8	2.6-5.5	24	4.19±0.8	3.2-5.6	53	4.11±0.8	2.6-5.6
Physical activity (min)									
Light (100-2019 counts·min^{-1})	29	60.45±36.2	24.2-180.5	24	46.81±20.4	27.6-110.8	53	54.28±30.6	24.2-180.5
Moderate (2020-5998 counts·min^{-1})	29	222.29±38.6	163.0-277.9	24	238.85±41.5	158.7-291.1	53	229.79±40.4	158.7-291.1
Vigorous (≥ 5999 counts·min^{-1})	29	11.95±13.7	0.6-61.5	24	18.66±17.1	0.7-77.8	53	14.99±15.6	0.6-77.8
Heart rate (bpm)									
Average	29	106.84±10.0	89.1-126.7	24	95.42±12.9	63.5-114.2	53	101.67±12.6	63.5-126.7
Maximum	29	156.41±10.8	131.0-174.0	24	143.63±14.2	105.0-167.0	53	150.62±13.9	105.0-174.0
Minimum	29	65.55±7.7	49.0-78.0	24	60.33±8.8	41.0-80.0	53	63.19±8.5	41.0-80.0
Heart rate zones (min)									
Very light (50-60% HRmax) ††	29	127.02±58.7	37.6-249.4	24	151.61±68.9	26.1-243.2	53	138.15±64.1	26.1-249.4
Light (60-70% HRmax)	29	108.60±55.3	12.3-216.7	24	96.12±51.3	0.0-205.7	53	102.95±53.4	0.0-216.7
Moderate (70-80% HRmax)	29	69.57±44.2	3.4-206.1	24	50.32±29.1	0.0-105.4	53	60.86±39.0	0.0-206.1
Hard (80-90% HRmax)	29	40.23±29.3	0.0-112.5	24	23.04±26.7	0.0-75.9	53	32.44±29.2	0.0-112.5
Maximum (90-100% HRmax)	29	20.77±29.8	0.0-105.2	24	6.29±18.0	0.0-64.6	53	14.21±26.0	0.0-105.2
P39									
Distance (km)	28	14.16±0.7	12.3-15.0	11	14.06±0.9	12.3-14.6	39	14.13±0.8	12.3-15.0
Duration (h)	28	6.37±0.3	5.3-7.1	11	6.42±0.5	5.2-7.0	39	6.39±0.4	5.2-7.1
Elevation gain (m)	28	38.57±6.8	26.0-45.0	11	34.82±7.3	25.0-45.0	39	37.51±7.1	25.0-45.0
Elevation loss (m)	28	547.75±13.6	530.0-583.0	11	541.45±15.6	530.0-573.0	39	545.97±14.3	530.0-583.0
Stride length (cm)	28	60.25±11.7	35.9-82.7	11	65.65±7.8	53.0-76.3	39	61.77±10.9	35.9-82.7
Walking speed (km/h)	28	3.67±0.7	2.2-5.1	11	3.78±0.7	3.0-5.0	39	3.70±0.7	2.2-5.1
Physical activity (min)									
Light (100-2019 counts·min^{-1})	28	74.35±15.6	38.9-102.8	11	76.18±24.5	49.0-121.5	39	74.86±18.2	38.9-121.5
Moderate (2020-5998 counts·min^{-1})	28	177.67±14.1	139.9-202.6	11	182.36±17.5	156.3-207.2	39	178.99±15.0	139.9-207.2
Vigorous (≥ 5999 counts·min^{-1})	28	2.78±4.6	0.3-20.8	11	3.09±2.8	0.2-9.7	39	2.87±4.1	0.2-20.8
Heart rate (bpm)									
Average	28	96.04±8.9	78.6-113.9	11	91.55±12.7	68.4-110.9	39	94.77±10.1	68.4-113.9
Maximum	28	136.18±12.2	117.0-166.0	11	125.55±13.1	108.0-148.0	39	133.18±13.2	108.0-166.0
Minimum	28	67.36±8.5	48.0-82.0	11	66.45±8.5	51.0-78.0	39	67.10±8.4	48.0-82.0
Heart rate zones (min)									
Very light (50-60% HRmax)	28	150.39±81.9	26.0-268.0	11	158.86±106.5	8.9-361.5	39	152.78±88.1	8.9-361.5
Light (60-70% HRmax)	28	126.08±88.2	3.6-258.1	11	119.27±111.0	2.0-279.4	39	124.16±93.7	2.0-279.4
Moderate (70-80% HRmax)	28	20.82±36.6	0.0-140.2	11	17.40±23.6	0.0-64.1	39	19.86±33.2	0.0-140.2
Hard (80-90% HRmax)	28	2.83±7.9	0.0-39.8	11	0.31±0.6	0.0-2.0	39	2.12±6.8	0.0-39.8
Maximum (90-100% HRmax)	28	0.04±0.2	0.0-0.9	11	0.00±0.0	0.0-0.0	39	0.03±0.1	0.0-0.9

†P34, Seixal – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela; P39, Pico das Pedras – Caldeirão Verde – Ilha; ††HRmax, maximum heart rate.

Table S6.9 Distribution of the nature-based tourists' perception of the 'levadas' and trails-related features: P01, P02 and P03.

Variables†	Ordinal category scale††						
	1	2	3	4	5	Median	Mode
P01 (n = 116)							
Narrow	20 (17.5)	37 (32.5)	23 (20.2)	25 (21.9)	9 (7.9)	2.5	2
Irregular	24 (21.1)	39 (34.2)	32 (28.1)	12 (10.5)	7 (6.1)	2.0	2
Unprotected	28 (24.3)	39 (33.9)	24 (20.9)	17 (14.8)	7 (6.1)	2.0	2
Degraded protections	18 (15.8)	45 (39.5)	28 (24.6)	12 (10.5)	11 (9.6)	2.0	2
Poor signage	30 (26.1)	30 (26.1)	27 (23.5)	15 (13.0)	13 (11.3)	2.0	1[a]
Cliffs	18 (15.7)	32 (27.8)	30 (26.1)	21 (18.3)	14 (12.2)	3.0	2
Landslides	43 (37.7)	39 (34.2)	21 (18.4)	7 (6.1)	4 (3.5)	2.0	1
Slippery	13 (11.4)	43 (36.7)	37 (32.5)	15 (13.2)	6 (5.3)	3.0	2
Falling rocks	57 (50.0)	35 (30.7)	15 (13.2)	5 (4.4)	2 (1.8)	1.5	1
Demanding	40 (35.1)	35 (30.7)	27 (23.7)	7 (6.1)	5 (4.4)	2.0	1
P02 (n = 155)							
Narrow	32 (20.9)	42 (27.5)	47 (30.7)	28 (18.3)	4 (2.6)	3.0	3
Irregular	41 (26.8)	44 (28.8)	39 (25.5)	20 (13.1)	9 (5.9)	2.0	2
Unprotected	43 (28.3)	46 (30.3)	44 (28.9)	16 (10.5)	3 (2.0)	2.0	2
Degraded protections	25 (16.3)	43 (28.1)	44 (28.8)	33 (21.6)	8 (5.2)	3.0	3
Poor signage	43 (27.7)	49 (31.6)	37 (23.9)	16 (10.3)	10 (6.5)	2.0	2
Cliffs	16 (10.5)	23 (15.1)	35 (23.0)	42 (27.6)	36 (23.7)	4.0	4
Landslides	49 (32.2)	59 (38.8)	29 (19.1)	13 (8.6)	2 (1.3)	2.0	2
Slippery	27 (17.6)	54 (35.3)	44 (28.8)	24 (15.7)	4 (2.6)	2.0	2
Falling rocks	62 (40.5)	53 (34.6)	27 (17.6)	7 (4.6)	4 (2.6)	2.0	1
Demanding	20 (13.2)	34 (22.5)	44 (29.1)	39 (25.8)	14 (9.3)	3.0	3
P03 (n = 60)							
Narrow	23 (38.3)	13 (21.7)	18 (30.0)	6 (10.0)	0 (0.0)	2.0	1
Irregular	17 (28.3)	20 (33.3)	14 (23.3)	7 (11.7)	2 (3.3)	2.0	2
Unprotected	18 (30.0)	17 (28.3)	14 (23.3)	8 (13.3)	3 (5.0)	2.0	1
Degraded protections	11 (18.3)	19 (31.7)	13 (21.7)	11 (18.3)	6 (10.0)	2.5	2
Poor signage	17 (28.3)	13 (21.7)	12 (20.0)	10 (16.7)	8 (13.3)	2.5	1
Cliffs	14 (23.3)	8 (13.3)	25 (41.7)	10 (16.7)	3 (5.0)	3.0	3
Landslides	25 (41.7)	18 (30.0)	12 (20.0)	4 (6.7)	1 (1.7)	2.0	1
Slippery	16 (26.7)	22 (36.7)	12 (20.0)	7 (11.7)	3 (5.0)	2.0	2
Falling rocks	31 (51.7)	17 (28.3)	7 (11.7)	2 (3.3)	3 (5.0)	1.0	1
Demanding	21 (35.0)	18 (30.0)	12 (20.0)	7 (11.7)	2 (3.3)	2.0	1

†P01, 25 Fontes (Rabaçal or 'Garagem'); P02, Pico Ruivo (Pico Areeiro or Achada do Teixeira); P03, Ponta de S. Lourenço (Cais do Sardinha). ††Ordinal category scale with 1 representing no agree and 5 indicating fully agree. The percentage in brackets refers to 'valid percentage'.

[a]Multiple modes exist. The smallest value is shown.

Table S6.10 Distribution of the nature-based tourists' perception of the 'levadas' and trails-related features: P04, P05, P08 and P09.

Variables[†]	Ordinal category scale[††]					Median	Mode
	1	2	3	4	5		
P04 (n = 34)							
Narrow	11 (32.4)	10 (29.4)	7 (20.6)	5 (14.7)	1 (2.9)	2.0	1
Irregular	18 (54.5)	9 (27.3)	5 (15.2)	1 (3.0)	0 (0.0)	1.0	1
Unprotected	13 (39.4)	10 (30.3)	4 (12.1)	5 (15.2)	1 (3.0)	2.0	1
Degraded protections	12 (36.4)	13 (39.4)	7 (21.2)	1 (3.0)	0 (0.0)	2.0	2
Poor signage	11 (33.3)	8 (24.2)	4 (12.1)	7 (21.2)	3 (9.1)	2.0	1
Cliffs	9 (26.5)	7 (20.6)	7 (20.6)	6 (17.6)	5 (14.7)	3.0	1
Landslides	15 (44.1)	15 (44.1)	3 (8.8)	1 (2.9)	0 (0.0)	2.0	1[a]
Slippery	10 (29.4)	11 (32.4)	10 (29.4)	2 (5.9)	1 (2.9)	2.0	2
Falling rocks	21 (61.8)	9 (26.5)	4 (11.8)	0 (0.0)	0 (0.0)	1.0	1
Demanding	12 (35.3)	11 (32.4)	8 (23.5)	3 (8.8)	0 (0.0)	2.0	1
P05 (n = 42)							
Narrow	4 (10.0)	6 (15.0)	14 (35.0)	12 (30.0)	4 (10.0)	3.0	3
Irregular	11 (27.5)	7 (17.5)	15 (37.5)	6 (15.0)	1 (2.5)	3.0	3
Unprotected	6 (15.8)	8 (21.1)	11 (28.9)	12 (31.6)	1 (2.6)	3.0	4
Degraded protections	4 (9.8)	10 (24.4)	14 (34.1)	11 (26.8)	2 (4.9)	3.0	3
Poor signage	11 (26.8)	10 (24.4)	11 (26.8)	6 (14.6)	3 (7.3)	2.0	1[a]
Cliffs	2 (5.0)	10 (25.0)	9 (22.5)	7 (17.5)	12 (30.0)	3.0	5
Landslides	11 (26.8)	14 (34.1)	11 (26.8)	3 (7.3)	2 (4.9)	2.0	2
Slippery	3 (7.5)	7 (17.5)	13 (32.5)	12 (30.0)	5 (12.5)	3.0	3
Falling rocks	19 (48.7)	10 (25.6)	8 (20.5)	1 (2.6)	1 (2.6)	2.0	1
Demanding	6 (15.0)	14 (35.0)	15 (37.5)	4 (10.0)	1 (2.5)	2.5	3
P08 (n = 86)							
Narrow	21 (24.7)	22 (25.9)	31 (36.5)	8 (9.4)	3 (3.5)	2.0	3
Irregular	22 (26.2)	23 (27.4)	29 (34.5)	8 (9.5)	2 (2.4)	2.0	3
Unprotected	18 (21.2)	21 (24.7)	19 (22.4)	20 (23.5)	7 (8.2)	3.0	2
Degraded protections	25 (30.1)	25 (30.1)	18 (21.7)	11 (13.3)	4 (4.8)	2.0	1[a]
Poor signage	11 (12.9)	12 (14.1)	30 (35.3)	15 (17.6)	17 (20.0)	3.0	3
Cliffs	9 (10.7)	15 (17.9)	18 (21.4)	35 (41.7)	7 (8.3)	3.5	4
Landslides	21 (24.7)	33 (38.8)	25 (29.4)	4 (4.7)	2 (2.4)	2.0	2
Slippery	8 (9.4)	23 (27.1)	22 (25.9)	26 (30.6)	6 (7.1)	3.0	4
Falling rocks	25 (29.4)	31 (36.5)	20 (23.5)	6 (7.1)	3 (3.5)	2.0	2
Demanding	17 (20.2)	18 (21.4)	26 (31.0)	20 (23.8)	3 (3.6)	3.0	3
P09 (n = 33)							
Narrow	7 (31.8)	5 (22.7)	6 (27.3)	4 (18.2)	0 (0.0)	2.0	1
Irregular	9 (40.9)	6 (27.3)	6 (27.3)	1 (4.5)	0 (0.0)	2.0	1
Unprotected	5 (22.7)	7 (31.8)	5 (22.7)	4 (18.2)	1 (4.5)	2.0	2
Degraded protections	7 (31.8)	6 (27.3)	8 (36.4)	1 (4.5)	0 (0.0)	2.0	3
Poor signage	6 (28.6)	1 (4.8)	9 (42.9)	3 (14.3)	2 (9.5)	3.0	3
Cliffs	5 (22.7)	10 (45.5)	4 (18.2)	3 (13.6)	0 (0.0)	2.0	2
Landslides	13 (59.1)	6 (27.3)	3 (13.6)	0 (0.0)	0 (0.0)	1.0	1
Slippery	13 (59.1)	5 (22.7)	4 (18.2)	0 (0.0)	0 (0.0)	1.0	1
Falling rocks	13 (59.1)	7 (31.8)	2 (9.1)	0 (0.0)	0 (0.0)	1.0	1
Demanding	13 (59.1)	3 (13.6)	5 (22.7)	1 (4.5)	0 (0.0)	1.0	1

[†]P04, Ribeiro Frio – Portela; P05, Caldeirão Verde (Queimadas or Pico das Pedras); P08, Arco de S. Jorge – Quinta do Furão; P09, Levada do Norte (Estreito de Cª de Lobos – Cabo Girão). [††]Ordinal category scale with 1 representing no agree and 5 indicating fully agree. The percentage in brackets refers to 'valid percentage'.

[a]Multiple modes exist. The smallest value is shown.

Table S6.11 Distribution of the nature-based tourists' perception of the 'levadas' and trails-related features: P10, P13, P14 and P15.

Variables[†]	Ordinal category scale[††]					Median	Mode
	1	2	3	4	5		
P10 (n = 74)							
Narrow	17 (23.0)	22 (29.7)	25 (33.8)	7 (9.5)	3 (4.1)	2.0	3
Irregular	23 (31.1)	28 (37.8)	14 (18.9)	3 (4.1)	6 (8.1)	2.0	2
Unprotected	11 (14.9)	22 (29.7)	21 (28.4)	17 (23.0)	3 (4.1)	3.0	2
Degraded protections	12 (16.4)	25 (34.2)	20 (27.4)	14 (19.2)	2 (2.7)	2.0	2
Poor signage	6 (8.2)	20 (27.4)	24 (32.9)	12 (16.4)	11 (15.1)	3.0	3
Cliffs	7 (9.5)	13 (17.6)	22 (29.7)	23 (31.1)	9 (12.2)	3.0	4
Landslides	22 (29.7)	28 (37.8)	18 (24.3)	5 (6.8)	1 (1.4)	2.0	2
Slippery	18 (24.3)	26 (35.1)	17 (23.0)	10 (13.5)	3 (4.1)	2.0	2
Falling rocks	20 (27.0)	29 (39.2)	18 (24.3)	4 (5.4)	3 (4.1)	2.0	2
Demanding	26 (35.1)	25 (33.8)	17 (23.0)	3 (4.1)	3 (4.1)	2.0	1
P13 (n = 105)							
Narrow	11 (10.6)	17 (16.3)	41 (39.4)	25 (24.0)	10 (9.6)	3.0	3
Irregular	12 (11.7)	18 (17.5)	28 (27.2)	32 (31.1)	13 (12.6)	3.0	4
Unprotected	9 (8.8)	22 (21.6)	37 (36.3)	21 (20.6)	13 (12.7)	3.0	3
Degraded protections	19 (18.6)	42 (41.2)	22 (21.6)	12 (11.8)	7 (6.9)	2.0	2
Poor signage	8 (7.7)	13 (12.5)	30 (28.8)	29 (27.9)	24 (23.1)	4.0	3
Cliffs	6 (5.7)	22 (21.0)	39 (37.1)	27 (25.7)	11 (10.5)	3.0	3
Landslides	18 (17.5)	29 (28.2)	37 (35.9)	15 (14.6)	4 (3.9)	3.0	3
Slippery	10 (9.7)	21 (20.4)	43 (41.7)	25 (24.3)	4 (3.9)	3.0	3
Falling rocks	28 (27.2)	39 (37.9)	28 (27.2)	7 (6.8)	1 (1.0)	2.0	2
Demanding	7 (6.7)	13 (12.5)	29 (27.9)	37 (35.6)	18 (17.3)	4.0	4
P14 (n = 119)							
Narrow	26 (21.8)	36 (30.3)	30 (25.2)	19 (16.0)	8 (6.7)	2.0	2
Irregular	39 (33.3)	38 (32.5)	25 (21.4)	10 (8.5)	5 (4.3)	2.0	1
Unprotected	36 (31.3)	33 (28.7)	27 (23.5)	17 (14.8)	2 (1.7)	2.0	1
Degraded protections	27 (23.1)	39 (33.3)	40 (34.2)	9 (7.7)	2 (1.7)	2.0	3
Poor signage	40 (34.5)	25 (21.6)	30 (25.9)	15 (12.9)	6 (5.2)	2.0	1
Cliffs	42 (35.6)	32 (27.1)	29 (24.6)	13 (11.0)	2 (1.7)	2.0	1
Landslides	51 (43.2)	36 (30.5)	24 (20.3)	7 (5.9)	0 (0.0)	2.0	1
Slippery	12 (10.2)	28 (23.7)	54 (45.8)	17 (14.4)	7 (5.9)	3.0	3
Falling rocks	58 (49.2)	35 (29.7)	23 (19.5)	2 (1.7)	0 (0.0)	2.0	1
Demanding	35 (29.4)	35 (29.4)	33 (27.7)	13 (10.9)	3 (2.5)	2.0	1[a]
P15 (n = 38)							
Narrow	10 (27.0)	8 (21.6)	11 (29.7)	6 (16.2)	2 (5.4)	3.0	3
Irregular	18 (47.4)	12 (31.6)	7 (18.4)	1 (2.6)	0 (0.0)	2.0	1
Unprotected	15 (39.5)	8 (21.1)	6 (15.8)	7 (18.4)	2 (5.3)	2.0	1
Degraded protections	12 (31.6)	10 (26.3)	6 (15.8)	7 (18.4)	3 (7.9)	2.0	1
Poor signage	12 (31.6)	4 (10.5)	14 (36.8)	6 (15.8)	2 (5.3)	3.0	3
Cliffs	9 (23.7)	6 (15.8)	14 (36.8)	8 (21.1)	1 (2.6)	3.0	3
Landslides	25 (65.8)	7 (18.4)	3 (7.9)	3 (7.9)	0 (0.0)	1.0	1
Slippery	10 (26.3)	10 (26.3)	11 (28.9)	7 (18.4)	0 (0.0)	2.0	3
Falling rocks	25 (65.8)	7 (18.4)	4 (10.5)	2 (5.3)	0 (0.0)	1.0	1
Demanding	14 (36.8)	7 (18.4)	13 (34.2)	4 (10.5)	0 (0.0)	2.0	1

[†]P10, Larano (Porto da Cruz – Machico); P13, S. Roque do Faial – Penha d'Águia – S. Roque do Faial or Santana; P14, Levada do Moinho (Porto Moniz); P15, Levada Nova (Calheta) – Paul do Mar or Jardim do Mar. [††]Ordinal category scale with 1 representing no agree and 5 indicating fully agree. The percentage in brackets refers to 'valid percentage'.

[a]Multiple modes exist. The smallest value is shown.

Table S6.12 Distribution of the nature-based tourists' perception of the 'levadas' and trails-related features: P19, P21, P25 and P34.

Variables†	Ordinal category scale††						
	1	2	3	4	5	Median	Mode
P19 (n = 36)							
Narrow	8 (23.5)	9 (26.5)	11 (32.4)	5 (14.7)	1 (2.9)	2.5	3
Irregular	9 (25.7)	11 (31.4)	8 (22.9)	4 (11.4)	3 (8.6)	2.0	2
Unprotected	8 (22.9)	14 (40.0)	7 (20.0)	5 (14.3)	1 (2.9)	2.0	2
Degraded protections	11 (31.4)	9 (25.7)	9 (25.7)	4 (11.4)	2 (5.7)	2.0	1
Poor signage	10 (30.3)	4 (12.1)	13 (39.4)	3 (9.1)	3 (9.1)	3.0	3
Cliffs	6 (17.6)	11 (32.4)	10 (29.4)	5 (14.7)	2 (5.9)	2.5	2
Landslides	13 (37.1)	16 (45.7)	4 (11.4)	2 (5.7)	0 (0.0)	2.0	2
Slippery	4 (11.4)	17 (48.6)	6 (17.1)	7 (20.0)	1 (2.9)	2.0	2
Falling rocks	12 (34.3)	15 (42.9)	6 (17.1)	2 (5.7)	0 (0.0)	2.0	2
Demanding	3 (8.8)	9 (26.5)	9 (26.5)	9 (26.5)	4 (11.8)	3.0	2[a]
P21 (n = 132)							
Narrow	33 (25.4)	39 (30.0)	34 (26.2)	18 (13.8)	6 (4.6)	2.0	2
Irregular	34 (26.2)	36 (27.7)	32 (24.6)	19 (14.6)	9 (6.9)	2.0	2
Unprotected	36 (27.5)	38 (29.0)	35 (26.7)	17 (13.0)	5 (3.8)	2.0	2
Degraded protections	26 (19.8)	28 (21.4)	51 (38.9)	20 (15.3)	6 (4.6)	3.0	3
Poor signage	26 (19.7)	27 (20.5)	43 (32.6)	22 (16.7)	14 (10.6)	3.0	3
Cliffs	11 (8.3)	27 (20.5)	33 (25.0)	34 (25.8)	27 (20.5)	3.0	4
Landslides	40 (31.3)	40 (31.3)	31 (24.2)	12 (9.4)	5 (3.9)	2.0	1[a]
Slippery	26 (19.7)	41 (31.1)	34 (25.8)	26 (19.7)	5 (3.8)	2.0	2
Falling rocks	47 (35.6)	35 (26.5)	37 (28.0)	10 (7.6)	3 (2.3)	2.0	1
Demanding	14 (10.6)	28 (21.2)	47 (35.6)	25 (18.9)	18 (13.6)	3.0	3
P25 (n = 143)							
Narrow	33 (23.9)	48 (34.8)	37 (26.8)	16 (11.6)	4 (2.9)	2.0	2
Irregular	25 (18.0)	37 (26.6)	49 (35.3)	16 (11.5)	12 (8.6)	3.0	3
Unprotected	43 (30.7)	45 (32.1)	30 (21.4)	17 (12.1)	5 (3.6)	2.0	2
Degraded protections	34 (24.5)	41 (29.5)	37 (26.6)	19 (13.7)	8 (5.8)	2.0	2
Poor signage	26 (18.7)	27 (19.4)	41 (29.5)	27 (19.4)	18 (12.9)	3.0	3
Cliffs	37 (26.4)	28 (20.0)	42 (30.0)	21 (15.0)	12 (8.6)	3.0	3
Landslides	40 (29.0)	45 (32.6)	36 (26.1)	12 (8.7)	5 (3.6)	2.0	2
Slippery	17 (12.1)	32 (22.9)	48 (34.3)	31 (22.1)	12 (8.6)	3.0	3
Falling rocks	44 (31.4)	53 (37.9)	26 (18.6)	13 (9.3)	4 (2.9)	2.0	2
Demanding	19 (13.8)	36 (26.1)	42 (30.4)	30 (21.7)	11 (8.0)	3.0	3
P34 (n = 53)							
Narrow	13 (25.0)	16 (30.8)	16 (30.8)	7 (13.5)	0 (0.0)	2.0	2[a]
Irregular	8 (15.4)	14 (26.9)	15 (28.8)	12 (23.1)	3 (5.8)	3.0	3
Unprotected	12 (23.5)	23 (45.1)	10 (19.6)	3 (5.9)	3 (5.9)	2.0	2
Degraded protections	12 (23.1)	22 (42.3)	9 (17.3)	7 (13.5)	2 (3.8)	2.0	2
Poor signage	8 (15.1)	13 (24.5)	18 (34.0)	13 (24.5)	1 (1.9)	3.0	3
Cliffs	8 (15.1)	21 (39.6)	15 (28.3)	6 (11.3)	3 (5.7)	2.0	2
Landslides	14 (26.9)	22 (42.3)	12 (23.1)	3 (5.8)	1 (1.9)	2.0	2
Slippery	4 (7.7)	7 (13.5)	23 (44.2)	11 (21.2)	7 (13.5)	3.0	3
Falling rocks	22 (42.3)	22 (42.3)	5 (9.6)	2 (3.8)	1 (1.9)	2.0	1[a]
Demanding	7 (13.5)	13 (25.0)	11 (21.2)	16 (30.8)	5 (9.6)	3.0	4

†P19, Encumeada – Pico Ruivo – Achada do Teixeira; P21, Jardim do Mar – Prazeres – Paul do Mar; P25, Encumeada – Caramujo – Pico Ruivo do Paul – Estanquinhos or Feiteiras; P34, Seixal (Cais) – Chão da Ribeira – Fanal – Levada dos Cedros – Ribeira da Janela. ††Ordinal category scale with 1 representing no agree and 5 indicating fully agree. The percentage in brackets refers to 'valid percentage'.

[a]Multiple modes exist. The smallest value is shown.

Table S6.13 Distribution of the nature-based tourists' perception of the 'levadas' and trails-related features: P39.

Variables†	Ordinal category scale††					Median	Mode
	1	2	3	4	5		
P39 (n = 39)							
Narrow	0 (0.0)	13 (34.2)	11 (28.9)	11 (28.9)	3 (7.9)	3.0	2
Irregular	8 (21.1)	17 (44.7)	10 (26.3)	2 (5.3)	1 (2.6)	2.0	2
Unprotected	9 (23.1)	14 (35.9)	10 (25.6)	2 (5.1)	14 (10.3)	2.0	2
Degraded protections	3 (7.7)	15 (38.5)	11 (28.2)	6 (15.4)	4 (10.3)	3.0	2
Poor signage	4 (10.5)	7 (18.4)	11 (28.9)	8 (21.1)	8 (21.1)	3.0	3
Cliffs	2 (5.3)	4 (10.5)	9 (23.7)	10 (26.3)	13 (34.2)	4.0	5
Landslides	12 (30.8)	15 (38.5)	9 (23.1)	3 (7.7)	0 (0.0)	2.0	2
Slippery	3 (7.7)	13 (33.3)	10 (25.6)	9 (23.1)	4 (10.3)	3.0	2
Falling rocks	17 (43.6)	16 (41.0)	5 (12.8)	0 (0.0)	1 (2.6)	2.0	1
Demanding	11 (28.9)	11 (28.9)	10 (26.3)	4 (10.5)	2 (5.3)	2.0	1[a]

†P39, Pico das Pedras – Caldeirão Verde – Ilha. ††Ordinal category scale with 1 representing no agree and 5 indicating fully agree. The percentage in brackets refers to 'valid percentage'.

Table S6.14 Estimated parameters and standard errors of the multilevel models exploring the relationship of moderate-to-vigorous physical activity in ‘levadas’ and trails with biological characteristics of the nature-based tourists and hike features.

	Model 1		Model 2		Model 3		Model 4	
Parameter and fit statistic	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Fixed Effect								
Intercept	165.193***	8.574	163.901***	8.467	165.315***	0.397	162.587***	2.843
Age			-0.322***	0.065	-0.274***	0.067	-0.1819***	0.052
Gender			2.303	1.588	-0.399	1.830	-0.540	1.430
Percent body fat					-0.475**	0.166	-0.329**	0.130
Distance							10.054***	0.395
Elevation gain							0.012**	0.005
Elevation loss							0.035***	0.004
Demanding of the ‘levadas’ and trails							-1.312**	0.553
Random effect								
Level 2 variance (trails)	3221.850	707.241	3121.153	675.654	3061.7752	663.192	292.078	70.824
Level 1 variance (tourists)	928.948	33.729	914.460	33.203	907.996	33.177	534.061	19.870
Model fit								
Deviance	15295.787		15270.531		15075.043		13685.191	

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

Table S6.15 Mediation of the effect of moderate-to-vigorous physical activity on cardiorespiratory fitness through habitual physical activity, controlling for 'levadas' and trails, and age (n = 967).

Antecedent†		Consequent††						
		M (habitual physical activity)				*Y* (cardiorespiratory fitness)		
		Coeff.	SE	*p*		Coeff.	SE	*p-value*
X (moderate-to-vigorous physical activity)	*a*	0.003	0.001	< 0.001	*c*'	-0.034	0.011	0.002
M (habitual physical activity)		-	-	-	*b*	-4.643	0.441	< 0.001
C_1 ('levadas' and trails)	f_1	-0.008	0.004	0.027	g_1	-0.041	0.048	0.390
C_2 (age)	f_2	0.018	0.004	< 0.001	g_2	0.124	0.054	0.023
Constant	i_M	7.135	0.220	< 0.001	i_Y	134.686	4.348	< 0.001
		$R^2 = 0.038$				$R^2 = 0.124$		
		$F(3, 963) = 12.683, p < 0.001$				$F(4, 962) = 34.043, p < 0.001$		

†Predictor or independent variable; ††dependent or outcome variable; *C*, constant; Coeff, coefficient; SE, standard error [adapted from Hayes (2018)].

Table S6.16 Total, direct and indirect effects of moderate-to-vigorous physical activity on cardiorespiratory fitness through habitual physical activity, controlling for 'levadas' and trails, and age (n = 967).

Parameters	Point estimate†	BootSE	BootLLCI	BootULCI
Total effect of *X* on *Y*	-0.049	0.012	-0.072	-0.026
Indirect effect of *X* on *Y*	-0.015	0.004	-0.023	-0.008
Direct effect of *X* on *Y*	-0.034	0.011	-0.056	-0.112

†Effect; BootSE, bootstrap standard error; BootLLCI, bootstrap lower limit confidence interval (95%); BootULCI, bootstrap upper limit confidence interval (95%); number of bootstrap samples for percentile bootstrap confidence intervals: 5000; *X*, moderate-to-vigorous physical activity; *Y*, cardiorespiratory fitness.

Table S6.17 Mediation of the effect of moderate-to-vigorous physical activity on percent body fat through habitual physical activity, controlling for 'levadas' and trails, and age (18-59 years; n = 967).

Antecedent†		Consequent††						
		M (habitual physical activity)				*Y* (percent body fat)		
		Coeff.	SE	*p*		Coeff.	SE	*p-value*
X (moderate-to-vigorous physical activity)	*a*	0.003	0.001	< 0.001	*c*'	-0.018	0.004	< 0.001
M (habitual physical activity)		-	-	-	*b*	-0.860	0.152	< 0.001
C_1 ('levadas' and trails)	f_1	-0.008	0.004	0.027	g_1	-0.022	0.016	0.185
C_2 (age)	f_2	0.018	0.004	< 0.001	g_2	0.156	0.019	< 0.001
Constant	i_M	7.135	0.220	< 0.001	i_Y	25.596	1.497	< 0.001
		$R^2 = 0.038$				$R^2 = 0.122$		
		$F(3, 963) = 12.683, p < 0.001$				$F(4, 962) = 33.283, p < 0.001$		

†Predictor or independent variable; ††dependent or outcome variable; *C*, constant; Coeff, coefficient; SE, standard error [adapted from Hayes (2018)].

Table S6.18 Total, direct and indirect effects of moderate-to-vigorous physical activity on percent body fat through habitual physical activity, controlling for ‘levadas’ and trails, and age (18-59 years; n = 967).

Parameters	Point estimate†	BootSE	BootLLCI	BootULCI
Total effect of *X* on *Y*	-0.021	0.004	-0.028	-0.013
Indirect effect of *X* on *Y*	-0.003	0.001	-0.005	-0.001
Direct effect of *X* on *Y*	-0.018	0.004	-0.025	-0.010

†Effect; BootSE, bootstrap standard error; BootLLCI, bootstrap lower limit confidence interval (95%); BootULCI, bootstrap upper limit confidence interval (95%); number of bootstrap samples for percentile bootstrap confidence intervals: 5000; *X*, moderate-to-vigorous physical activity; *Y*, percent body fat.

Table S6.19 Mediation of the effect of moderate-to-vigorous physical activity on aerobic endurance through physical activity (sport index), controlling for ‘levadas’ and trails, and age (n = 378).

Antecedent†	Consequent††							
	M [physical activity (sport index)]				*Y* (aerobic endurance)			
		Coeff.	SE	*p*		Coeff.	SE	*p-value*
X (moderate-to-vigorous physical activity)	a	0.001	0.001	0.045	c'	0.072	0.080	0.374
M [physical activity (sport index)]		-	-	-	b	28.038	6.231	< 0.001
C_1 (‘levadas’ and trails)	f_1	0.002	0.003	0.538	g_1	-0.531	0.319	0.096
C_2 (age)	f_2	0.006	0.007	0.387	g_2	-2.706	0.805	< 0.001
Constant	i_M	2.733	0.481	< 0.001	i_Y	728.133	60.672	< 0.001
	$R^2 = 0.015$				$R^2 = 0.089$			
	$F(3, 374) = 1.847$, $p = 0.138$				$F(4, 373) = 9.149$, $p < 0.001$			

†Predictor or independent variable; ††dependent or outcome variable; *C*, constant; Coeff, coefficient; SE, standard error [adapted from Hayes (2018)].

Table S6.20 Total, direct and indirect effects of moderate-to-vigorous physical activity on aerobic endurance through physical activity (sport index), controlling for ‘levadas’ and trails, and age (n = 378).

Parameters	Point estimate†	BootSE	BootLLCI	BootULCI
Total effect of *X* on *Y*	0.109	0.082	-0.052	0.270
Indirect effect of *X* on *Y*	0.038	0.019	0.005	0.078
Direct effect of *X* on *Y*	0.072	0.080	-0.086	0.229

†Effect; BootSE, bootstrap standard error; BootLLCI, bootstrap lower limit confidence interval (95%); BootULCI, bootstrap upper limit confidence interval (95%); number of bootstrap samples for percentile bootstrap confidence intervals: 5000; *X*, moderate-to-vigorous physical activity; *Y*, aerobic endurance.

Table S6.21 Mediation of the effect of moderate-to-vigorous physical activity on percent body fat through physical activity (sport index), controlling for 'levadas' and trails, and age (aged 60 years and above; n = 378).

Antecedent[†]	Consequent[††]							
		M [physical activity (sport index)]				*Y* (percent body fat)		
		Coeff.	SE	*p*		Coeff.	SE	*p-value*
X (moderate-to-vigorous physical activity)	a	0.001	0.001	0.045	c'	-0.015	0.005	0.004
M [physical activity (sport index)]		-	-	-	b	-1.419	0.404	< 0.001
C_1 ('levadas' and trails)	f_1	0.002	0.003	0.538	g_1	0.032	0.021	0.126
C_2 (age)	f_2	0.006	0.007	0.387	g_2	-0.070	0.052	0.179
Constant	i_M	2.733	0.481	< 0.001	i_Y	34.561	3.913	< 0.001
		$R^2 = 0.015$				$R^2 = 0.060$		
		$F(3, 374) = 1.847$, $p = 0.138$				$F(4, 373) = 5.996$, $p < 0.001$		

[†]Predictor or independent variable; [††]dependent or outcome variable; *C*, constant; Coeff, coefficient; SE, standard error [adapted from Hayes (2018)].

Table S6.22 Total, direct and indirect effects of moderate-to-vigorous physical activity on percent body fat through physical activity (sport index), controlling for 'levadas' and trails, and age (aged 60 years and above; n = 378).

Parameters	Point estimate[†]	BootSE	BootLLCI	BootULCI
Total effect of *X* on *Y*	-0.017	0.005	-0.028	-0.007
Indirect effect of *X* on *Y*	-0.002	0.001	-0.004	-0.000
Direct effect of *X* on *Y*	-0.015	0.005	-0.026	-0.005

[†]Effect; BootSE, bootstrap standard error; BootLLCI, bootstrap lower limit confidence interval (95%); BootULCI, bootstrap upper limit confidence interval (95%); number of bootstrap samples for percentile bootstrap confidence intervals: 5000; *X*, moderate-to-vigorous physical activity; *Y*, percentage of body fatness.

Table S6.23 Descriptive statistics for health-related physical fitness.

Variables	Nature-based tourists			
	18-59 years		60 years and above	
	n	$\bar{x} \pm sd$	n	$\bar{x} \pm sd$
Anthropometry				
Stature (cm)	967	168.05±8.4	378	166.60±9.1
Body mass (kg)	967	65.92±12.1	378	67.83±12.4
Skinfold thickness (mm)[†]				
Abdominal	611	18.87±6.3	189	18.80±6.6
Chest	356	12.64±5.3	189	15.14±4.9
Subscapular	356	16.33±6.1	189	17.93±5.2
Suprailiac	611	15.45±6.0	189	15.46±6.0
Triceps	967	16.96±6.0	378	15.64±5.5
Physical fitness				
3-minute step test (bpm)	967	95.01±16.9	-	-
6-minute walk (m)	-	-	378	645.58±71.9
Percentage of body fatness (%)	967	22.14±5.8	378	23.41±4.6

[†]Females: suprailiac and abdominal; males: chest and subscapular; both, females and males, triceps. For nature-based tourists, aged 18-59 years, 611 females and 356 males. For nature-based tourists aged 60 years and above, 189 females and 189 males.