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PERCEPTIONS AND PREFERENCES ABOUT INSECT-BASED BARS IN THE GERMAN MARKET: A LITERATURE OVERVIEW

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Abstract -Group part

Given the environmental and nutritional benefits of consuming insects, entomophagy has been increasing in significance. The research deals with insect-based food, particularly with insect-based bars in the German market. It aims to determine German consumers' perceptions of insect-based bars and the preferred product attributes. By conducting interviews, perceptual map and conjoint analyses, and a field trial, an understanding of the optimal positioning and consumer preferences is provided to improve market acceptance. Results indicate that insect-based bars are perceived as high-quality but low in appeal, while the preferred product has a nut base, chocolate taste, and a price of €1.69.

Abstract – Individual part

Since the intensification of the discussion on entomophagy in the Western world, there has been increased attention in the body of literature, mainly for factors influencing the consumption of insect food. The literature covers the current state of the art and identifies seven key factors that were mentioned the most and play the most decisive role in entomophagy. The seven factors are: socio-demographics and cultural aspects, food neophobia, disgust, personal experience, familiarity & context, knowledge, sensory attributes & product properties, and promotion & packaging.

Keywords: Market Research, Interview, Perceptual Map, Conjoint Analysis, Field Trial, Insect-based Food, Insect-based Bars, German Market

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1 Introduction

Eating insects, termed entomophagy, has gained substantial interest and attention in recent years (Ardoin and Prinyawiwatkul 2021). In the wake of a growing population, food insecurity, and urbanization, the consideration of alternative diets seems inevitable. According to researchers, the world population will amount to nine billion people by 2050, making it impossible to sufficiently nourish the human population with the existing food sources (Van Huis et al. 2013). Meat consumption is expected to be twice as high (465 million tons) in 2050 as it was in 1999/2001 (229 million tons) posing a risk to the future food supply (Steinfeld et al. 2006). To overcome these problems, the consumption of insects appears indispensable (Orsi, Voege, and Stranieri 2019).

Insect-based food has been part of human diets for many centuries (Kouřimská and Adámková 2016) and is beneficial in different aspects: for the environment, the individual itself, and the overall population (Caparros Megido et al. 2016). The production of eatable insects has a lower environmental impact than conventional meat production, due to the lower greenhouse emission. It takes less breeding space, and significantly less land and water usage (Van Huis et al. 2013). In fact, the required farmland per gram of protein of cows is 14 times higher than for insects (FAO[1] 2018). Concerning the water usage required per gram of production, insects only make up 1% of the needed water compared to beef production (Statista 2016). Consequently, insect-based food causes fewer environmental contaminants than conventional meat production (Van Huis et al. 2013). Alongside these environmental benefits, including insects in human diets has several advantages for the individual. The Food and Agriculture Organization of the United Nations supports insects as a natural protein source (Van Huis et al. 2013). In their dry weight mealworms

[1] FAO is the abbreviation for Food and Agricultural Organization.

and crickets include approximately 50% and 75% protein respectively (Rumpold and Schlüter 2013a). Other valuable nutrition-rich ingredients are essential amino acids, indicating a high mineral and vitamin ratio (particularly Omega 3 and vitamin B12), low cholesterol concentration compared to meat-based products, and unsaturated fat (Belluco et al. 2013; Makkar et al. 2014; Rumpold and Schlüter 2013b). Lastly, including insects in human diets also helps to fight against the food supply shortage predicted in the future and thus profiting the overall population. As insects have a high fecundity rate, with year-round breeding a higher level of production can be ensured (Bednářová et al. 2013). Also, the conversion rate of insects is relatively high, meaning that a great portion of the food can be used as final nourishment. Due to these conditions, a larger amount of the population can be supplied (Baiano 2020; Caparros Megido et al. 2016).

Despite the many positive consequences, the willingness to consume insect-based food remains low, as deeply entrenched behavioural attitudes and various other factors are still prevalent (Lammers, Ullmann, and Fiebelkorn 2019; Tan et al. 2016). Particularly, Western and German consumers identify barriers that hold them back from including insects in their diet (Ardoin and Prinyawiwatkul 2021). Yet, due to its presumed indispensable use in the future (Orsi, Voege, and Stranieri 2019), it is necessary to identify business opportunities in Germany that can be leveraged by companies. As elaborating on all possible insect-based food products would have exceeded the scope of the paper, the researchers decided to focus on one product category being insect-based bars. Therefore, the overarching aim of the research is to identify the German consumers' perceptions and product preferences on insect-based bars. The answer to that will be based on two research questions (RQs): (RQ1) *"How do German consumers perceive insect-based bars against existing bar alternatives?"* and (RQ2) *"What are the preferred product attributes of insect-based bars in the German market?"*.

To find meaningful results, the paper is structured into theoretical and empirical parts and concludes with a discussion and managerial implications (figure 1).

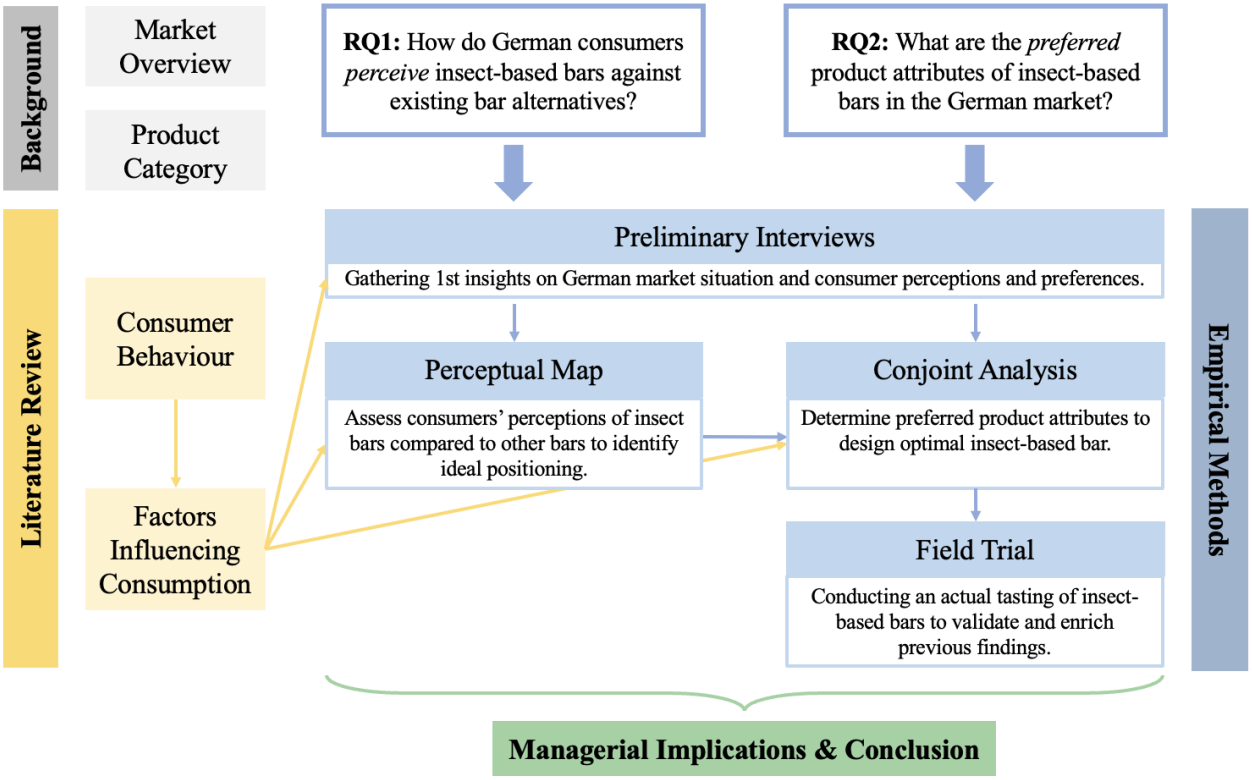

Figure 1: *Overall structure of the thesis*

A more detailed overview of the thesis structure is elaborated in the following:

1. In the second chapter, a **background** about the industry insect-based food is given. Firstly, a market overview, key statistics and market trends are provided to gain a profound understanding of the topic. Secondly, the difference between processed and unprocessed insect-based food is explained leading to the researchers' selected product category.
2. The third chapter is devoted to the **literature review**. It defines the different behavioural terms used within the research to give the reader a scientific understanding of the subject of consumer behaviour. Based on a comprehensive literature research, seven main key factors influencing the consumption of insect-based food are identified. Those factors serve as a foundation for the

empirical methods of the interviews, the perceptual map, and the conjoint analysis. It allowed generating first insights into how consumers assess eatable insects.

3. In sections 4.1.1 and 4.1.2, **preliminary expert and consumer interviews** are conducted. The purpose is to validate the findings of the literature review and get first impressions of the current market situation and consumer perceptions. Both parts are introduced by a theoretical background, followed by an explanation of the selection of the interview partners and questions. In the final step, the interview insights are evaluated. The findings serve as the base for the further empirical studies, respectively their study designs.
4. The goal of the second empirical part 4.2 is to determine the consumers' **perception** of insect-based bars and their **positioning** in comparison to other bars. Insights from the literature and interviews are essential to set up a perceptual map survey. After examining the perceptual map methodology, the survey setup, and the results, a provisional answer to RQ1 is derived.
5. In section 4.3, first answers to the RQ2 are provided by conducting a choice-based **conjoint analysis**. Based on the insights gathered in the literature review, preliminary interviews, and perceptual map analysis, the conjoint survey is designed. The section incorporates three different parts. First, the methodology provides the theoretical base and answers why the choice-based analysis is conducted. Second, the survey design explores the attributes and levels that are tested in the survey. Lastly, the results regarding the preferred product attributes are given and the outcomes are put into context.
6. Chapter 4.4 deals with a **field trial** aiming to qualitative validate and enrich the quantitative conjoint analysis findings as well as to find reasons behind the results. Similar to the other empirical parts, it first explains the methodology and setup, followed by the presentation and discussion of the results. This knowledge helps to extensively answer RQ2 in chapter 5.

7. The fifth chapter thoroughly discusses the **results** from all previous empirical results. Subsequently RQ1 and RQ2 are answered. Based on the findings, managerial implications are given.

The data obtained in the thesis yielded the following results:

The **interviews** revealed that consumers have ambivalent perceptions regarding insect-based food as they characterise it with disgust but also with quality, health, and sustainability. Major barriers are the low availability as well as the lack of knowledge about entomophagy and its benefits. Crucial factors for future consumption are a pleasant taste that is equivalent to non-insect bars and reasonable prices.

The **perceptual map** indicated that insect-based bars are perceived as high in quality (in terms of sustainability, healthiness, good ingredients) but low in appeal (in regard to taste, information, disgust, protein). It emerged that insect-based bars are the market leader in quality while being least appealing compared to existing bar alternatives. Regarding the existing bars, the map illustrates that nut and oat bars are the tastiest bars, in comparison to insect and protein bars that are perceived as the most disgusting ones. Fruit bars are associated with high available information about the bar.

The **conjoint analysis** identified that consumers place the highest value on the attributes base, flavour, and price. In contrast, the eco-label, design (i.e., insect illustration) and marketing claims play a less critical role in their decision-making. Considering attribute levels, customers especially prefer nut bases, chocolate flavour and a price of €1.69. The sample values the integration of an eco-label and agrees that the design should not contain an insect illustration. Preferences on marketing claims were ambiguous, favouring health and sustainability claims. The study further found an elastic demand. Lastly, the findings uncovered preference differences between the typically described target group and the overall sample.

The **field trial** provided additional insights regarding consumers' preferences for the insect bars' packaging, appearance, taste, and willingness to pay (WTP). In terms of packaging, opinions were highly controversial, yet the majority preferred if the bar's name does not mention insects. To be attractive, no insects should be visible on the bar because their appearance evokes disgust. Overall, the insect bars were rated as tasty or very tasty. The sample preferred a crunchy texture, a chocolate coating and trend flavours such as macadamia-salted caramel the most. The participants' average WTP was €2.04.

2 Background

Given that entomophagy is still a rather novel, and for many an unfamiliar topic, the following part will provide some background information to get an overview of the current market situation and available product categories.

2.1 Market Overview

Insects have been a common food source since prehistoric times and are still part of human diets in modern times (Kouřimská and Adámková 2016). By 2018, the market value of edible insects worldwide accounted for $406.3 million and is estimated to reach $1,181.6 million by 2023 (Business Wire and Statista estimates 2018). The majority of insects are eaten in the Asian-Pacific region making up approximately a market value of $476.9 million in 2023, followed by Europe ($261.6 million) surpassing Latin America ($250.6 million) (Bloomberg and Meticulous Research 2018). In comparison to that, North America (+28%) and Europe (+26%) record the highest compounded annual growth of edible insects by region (from 2018-2023) indicating a significant growth potential (Mekko Graphics and Meticulous Research 2018). Nowadays, about two billion people across 113 countries are consuming insect-based food (Ardoin and Prinyawiwatkul 2021). Among those 2,000 edible insect species, mainly beetles (31%), larvae (18%), hymenoptera (14%),

and grasshoppers (14%) are frequently consumed in various forms (BfR 2016). Compared to other regions, where insects have been part of human diets for a long time, in Europe, selling insect-based food has only become permitted in 2018. As insect-based food is categorized as a novel food it is subjected to approval and authorization of the Novel Food Regulation[2]. Despite the high level of safety testing, still, most Western cultures do not consider them as an alternative food source or even regard them as culturally inappropriate (Kouřimská and Adámková 2016; Piha et al. 2018). A study revealed that 42% of the 954 German respondents would "absolutely not" eat insects, whereas only 5% would absolutely include them in their diet (YouGov 2022). However, due to the increase in market value in Europe, Western culture tends to familiarize itself with insect-based food (Piha et al. 2018). For this reason, mainly start-ups have entered the market and are targeting men aged 18-39 years and humans with at least one of the four following characteristics: (1) People with a distinct curiosity and a strong sense of sensation seeking, as they are more open-minded towards alternatives (Caparros Megido et al. 2016); (2) People that are already familiar with eating insects, due to their significantly more positive attitude towards entomophagy (Hartmann et al. 2015; Verbeke 2015); (3) Human beings with an expressed awareness for sustainability and intention to reduce meat consumption; (4) Fitness euphoric people that value the nutrition level and high protein sources in their food (Verbeke 2015; Chan 2019).

2.2 Product Category

Considering the available products on the market a distinction needs to be made between unprocessed and processed insect-based food. Unprocessed insect food presents the insect as a whole (e.g., a snack made of deep-fried crickets). In comparison, processed insect-based food still

[2] Novel Food Regulation: "The Novel Food Regulation helps food businesses bringing innovative foods to the EU market, while guaranteeing their safety, and concerns any food which was not consumed in the EU to a significant degree before 15 May 1997." (European Comission 2022).

incorporates insects but, in a form, where it is not visible (House 2016). A body of literature investigated that the concealed inclusion of insects leads to a higher consumer acceptance than for unprocessed insect-based food, as processed insects trigger less aversion (Caparros Megido et al. 2014; Tucker 2014; Schösler, De Boer and Boersema 2012; Tan et al. 2016; Lensvelt and Steenbekkers 2014). Types of processed insect food are meat alternatives such as insect-based burger patties, pasta, pizza, and comestibles that contain flour such as biscuits, pancakes, and bars (Caparros Megido et al. 2014; Lensvelt and Steenbekkers 2014). The following research paper will however solely focus on insect bars. The fact that the bars[3] can be consumed immediately before changing one's mind about insect food benefits the trial acceptance. Whereas, for other products that still need to be prepared like burgers, pasta, and pancakes, people have more time to evaluate the alternatives and are prone to choose the non-insect-based option (Fischer and Steenbekkers 2018; Orsi, Voege, and Stranieri 2019). Thus, bars appear to be a good entry point to the market compared to non-ready-to-eat products. Within the last couple of years, bars have increasingly become more popular among German consumers. Fruit, oat, nut, and protein bars have entered and captured the market, predominated by chocolate bars (Schadwinkel 2018). Due to the increased popularity and the high likelihood of consumption some start-ups like isaac nutrition, Essento, or JiMiNi'S have already entered the insect-based bar Western market with a variety of flavours (isaac nutrition 2022; Essento 2022; JiMiNi'S 2022). Yet, apart from Essento bars, which can also be bought in a Swiss retail chain, the others are merely available at their respective online shop and do not have a presence in retail stores.

[3] Bar or snack bar will be used interchangeably.

3 Literature Review

Since the intensification of the discussion on entomophagy in the Western world, there has been increased attention in the body of literature. The following part presents a literature overview focused on consumer behaviour and influencing factors around insect consumption.

3.1 Consumer Behaviour

According to The Theory of Planned behaviour by Ajzen (1991, 181), "intentions are assumed to capture the motivational factors that influence a behaviour". Thus, it refers to how much effort consumers put on performing the behaviour. The stronger the intention, the more likely the consumer performs the behaviour. Three factors affect intention: Subjective norms, perceived behavioural control, and personal attitudes (Appendix 1). The relative importance of these factors depends on the situation and the intended behaviour (Ajzen 1991). Subjective norm considers the perception of social pressure to engage in the intended behaviour (Ajzen 1991). The perceived behavioural control encompasses past experiences and the level of difficulty involved to achieve the behaviour (Ajzen 1991). Attitude can be defined as "[…] an overall evaluation that expresses how much we like or dislike an object, issue, person or actions" (Hoyer, MacInnis, and Pieters 2012, 128). Further, attitudes depend on the consumer's overall evaluation and associations related to the situation or object but also the knowledge and experience gained by the consumer (Hoyer, MacInnis, and Pieters 2012; Smith and Swinyard 1983; Fazio, Zanna, and Cooper 1978). Piha et al. (2018) highlighted that consumer knowledge is built on product-related experiences as well as subjective and objective knowledge. Product-related experiences can be traced back to attitudes – more precisely it "[…] refers to behavioural antecedents of attitude" (Piha et al. 2018, 2). While objective knowledge refers to the actual knowledge a consumer has about a product, subjective

knowledge is the consumer's perception of that knowledge (Park, Mothersbaugh, and Feick 1994). In summary, intention, attitude, and perception, are closely related to a consumer's behaviour.

3.2 Factors Influencing Consumption of Insect-Based Food

Literature identifies key factors that influence intention, attitude, and perception, and ultimately the acceptance and willingness to consume insect-based food. Out of these factors, the following seven are reviewed: Socio-demographics & cultural aspects; food neophobia; disgust; personality, familiarity & context; knowledge; sensory attributes & product properties as well as promotion & packaging (figure 2). This approach is in line with previous literature on the consumption of insects and insect-based food. In the following, the most critical aspects are listed, constituting the basis for the empirical part.

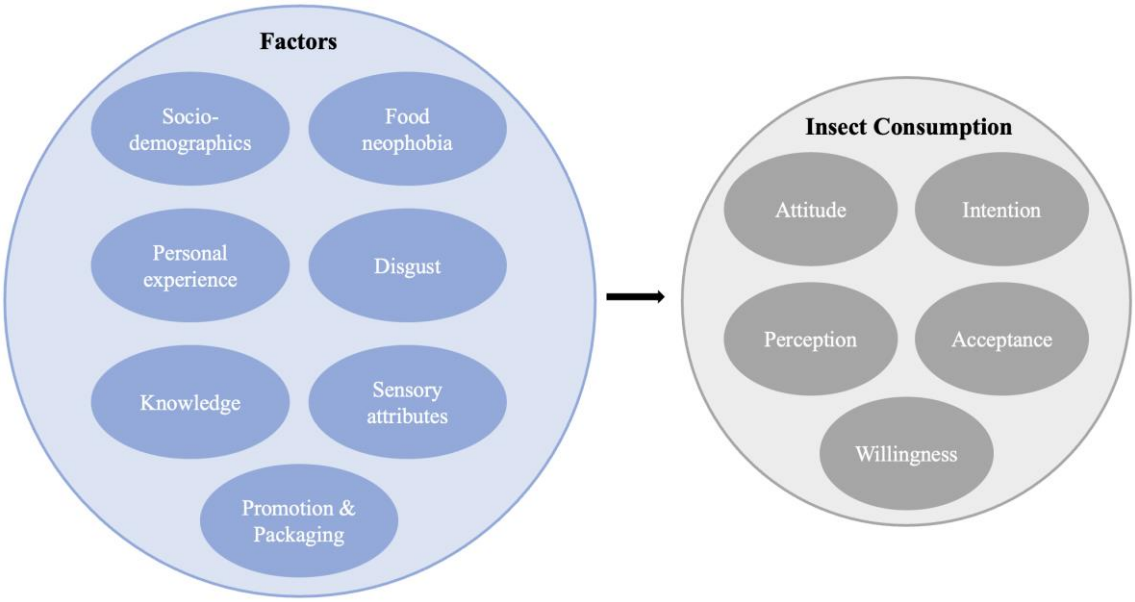

Figure 2: *Factors influencing consumption of insect-based food*
Own illustration based on Naranjo-Guevara et al. (2021)

3.2.1 Socio-Demographics & Cultural Aspects

As of February 2022, **gender** is investigated in 52 studies of which approximately two-third observed an effect of gender (Kröger et al. 2021). The attitude towards insects as food differs among gender (Caparros Megido et al. 2016; Cicatiello et al. 2016; Lammers, Ullmann, and

Fiebelkorn 2019). Most studies show that women are less willing to consume insects (Laureati et al. 2016; Menozzi et al. 2017; Tan, van den Berg, and Stieger 2016; Woolf et al. 2019). Verbeke (2015) observed that male respondents were two times more likely than female respondents to include insects in their diet. This might be explained by women having a higher aversion towards insects as well as being more afraid and disgusted than men (Orsi, Voege, and Stranieri 2019; Verbeke 2015). Moreover, some studies found that men are keener on taking on adventures, more open to trying something new and are more curious (de Boer, Schösler, and Boersema 2013; Szendrő, Tóth, and Nagy 2020; Verbeke 2015). In contrast, some studies did not determine gender as a significant factor on the willingness to accept insects as food (Hartmann et al. 2015; Naranjo-Guevara et al. 2021).

Regarding the significance of the factor **age**, the opinions are very mixed. Several studies did not identify age as a significant factor for the perception of insects (Cicatiello et al. 2016; Hartmann et al. 2015; Mancini et al. 2019). Most studies, that observed a link between age and the acceptance of insects as food, agree on young people being more open towards insects as food than older people (Orsi, Voege, and Stranieri 2019; Laureati et al. 2016; Szendrő, Tóth, and Nagy 2020; Tan, van den Berg, and Stieger 2015; Verbeke 2015). An increase of ten years in age results in a 27% decrease of the likelihood of implementing insect food in the diet (Verbeke 2015). The findings might be explained by a higher sensation-seeking attitude of younger people (Tan, van den Berg, and Stieger 2016). However, contrary observations exist (e.g., Caparros Megido et al. 2014; Dupont and Fiebelkorn 2020). Additionally, Szendrő, Tóth, and Nagy (2020) state that the highest acceptance of insects was found for middle-aged people (30-39 years-old) who had a higher knowledge about insect consumption than lower age groups (18-29 years-old). This is in line with (Caparros Megido et al. 2014) who showed that people older than 45 years were more open towards insect food.

A controversial driver of the willingness to eat insect-based food is **education**. Cicatiello et al. (2016) found that there is a link between education and the willingness to eat insects. A prior study revealed that more people with a university background (e.g., university students and staff) accepted insect-based food than people without a university background (Laureati et al. 2016). It may be due to a stronger environmental awareness of high educated people compared to less educated (Cicatiello et al. 2016). This might be explained by a higher positivity towards novelties of people with more knowledge (Szendrő, Tóth, and Nagy 2020). Most prior studies state that the level of education is not a significant factor (Hartmann et al. 2015; Kröger et al. 2021; Orsi, Voege, and Stranieri 2019; Tan, van den Berg, and Stieger 2015; Verbeke 2015).

Culture is a factor that influences the willingness to eat insects (Hartmann and Siegrist 2016; Sun-Waterhouse et al. 2016). Cultural acceptance and cultural conditioning are inevitable for the attitude towards insect foods (Ardoin and Prinyawiwatkul 2021; Hartmann et al. 2015). This is underlined by the finding that large differences in the perception of insects between Western and Eastern countries (Gómez-Luciano et al. 2019; Tan et al. 2015; Vanhonacker 2013). The willingness of Western consumers to implement insect food in their eating habits is very low compared to Eastern consumers (Gómez-Luciano et al. 2019). In Eastern societies, insects are seen as delicacy and valuable food items due to the nutrition and health benefits (Sun-Waterhouse et al. 2016). However, strong negative associations (e.g., pests, disease) as well as skepticism and disgust are factors of rejection in Western societies (Tan et al. 2015; Vanhonacker et al. 2013). According to Ardoin and Prinyawiwatkul (2021), Western consumers will not introduce insects into their diet as long as insect food does not deliver the same quality and satisfaction like traditional food. These observations can be confirmed by previous studies of Hartmann et al. (2015) and Tan et al. (2015), in which the differences between Chinese and German consumers as well as Thai and Dutch consumers were examined.

However, the perception regarding insects does not only vary across continents but also between European subcultures and between the Northern and Southern parts of a country (Hartmann et al. 2015; Menozzi et al. 2017; Sogari, Menozzi, and Mora 2019; Verneau 2016).

In comparison to the other sociodemographic factors, there are only a few studies examining the effect of **income and occupation**. Both factors are not considered as significant (Schlup and Brunner 2018; Szendrő, Tóth, and Nagy 2020; Woolf et al. 2019).

3.2.2 Food Neophobia

Food neophobia is defined as the reluctance to eat novel or unfamiliar foods (Pliner and Hobden 1992). Though what is considered as unfamiliar differs across cultures (La Barbera 2018). The current body of literature indicates that food neophobia is an essential predictor of people's willingness to consume insect-based food (Hartmann and Siegrist 2016; La Barbera 2018; Lammers, Ullmann, and Fiebelkorn 2019; Caparros Megido et al. 2016; Orsi, Voege, and Stranieri 2019; Piha et al. 2018; Tan, van den Berg, and Stieger 2016; Verbeke 2015). Potential drivers for insect neophobia are the poor prevalence of insect food in the West, the fear of an adverse taste, the expectation of undesirable effects after consumption, and a general aversion to insects (Caparros Megido et al. 2016; Verbeke 2015). Caparros Megido et al. (2016) and Verbeke (2015) were among the first researchers to conduct a study about consumers' acceptance of insect-based food in Europe. Both studies identified food neophobia as the most significant factor contributing negatively to people's willingness to eat insects. Likewise, more recent entomophagy research focusing on Western countries concludes that food neophobia is among the key drivers in predicting consumers' acceptance of insects in their diet (Hartmann and Siegrist 2016; Lammers, Ullmann, and Fiebelkorn 2019; Orsi, Voege, and Stranieri 2019; Piha et al. 2018; Tan, van den Berg, and Stieger 2016; Zielińska 2020). Several researchers specifically assessed German

consumers' willingness to try insect products and unanimously acknowledged that their food neophobia towards insects is highly pronounced (Meixner and Mörl von Pfalzen 2018; Orsi, Voege, and Stranieri 2019; Hartmann et al. 2015). Considering the insect food condition, various studies demonstrate that food neophobia not only negatively impacts people's willingness to eat insects in their unprocessed form but also in their processed one (Hartmann and Siegrist 2016; Lammers, Ullmann, and Fiebelkorn 2019; Verbeke 2015). Nevertheless, according to Orsi, Voege, and Stranieri (2019), food neophobia is more distinct for whole insect products. To reduce insect neophobia, several actions have been proposed. Offering tastings helps to lower food neophobia (Lensvelt and Steenbekkers 2014; Caparros Megido et al. 2016; Orsi, Voege, and Stranieri 2019), whereas informing people about the benefits of insect food has not proven to be an effective strategy (Lensvelt and Steenbekkers 2014; Verbeke 2015). Moreover, several studies revealed that food neophobia decreases when the insects are incorporated in an invisible form in a familiar meal such as pasta or burgers (Hartmann et al. 2015; Lensvelt and Steenbekkers 2014; Caparros Megido et al. 2016; Tan, van den Berg, and Stieger, 2016).

3.2.3 Disgust

After food neophobia, **disgust** is the second most mentioned factor to explain Westerners' aversion to insect-based food (Hartmann et al. 2015; La Barbera 2018; Lammers, Ullmann, and Fiebelkorn 2019; Orsi, Voege, and Stranieri 2019; Piha et al. 2018; Russell and Knott 2021; Tan, van den Berg, and Stieger 2016; Verbeke 2015). Disgust is an emotional reaction that is said to be universal for all humans, however, it can be evoked by a diverse set of factors (Rozin and Fallon 1987). Generally, disgust is a critical driver for adverse reactions to novel foods, especially those of animal origin (Pliner and Pelchat 1991). Concerning insects, research shows that consumers' disgust sensitivity is highly individual and depends on various aspects such as culture and age (La Barbera

2018; Orsi, Voege, and Stranieri 2019). For example, Orsi, Voege, and Stranieri (2019), demonstrated that younger consumers have a lower disgust sensitivity than older ones. Overall, prior studies conclude that disgust towards insects negatively influences the acceptance of insects as food (Fischer and Steenbekkers 2018; Gmuer et al. 2016; Hartmann and Siegrist 2016; La Barbera et al. 2018; Mancini et al. 2019a; Meixner and von Pfalzen 2018; Orsi, Voege, and Stranieri 2019; Russell and Knott 2021; Verbeke 2015). La Barbera et al. (2018) studied the relationship between food neophobia and disgust to learn about the two factors' relative contribution to the acceptance of insect-based food. The experiment highlighted that both elements contribute independently to consumers' willingness to try insect products, though disgust had a significantly higher explanatory power. Conversely, in the study by Hartmann and Siegrist (2016), disgust has been found to contribute less than food neophobia to people's willingness to eat insect food. Similarly, to food neophobia, disgust towards eating insects could be reduced through tastings and offering processed insect products (Hartmann and Siegrist 2016; Lensvelt and Steenbekkers 2014; Mancini et al. 2019b; Orsi, Voege, and Stranieri 2019).

3.2.4 Personal Experience, Familiarity & Context

Personal experience refers to previous insect consumption. In a literature review, it was found that all considered studies dealing with personal experience (28 in total) stated a positive impact of previous consumption on consumer acceptance toward edible insects (Kröger et al. 2021). Experimental tasting positively affects peoples' perception of insects and peoples' willingness to consume insects in the future (Caparros Megido et al. 2014; Caparros Megido et al. 2016; Collins, Vaskou, and Kountouris 2019; Woolf et al. 2019). This results from a positive correlation between a positive first tasting experience of novel food and the probability of consuming it in the future (Sogari, Menozzi, and Mora 2018). In case of no prior tasting experience, decisions to try insects

are mostly dependent on the participants' level of interest and disgust or curiosity (Tan et al. 2015). Hereby, a factor influencing the willingness for tasting is also gender. In line with the findings in 3.2.1, 27% of men had previous tasting experience whereas only 13% of women tried insects before (Wilkinson et al. 2018).

Furthermore, the higher the number of insect consumption occasions, the higher the willingness to consume insects (Woolf et al. 2019). Thus, increasing exposure by providing opportunities to try insects may be a very effective strategy to generate acceptance and familiarity among consumers (Ardoin and Prinyawiwatkul 2021; Wilkinson et al. 2018). However, an insect tasting does not result in an unrestrained acceptance of insects as food as barriers like availability exist (Tan et al. 2015). In addition, a bad consumption experience can lead to a rejection of insects as food and was mainly a result of disgust, unfamiliarity, or both (Tan et al. 2015).

A further component shaping the willingness to try insect-based food is explained by the **context**. For Western consumers, most insect tasting experiences are unique occasions that occur during journeys, special events or in local restaurants (Tan et al. 2015). A higher willingness can be found at pubs and food festivals in comparison to calmer environments such as cafés (Motoki et al. 2020) and in curious situations compared to the consumption within a regular meal (Tan et al. 2016). The extent to which people accept edible insects as food hinges also on the involved emotions. Motoki et al. (2020) suggests that people show a higher willingness to eat edible insect products when the context evokes positive emotions such as excitement and fun. Moreover, participants indicated that they would be more inclined towards insect-based food when gathering with friends since this setting typically goes hand in hand with feelings of fun and excitement compared to other social contexts (Motoki et al. 2020).

3.2.5 Knowledge

A prior study by (Lammers, Ullmann, and Fiebelkorn 2019) demonstrated that 94% of the German participants have heard of the use of insects as food. The same study further found out that they largely drew their **knowledge** on edible insects from media sources such as the internet, TV, and newspapers. According to the study results, however, the knowledge of entomophagy does not translate into a likeliness to eat insect-based food despite marketing efforts (Lammers, Ullmann, and Fiebelkorn 2019; Verbeke 2015). Other prior studies highlighted that additional informational campaigns containing nutritional and environmental advantages might be required to increase the willingness to eat insect-based food (Collins, Vaskou, and Kountouris 2019; Cox, Evans, and Lease 2007; Rumpold and Schlüter 2013a). Although consumers are aware of entomophagy, they lack knowledge about e.g., the nutritional benefits (Collins, Vaskou, and Kountouris 2019).

Several studies indicate (Menozzi et al. 2017; Schlup and Brunner 2018; Tan et al. 2015) that a high notion of **environmental awareness** induces an increased acceptance of insect-based food. According to Kostecka, Konieczna, and Cunha (2017) and House (2016) environmental awareness is even correlated with an increased likelihood to consume insect-based food (Hartmann and Siegrist 2016) but does not represent a sufficient stimulus for repeat purchases (House 2016). In contrast, while insect-based food is widely considered as sustainable (Hartmann et al. 2018), other studies suggest that it is rarely a sufficient motive for eating insect-based food (Lammers, Ullmann, and Fiebelkorn 2019; Naranjo-Guevara et al. 2021), especially in the German market (Hartmann et al. 2015; Lammers, Ullmann, and Fiebelkorn 2019). Concerning health-awareness, a study by Hartmann et al. (2015) indicates that health awareness does not trigger an increased likelihood to consume unprocessed insects among German consumers.

3.2.6 Sensory Attributes & Product Properties

Sensory aspects and product properties play a role in shaping the consumer acceptance of insect-based food (Lammers, Ullmann, and Fiebelkorn 2019; Schlup and Brunner 2018), whereas taste, texture, appearance, insect type and product category are considered as associated factors in the following.

Taste displays a first critical determinant for the consumer acceptance (Caparros Megido et al. 2016), specifically in the case of bars (Bartkowicz and Babicz-Zielińska 2020). Moreover, taste is also a major predictor in the continuous consumption of edible insect products (Tan et al. 2016). A study has illuminated that the more negative a person's attitude towards insects is, the lower is the perceived sensory-liking and willingness to try insects (Tan et al. 2015). A match between real and expected **texture** and taste also displayed a critical success factor (Collins, Vaskou and Kountouris 2019). Insect-based dishes and ultimately products with both texture and sensorial characteristics adapted to Western preferences and familiar preparations can enhance the acceptance of edible insects (Clarkson, Mirosa, and Birch 2018; Mishyna, Chen, and Benjamin 2020; Naranjo-Guevara et al. 2021; Tan et al. 2015; Tan et al. 2016). However, another study found that even though insects were prepared in a familiar way, the insect-based products were rated lower in taste than the original product (Tan, van den Berg, and Stieger 2016). In terms of product **appearance**, prior literature agreed that the visibility of insect pieces leads to negative associations (Bartkowicz and Babicz-Zielińska 2020; Hartmann et al. 2015; Orsi, Voege, and Stranieri 2019; Tan, van den Berg, and Stieger 2016) and consumers may be more open-minded towards processed insect-based food (Ardoin and Prinyawiwatkul 2021; Caparros Megido et al. 2016; Naranjo-Guevara et al. 2021; Schäufele, Albores, and Hamm 2019; Tan et al. 2015).

3.2.7 Promotion & Packaging

Another critical area to consider is **media and communication** since they are the first touchpoints consumers typically have with products. Consumers that trust media reporting on insect food (i.e., on its nutritional and environmental benefits) could be more motivated to engage in purchase activism for sustainability reasons. Media trust can be established by an increased exposure of insect products (Legendre et al. 2019). Additionally, the use of influencer endorsement may further drive consumers to trial while disseminating knowledge about edible insects and their taste (Collins, Vaskou, and Kountouris 2019; Shelomi 2015).

As far as **packaging and labels** are concerned, an appealing naming, branding, description texts, product visualization and the conveyance of health advantages are critical to positively impact consumer's perceptions of insect-based food (Ardoin and Prinyawiwatkul 2021). Moreover, consumers prefer not to see a realistic visualization of the base insect on-pack (de-Magistris, Pascucci, and Mitsopoulos 2015) and rather prefer a more ambiguous naming and more implicit descriptions (Baker, Shin, and Kim 2016). According to Müller et al. (2016), insect-product claims are majorly related to health, while focusing predominantly on protein. The second most prominent claim is centered around taste (18.9%) and claims about the environment represent 17.1%, often comparing production of edible insects with traditional livestock production (Müller et al. 2016). Set against this, it has been argued that a shift from claims about health to a more hedonic approach - highlighting the tasty and exceptional experience - may lead to elevated expectations and in turn to a higher likeliness to consume insects (Berger et al. 2018; Clarkson, Mirosa, and Birch 2018). Customers might also believe that the claims constitute more of a marketing trap since current edible insect products do not have an ecological or organic label (Lammers, Ullmann, and Fiebelkorn 2019). Consumers further suggested that insects as ingredients should be clearly declared on-pack (Van Thielen et al. 2019).

3.2.8 Summary

Table 1 provides a summary of the key take-aways from the literature review from 3.2 which serve as the basis for the further research methods.

Section	Key Facts Factors Influencing Consumption
Socio-demographics	Findings are controversial regarding gender and age. However, men and younger people tend to be more open towards insect-based food and positive link between education and willingness to consume insects was found in earlier studies (cp. 3.2.1).
Food neophobia	Literature agrees that food neophobia is a major factor shaping consumer's willingness to consume insects whereas tastings and the incorporation of insects in an invisible form can mitigate this effect (cp. 3.2.2).
Disgust	Disgust is an explaining variable for Westerner's reluctance towards insect-based food. It can be reduced by tastings and through offering processed products (cp. 3.2.3).
Familiarity	Familiarity with insects through increasing exposure (e.g., prior tastings) positively impinges on consumers' perceptions of insects and the willingness to consume it in the future (cp. 3.2.4).
Knowledge	Literature reveals dissonance about the importance of knowledge, environmental and health awareness about entomophagy in terms of likeliness to consume (cp. 3.2.5).
Sensory attributes	Literature agrees on taste as a critical aspect shaping consumers' acceptance of insect-based food. Consumers value products with appealing texture and similarity to known products (cp. 3.2.6).
Promotion & packaging	A trustworthy media conveyance of the benefits of insect-based food, may lead to purchase activism. Though most companies that offer insect-based food use nutritional claims, studies suggest that hedonic claims may increase expectations towards the product. While consumers do not want to face an on-pack insect illustration, they value transparency, e.g., through an eco-label or on-pack ingredient declaration (cp. 3.2.7).

Table 1: *Key facts factors influencing consumption*

4 Empirical Methods

Primary research was carried out aimed at contributing to the already existing body of knowledge and answering the respective research problems (Hox and Boeije 2005), expressed through RQ1 and RQ2 in this paper. To determine the consumers' perceptions and preferences for the German market, four empirical methods were exerted. They include preliminary interviews and a perceptual map analysis to answer RQ1 and a conjoint analysis and a field trial to answer RQ2.

4.1 Preliminary Interviews

The expert and consumer interviews generated more specific knowledge on the German market and its consumers. In line with the literature review (cp. part 3), it appeared that the perception about insect-based food is often characterised by disgust, or sometimes by a great quality, being healthy, and sustainable. There was a broad agreement that taste is a critical factor shaping the acceptance of insect-based food. However, most commonly, consumers have low to no perception about insect-based food due to a lack of knowledge about entomophagy and its benefits as well as a missing presence in retail stores. To validate the previous qualitative findings, it is crucial to carry out a quantitative perceptual map analysis among a bigger sample to ultimately draw statistically proven conclusions on the consumer perceptions.

4.2 Perceptual Map

While the first factor (55%) is the most important one to explain the investigated items, the second one accounts for 31% of the cumulative variance, and the third one is the smallest with only 13% (table 6). The low explanation power of the third factor is also emphasized when looking at the scree plot as the third component is closely located to an eigenvalue of 1.0. Nevertheless, the communalities, which indicate how well the variables are represented by the factors, are promising,

given that they are all close to one (Backhaus et al. 2018). Despite the positive outcomes, the unlimited and unrotated analysis has a major drawback revealed by the factor loadings of the attributes which are indicated in the component matrix. According to Backhaus et al. (2018), the absolute value of each loading needs to be greater than 0.5 to be relevant. Yet, if one attributes loads on more than one factor simultaneously with a value greater than 0.5 (=cross-loading) it is not possible to clearly associate the attribute with one factor and thus to draw reasonable conclusions. Cross-loadings are represented by their light colour in the component matrix (table 7; Appendix 12). As this output delivered cross-loadings for four out of the eight attributes (taste, protein, sustainability, health) another step was conducted.

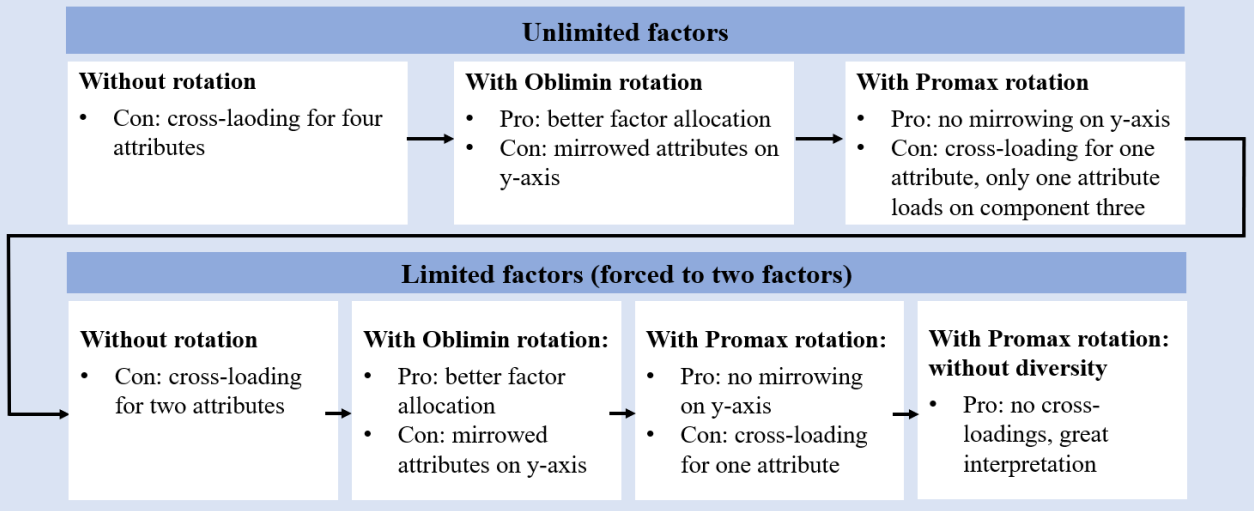

Figure 5: *Perceptual map steps to obtain interpretable results*

For a better attribute to factor allocation and interpretation, an unlimited but rotated factor analysis was performed in the **second step** (figure 5). When deciding which rotation to take, it is crucial to consider the correlation between the factors. An orthogonal rotation (e.g., Varimax) is characterized by non-correlated factors, while an oblique rotation (e.g., Oblimin, Promax) is applied when the factors correlate because it relaxes the orthogonality constraint. The latter is favourable in social science as factors normally correlate (Hair et al. 2010). Thus, an oblique rotation was used. However, within the common Oblimin rotation the attributes were mirrored on

the y-axis. Consequently, a positive attribute like taste is located negatively in the three-dimensional coordinate system, whereas a negative like disgust appears positively. This change of sign makes it challenging to interpret the results, wherefore subsequently an unlimited factor analysis with a Promax rotation was carried out. It provided favourable outcomes for the signs of taste and disgust and reduced the cross-loadings from four to one (health). However, only one attribute loaded on the third factor (protein) (Appendix 12). As mentioned previously the third component covered only a little part of the cumulated variance percentage and is also extremely close to the eigenvalue threshold of 1.0.

That is why a factor analysis forced to two dimensions without rotation was conducted in a **fourth step**. The two-factor solution can explain 86% of the total variance, representing a satisfactory result. In other words, 86% of the information can be obtained when only two factors are extracted. (In contrast, the three-factor solution could explain 99% of the total variance.) Moreover, the extracted communalities demonstrate that, except for two variables, the factors explain more than 90% of the respective variance of each variable. Yet, more than 50% of the variance is still explained for the two variables “protein” and “health” (table 6). Looking at the factor loadings, it can be witnessed that two out of eight attributes (taste & sustainability) are cross-loaded on both factors (table 7). As a result, no clear pattern can be identified, which does not allow for a meaningful interpretation of the loadings. Therefore, the oblique rotation method Oblimin was applied. However, still two attributes (information & diversity) load on both factors. Moreover, the interpretation of the loadings constitutes the same issue as with the three-factor Oblimin version. Consequently, the Promax rotation was used in the **next step** resulting in improved interpretability and less ambiguous factor loadings (table 7). Only diversity still has a noticeable cross-loading (>0.5 on both components) which is why this attribute has been excluded for the next step.

Without Rotation		
	Components	
	1	2
Taste	-.712	.664
Disgust	.866	-.467
Information	-.974	.117
Protein	.337	-.650
GoodIngredients	.466	.875
Sustainability	.734	.632
Health	.576	.464
Diversity	-.997	-.072

With Rotation OBLIMIN		
	Pattern Matrix	
	Components	
	1	2
Taste	-.982	.088
Disgust	.948	.164
Information	-.771	-.510
Protein	.708	-.309
GoodIngredients	-.304	.986
Sustainability	.060	.958
Health	.070	.726
Diversity	-.650	-.676

With Rotation PROMAX		
	Pattern Matrix	
	Components	
	1	2
Taste	1.016	.195
Disgust	-.961	.067
Information	.752	-.439
Protein	-.752	-.391
GoodIngredients	.390	1.040
Sustainability	.014	.973
Health	-.015	.735
Diversity	.615	-.621

With Rotation PROMAX		
	Pattern Matrix	
	Components	
	1	2
Taste	.987	.131
Disgust	-.953	.123
Information	.775	-.476
Protein	-.717	-.333
GoodIngredients	.304	.999
Sustainability	-.061	.954
Health	-.077	.729
Diversity excluded from analysis		

= attribute loads on component one

= attribute loads on component two

= cross-loading: if attribute mainly loads on component one but also high on component two

= cross-loading: if attribute mainly loads on component two but also high on component one

Table 7: *Factor loadings with limited number of factors*

Finally, the factor analysis was run for the last time, again limited to two dimensions and with the Promax rotation. The four attributes taste, disgust, information, and protein load clearly on component one, whereas the three attributes good ingredients, sustainability, and health load strongly on component two (table 7 & figure 6).

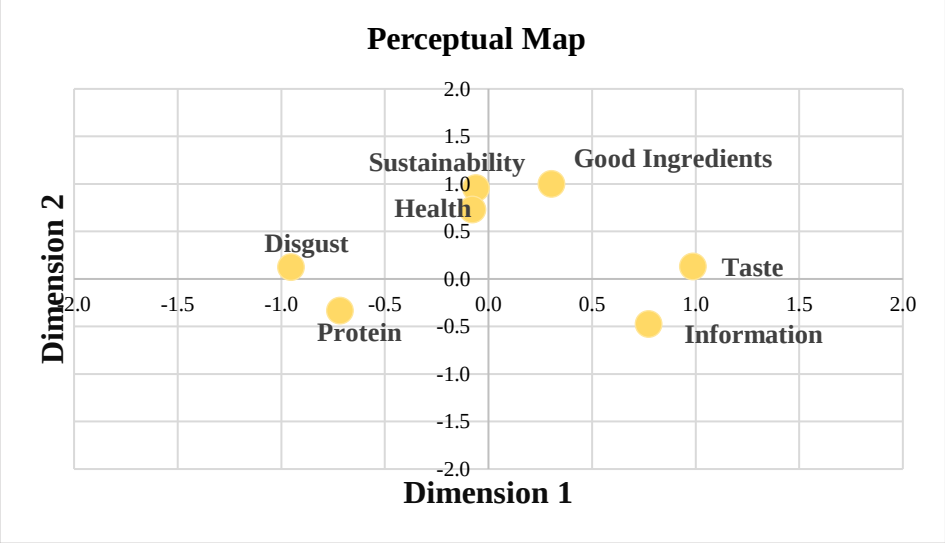

Figure 6: *Perceptual map only including attributes*

To discuss the perception of insect bars against existing bar types the factor scores (coordinates of the bars) (Appendix 13) were included in the SPSS component plot. The **ultimate perceptual map** including the attributes, bar types, dimensions, and vectors is illustrated in figure 7.

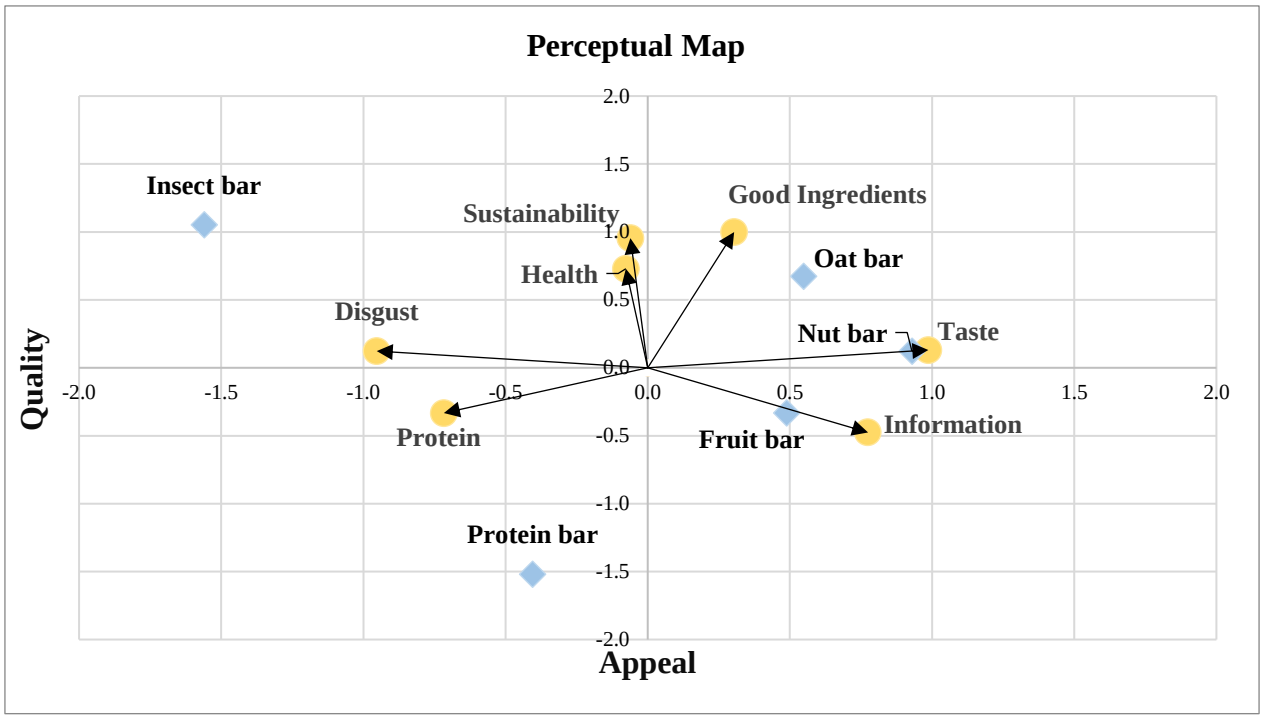

Figure 7: *Perceptual map including attributes and bars*

As seen in the figure, the components are no longer labelled as factor/dimension/component one and two but are now described with a collective term. To assign a meaning to the dimensions, the factor loadings play a decisive role. The stronger the factor loading to the dimension the greater the influence and the greater the attribute contributes to one factor (Hair et al. 2010). According to the pattern matrix[4] factor one is described by four attributes: taste, disgust, information, protein. Mainly taste and disgust are strongly related to the given factor, whereas information and protein have a lower factor loading and thus are less relevant to the factor. Since particularly taste and disgust are representing **factor one**, it has been labelled as **appeal**, resulting in the following statements: (1) The better the taste the higher the appeal; (2) The higher the disgust the lower the appeal; (3) The more information the higher the appeal; (4) The more protein the less the appeal. A further distinction between the attributes of appeal can be made. Taste and information are

[4] When applying an oblique rotation, SPSS produces two matrices instead of one. The structure matrix represents the correlations between variables and factors whereas the pattern matrix represents the factor loadings (IBM 2020).

positively associated with appeal, conversely, disgust and protein are negatively perceived. Consequently, taste and information belong to one cluster, and disgust and protein to the second cluster. The second dimension is described by the attributes good ingredients, sustainability, health. The matrix values disclose that health is least relevant to the factor, while the first two have similar values being close to one. All three attributes have in common that they represent a product standard, wherefore the **second factor** is from now on called **quality**. Hence, subsequent conclusions can be drawn: (1) The better the ingredients the better the quality; (2) The higher the sustainability the better the quality; (3) The healthier the better the quality. Since all attributes are similarly located within the perceptual map, they represent the third cluster.

Moreover, the **vectors in terms of length, angles, and directions** can be interpreted. A vector represents a line in the perceptual map from the origin to the product attribute. The longer the vector the stronger the attribute describes the product category, or in other words the better the attributes differentiate the brands/types of bars (Cornelius, Wagner, and Natter 2010). Based on the perception of the survey respondents the following attributes are listed in descending order of differentiation power: (1) Good ingredients; (2) Taste; (3) Disgust; (4) Sustainability; (5) Information; (6) Protein; (7) Health. The **vector lengths** of attributes one to five are similar while six and seven are comparatively shorter than the other five. Thus, good ingredients is the attribute that differentiates the bar types the most, while protein and health are the least pivotal. However, this can be traced back to the fact that protein and health have the lowest communalities and would have been better described by a third factor (Appendix 14). Therefore, this ranking should be treated with caution to avoid hasty conclusions.

Other noteworthy insights are the **vector angles**. The smaller the vector angles of the attributes the more correlated the survey participants' perceptions of the attributes (Cornelius, Wagner, and Natter 2010). For a proficient interpretation of the relatedness of the seven attributes, they are

divided into three categories of correlation. To identify the level of correlation commonly used coefficient values were adduced (Meghanathan 2016). The first one looks at attributes that are very strongly correlated with each other. Particularly, taste and information (correlation of 0.80) and sustainability and good ingredients (correlation of 0.87) are very strongly correlated. This means a bar that is perceived as sustainable is also perceived as healthy and free of harmful ingredients. Secondly, some attributes are strongly negatively correlated like taste and disgust (correlation of -0.94) and information and disgust (correlation of -0.93). Therefore, one can say that the better a bar tastes as well as the higher the information available about a bar the lower the level of disgust and vice versa. Hence, the attributes are placed in the opposite direction of each other and are seen as mutually exclusive. Thirdly, attributes that do not influence each other are called perpendicular and have a correlation coefficient value between -0.2 and 0.2. Among them are taste and health, taste and sustainability, disgust and health, likewise disgust and good ingredients. Those attributes are either very weak positive or very weak negative to each other and thus do only weakly affect the other attribute.

Lastly, **vector directions** have an impact on the interpretation of the perceptual map. The closer the vector is to an axis, the more it is assigned to one dimension (Cornelius, Wagner, and Natter 2010). From this, it can be drawn that taste and disgust are mainly contributing to the interpretation of the dimension of appeal. Whereas sustainability and health are closest to the dimension of quality. This finding is somehow aligned with the factor loading matrix which revealed that taste and disgust describe the first factor appeal the strongest. Yet, for quality, good ingredient has the highest loading. But as this attribute also loads on appeal, sustainability and health are thus closer to the quality axis.

In the next step, the **positioning** of the insect bar in comparison to its established competitors will be discussed after having examined each bars' individual positioning. The analysis of the bars'

positions in the perceptual map will reveal whether a white space exists in the snack bar market, which may be filled by the introduction of the optimal insect bar. Overall, the nut bar is perceived as the most appealing bar, whereas its quality is mediocre compared to the other bars. The nut bar is considered the tastiest bar, and consumers feel well informed about it. This finding could be the reason for the popularity of the nut bar as it is the second most frequently consumed one (Appendix 9). Only 28% of the respondents never eat nut bars, as opposed to more than 40% for all other bar types. The oat bar is perceived as the bar with the second-best appeal and quality, scoring high on health, sustainability, good ingredients, and taste. It is striking that no other bar is located clearly in the upper-right quadrant of the perceptual map, which means it is the only bar being relatively strongly on both dimensions. In contrast, the protein bar is the sole bar in the lower-left quadrant. Compared to its competitors, it is least associated with quality. Protein bars are usually made of a homogenous base, which hinders consumers from identifying its ingredients. Consequently, it is challenging for consumers to assess whether the ingredients are sustainably produced or free from harmful ingredients. In addition, protein bars are known for containing many additives[5] that keep the bar together but are not perceived as healthy (Steelsmith 2016). In terms of appeal, the protein bar is not perceived as being tasty, which could also be explained by the texture consumers often describe as sticky. However, consumers are the most knowledgeable about protein bars, which may be explained by the major protein trend in Germany in recent years (Thielking 2020). Moreover, the protein bar is most strongly associated with containing protein which validates the quality of the data, as any other outcome would be conspicuous. Further, it is noticeable that even though the protein bar is mostly associated with negative characteristics, it is still the most frequently consumed bar among the sample (Appendix 9). This finding could be attributed to the trend of

[5] According to the World Health Organization, Food additives are "substances added to food to maintain or improve its safety, freshness, taste, texture, or appearance" (WHO 2018).

protein-rich foods and their reputation to satiate quickly and help build muscle (Thielking 2020). The fruit bar is perceived as being of low quality, yet moderately appealing. Although the bar contains a lot of fruit, it is not perceived as healthy which could be due to its widespread reputation for containing a high amount of sugar. Stiftung Warentest revealed that fruit bars have on average 48% sugar in the German market (Stiftung Warentest 2020). Apart from that, consumers seem to be very educated about the bar. In turn, this could also contribute to the fact that the fruit bar is not perceived as healthy despite its name.

Finally, the **perceptions** of insect bars compared to existing bar alternatives are contrasted. On the one hand, the insect bar has the highest association with quality. On the other hand, it is perceived as the least appealing bar. It is striking that even though consumers are not well informed about insect-based bars, they perceive them as the highest quality bars. This result aligns with the consumers' expectations mentioned during the interviews. The consumers indicated they expect high-quality products with a low ecological impact. In the perceptual map, the insect bar is associated as very healthy, sustainable, and free of harmful ingredients. This insight indicates that the perceptions of quality attributes are based on intuition or expectations rather than actual knowledge. Moreover, the consumer perceptions imply that the respondents were not concerned about potential contamination through insects. These findings validate the results of the consumer interviews, where the majority did not express any safety or hygiene concerns. However, this is in contrast to existing literature (cp. 3.2.1). Regarding the first cluster in the appeal dimension (taste and information), it becomes evident that consumers have the least information about insect bars and consider them as the least tasty bar. Nevertheless, it is essential to mention that 100% of the respondents have never eaten insect bars, which is why it is only about perceived taste (Appendix 9). Current literature demonstrates that previous experience and familiarity positively influence the perception of insect-based food (cp. 3.2.4). Moreover, the expert interviews revealed that insect-

based food is rarely available in food retailers in Germany, limiting the available information significantly. Concerning the second cluster in the appeal dimension (disgust and protein), consumers associate insect bars with a high protein content and the most disgusting bar among the other types. Consumers seem to be aware of the natural protein source that insects represent, since they perceive the insect bar as the second most protein rich. Again, this aligns with the consumers' expectations during the interviews as they stated high-quality nutritional values are required to consume insect-based food. Regarding disgust, multiple factors can explain its strong association with the insect bar. First, given that more than 60% of the sample was female might have strengthened the disgust association (cp. 3.2.1). Second, the study was conducted with German consumers and previous research confirms that Western societies have strong negative associations with insects (cp. 3.2.1). Third, food neophobia and the general unfamiliarity of insect-based food influence the perception and acceptance significantly (cp. 3.2.2; 3.2.4). Compared to the protein bar, it is striking that the insect bar is associated with high protein content and high quality. This finding may be driven by the fact that protein bars are perceived as artificial protein sources, whereas insects are perceived as natural ones. In contrast to the oat and nut bar, the insect bar lacks appeal. Consumers are much more familiar with the oat and nut bar and perceive them as tasty. To enhance the insect bar's appeal and position it in the upper-right quadrant, it will be crucial to improve its taste perception. Consumers and experts confirmed during the interviews that taste is the most critical attribute to increase the acceptance of insect-based food. Additionally, consumers mentioned they would buy other bar alternatives if the insect bars were not tasty.

To identify which product features are preferred by consumers and are thereby more appealing, a conjoint analysis must be conducted.

4.3 Conjoint Analysis

Base and flavour: Concluding from the results, **taste** displays the variable with the highest importance, making up for almost half of the attribute importance. Averaged at 23.5%, the relative attribute importance score for flavour amounts to 21.4% for women and 26.6% for men, indicating that men place a higher importance to flavour. Age-wise, the importance of the factor base declines in the older age groups. While participants aged up to 25 indicated an above average importance for this attribute, the oldest age group values it less (23.1%), for them flavour being the most important attribute. Set against this, among the younger age group (age groups <=25 and 26-35), base matters the most. Interestingly, while flavour is most critical for the age group 46-80 (24.6%) and 26-35 (24.2%), it is below average for the youngest age bin (22.6%) and those aged 36-45 (20.0%). These findings are in accordance with both the expert interviews and literature (cp. 3.2.6). What is more, taste has a direct effect on the purchasing behaviour as most important purchase criteria (Glanz et al. 1998; Sheperd and Sparks 1994), further outweighing the role of other determinants such as price, health aspects or convenience (International Food Information Council 2020). Thus, it can be argued that an appealing taste might mitigate the high prices that consumers currently face, and consumers may be more willing to pay a price premium for tasty insect-based bars. In turn, an unsatisfactory taste might lower an insect bar's chance to succeed. This finding is highly critical since the perceptual map analysis revealed a positioning low in appeal. Moreover, the perceptual map revealed that a good bar taste can lower the disgust level which is which is one of the major variables explaining consumer's reluctance towards insect nutrition (cp. 3.2.3).

Price per 40g: Price is the third most important attribute (18.7%) for an average consumer in comparison to the other tested attributes. The age groups <=25 and 26-35 both find the attribute more important than the age group from 46 years onwards. On the one hand it can be argued that

younger respondents might have lower level of financial resources (Taylor et al. 2011) leading to a higher sensitivity towards price. On the other hand, it might be that younger respondents lay a higher importance on the price since they are concerned about fair prices. These findings are important as the younger respondents represent the target age. However, this also needs to be considered in the context of preference levels as explored below.

Eco-label: With 13.5%, the importance is relatively low. However, it is important to mention that the relative importance was tested in the conjoint analysis. The results might tempt one to equate the findings with a consumer's general importance. Following the results of BMEL (2021), 64% of the consumers always or usually pay attention to the organic label, 68% to the regional production label, 57% of the consumers to the fairtrade label and 55% to the animal welfare label. Thus, it needs to be recognized that consumers consider the sustainability aspect in the purchasing process but other factors like taste and price are of higher importance when buying an insect bar.

The older age groups (36-45 at 17.4% and 46-80 at 14.0%) as well as women (14.9%) assign above average importance towards an eco-label. The findings are supported by Witek and Kuźniar (2020) who found that the older the buyers are, the more they buy green products and additionally, women attach higher importance on purchasing green products than men.

Design: The overall importance is 11.1% that is rather low in comparison to taste and price. For the younger respondents (<=25 at 9.6% and 26-35 at 9.9%), the design is even less important than for the older respondents (36-45 at 12.8% and above 46 at 13.8%). The findings imply that the sample's purchase decision is not driven by the fact that the bars are based on insects.

Marketing claim: In general, with solely 7.3%, the overall sample ascribed the lowest importance to the attribute marketing claim. This is in line with previous findings that marketing as a discipline is approached with mistrust and scepticism (Heath and Heath 2008) and product packaging claims may be perceived more as a marketing trap especially in the absence of organic labels (Lammers,

Ullmann, and Fiebelkorn 2019). Moreover, the marketing claim is slightly more important to women (7.6% for women and 6.8% for men). This is in line with a prior study arguing that female participants considered claims more advantageous than male (Urala, Arvola, and Lähteenmäki 2003), what in turn might be in line with the perception that women favour a healthier diet in general (Zunft et al. 1997). Lastly, younger age groups and also the target segment place lower value on marketing claim than older age groups. This is congruent with the evidence that younger target groups lack trust in manufacturer's information (PricewaterhouseCoopers 2021). Yet, there is no other study that compares the importance of claims as a function of age groups. Similar to the design, it can be stated that marketing claims are not a decisive factor in the purchasing decision process of an insect-based bar.

Preferences for levels

This section is subdivided into the average preferences for levels and the distribution of preferences for levels. This subdivision answers the question about the preferred product attributes in detail, as different perspectives are taken when analysing the preferences. For the **average preferences for levels**, the relative value by level is examined – more precisely, the level partworth. This evaluation provides an answer to the question "What specific levels within an attribute drive customers' choice?" (Conjointly 2022f). The output considers the average preference scores for each level. It is important to highlight that it refers to the relative value meaning that the levels are compared with each other. Therefore, adding or removing a level would change the preference scores. As seen in figure 10, the diagram is zero-centered within each attribute and is scaled in a way that the sum of the positive values equals the sum of the negative values (Conjointly 2022f). The longer the diagram's bars, the relatively stronger positive or negative the preference or dispreference.

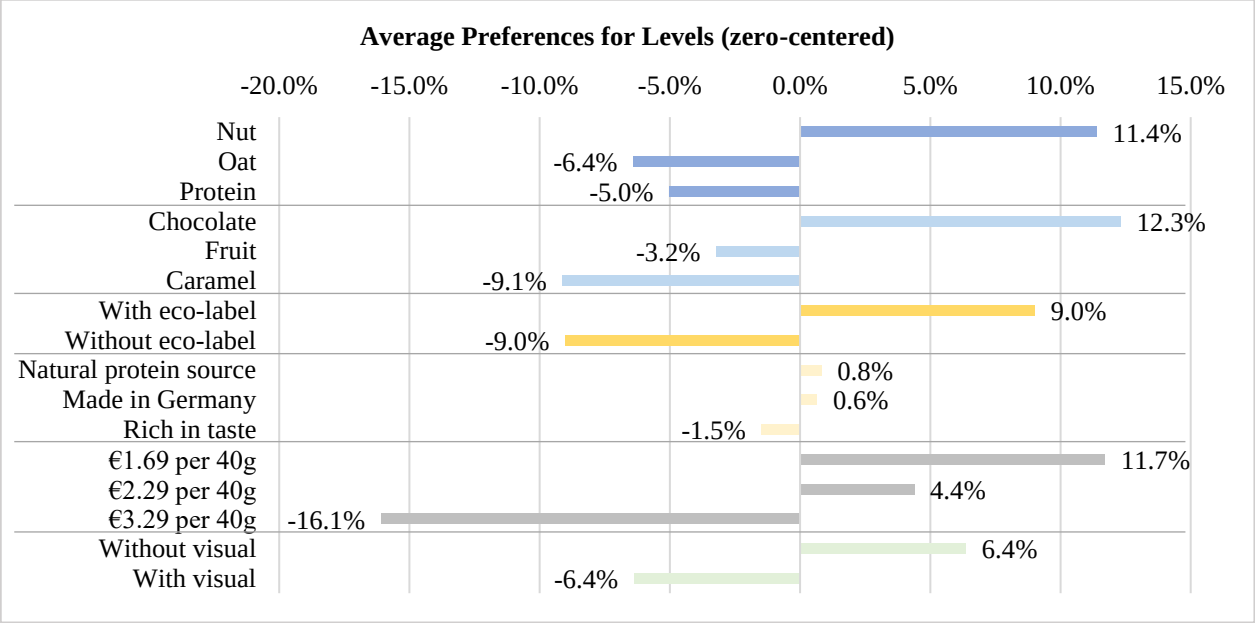

Figure 10: *Average preference for levels (α = 0.05)*

When considering the level partworths of the attribute base, one can conclude that the nut base is preferred over the oat and protein base. There is a stronger dispreference for oat than for protein. For flavour, chocolate has positive values whereas fruit and caramel have negative preference scores. Thus, chocolate is the most preferred flavour followed by fruit and finally by caramel. The average consumer gives higher value to an insect bar that contains an eco-label. Moreover, the survey revealed that the marketing claim "Rich in taste" is not valued by consumers as negative relative preference shares are present. Both claims "Natural protein source" and "Made in Germany" have positive relative values indicating a preference towards both. However, "Natural protein source" is slightly more preferred. With regard to the price per 40g, the expected outcome of having the highest preference for the lowest price (€1.69) and the highest dispreference for the highest price (€3.29) was obtained. Lastly, the average consumer prefers an insect bar's design without an insect visual.

The length of the diagram's bars indicates that the dispreference for a price of €3.29 is the strongest dispreference followed by the flavour caramel in comparison to the other levels across all attributes.

The lowest dispreference is given for the flavour fruit and for the claim “Rich in taste”. The strongest preference is provided for the flavour chocolate. However, it is closely followed by the price per 40g of €1.69 and the nut base. The lowest preferences across all attributes are given for the marketing claims, “Natural protein source” and “Made in Germany”.

In a next step, the **distribution of preferences for levels** was evaluated (figure 11). At this point, the distribution of the level’s preferences across consumers is considered within each attribute. The following question is asked: “Assuming that each consumer has a preference for different levels, what is the distribution of preferences for different levels (within each attribute) across consumers?” (Conjointly 2022f, para. 4).

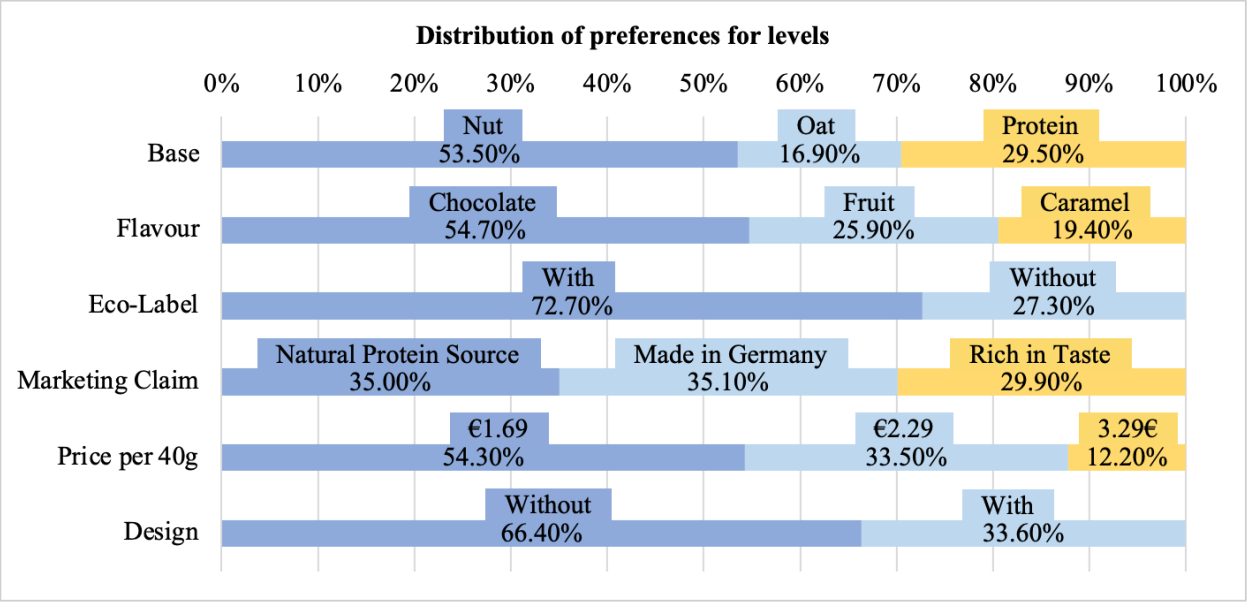

Figure 11: *Distribution of preferences for levels (α = 0.05)*

For the following result deep dive, the distribution of preference shares is used since it facilitates the process of putting the findings into context and the comparison of the differences between the segments, age, and gender.

Base and flavour: More than half of the consumers (53.5%) prefer an insect bar based on nuts and one third (29.5%) prefer the protein base. This is congruent with the findings in the perceptual map, in which nut bars have the second highest consumption frequency and represent also the most

appealing bar type. In terms of gender, the outputs show that 59.6% of female consumers prefer the nut base in comparison to 44.3% of the male consumers. Further, it was found that 15.8pp. more male consumers (39.1%) prefer protein base than female consumers (23.3%). There is evidence from prior surveys that protein bars are more regularly bought by men than by women (Hancocks 2019). In their purchase behaviour, men are more considerate about functional aspects while taste was found to be more critical to women in protein products (Hancocks 2019). Regarding age, differences can be found across both attributes, the first discussed being base. For the dispreferred protein base, 34.1% of the youngest age group (<=25) prefer it whereas the average preference share across all age groups is 24.8%. In particular, only 12.1% of the people aged between 36- and 45-years value protein and 25.3% the oldest age group (46-80). This is also in line with prior study findings which found that older age groups consume less, or no protein bars compared to younger consumers (Hancocks 2019). It is further strongly supported by the perceptual map survey results (cp. 4.2.3).

54.7% of the sample chose chocolate over fruit (25.9%) and caramel (19.4%). It is also validated by Mintel (2020) that nut and chocolate are the most common flavour subcategories in the bar market. Considering the flavour caramel, the average preference share across age groups is at 21.0% (Appendix 23). However, only 14.2% of the consumers aged between 26 and 35 years prefer caramel whereas 28.8% of the consumers aged between 36 and 45 prefer it. Again, there are differences in terms of gender: More men (58.2%) state a higher preference for chocolate than women (52.4%) whereas more women (27.6%, 20.0%) prefer fruit and caramel than men (23.4%, 18.4%). This finding might originate in different responses to sweetness. Women tend to be more receptive to sweet treats (Enns, Van Itallie, and Grinker 1979; Laeng, Berridge, and Butter 1993; Wansink, Cheney, and Chan 2003). In line with this, it has been found that the aroma of e.g.,

caramel or fruit often comes with sweetness, adopting sweet associations (Blank and Mattes 1990). Besides these results, no differences can be found between gender.

Price per 40g: The conjoint analysis allows for a value-based pricing approach that incorporates the consumers' preferences. With regard to the total sample, more than half of the total preferences (54.3%) goes to the lowest price point of €1.69, 33.5% to €2.29, and 12.2% to €3.29. As a result, 45.7% of the respondents accept a price of €2.29 or higher. Therefore, the preference between these two price points is relatively balanced with a slight lead of the lowest price. This is emphasized by the average price point of €2.09 that can be retrieved with the distribution shares. The reasonable distribution share of the price point of €2.29 might be explained by price being a proxy for the quality of the insect-based bar (Nagle and Müller 2017).

Additionally, the consumers between 36 and 45 years-old have the highest preference share with 23.5% for the highest price point (€3.29) across all age segments. Considering the assumption that with age raises the income and thus, the purchasing power (Taylor et al. 2011), one might have expected that the oldest age group would have the highest share for €3.29. In comparison to the other age groups, the youngest and oldest age groups have the lowest preference shares for the lowest price point (€1.69). In turn, they approve the two higher price points more than the two middle-aged segments (26-35 and 36-45 years). As discussed above, the youngest respondents place a relatively high importance on the attribute price. Therefore, it can be concluded that respondents <=25 are concerned about fair prices. In accordance with the "fairness effect" this would mean that young people value a price as fair as long as a price increase is justified by raising costs. If a seller leverages the market to add a price premium, it might be perceived as unfair (Nagle and Müller 2017). A fair price might change over time (Nagle and Müller 2017) implying that continuous market research is important to ensure the WTP and the level of fairness is met.

Eco-label: Almost three-quarters of the consumers (72.7%) prefer an insect bar with an eco-label and the remaining 27.3% prefer it without an eco-label. It is noteworthy that women also have a higher preference share for eco-labels than men which is in line with the finding in the section Attribute Importance. One might argue that when survey respondents have the option to choose between a more socially and a less socially accepted choice, the majority would go with the more socially accepted one. Hence, the actual behaviour cannot be tested relying only on the survey results. So, it is questionable if the survey responses regarding the eco-label correspond to reality.

Design: The level without an insect illustration accounts for 66.4% and with insect illustration for 33.6% of the overall preference share. The stronger preference towards not showing an insect is surprising as consumers generally value transparency during the purchasing process (cp. 3.2.7). However, this underlines the fact that the sample prefers not to be confronted with the fact that the bar contains insects. The results of the conjoint analysis confirm that consumers disprefer realistic visualizations of an insect (de-Magistris, Pascucci, and Mitsopoulos 2015). Following this conclusion, it should not be visible at first glance that the bar consists of insects and only limited transparency is needed. Younger people aged <= 25 have by far the lowest preference share (63.2%) for a design without an insect visualization revealing a relatively higher acceptance of a packaging with an insect picture. With a share of 72.4%, a clear tendency towards without a visual is observed for the participants between 36-45 years (Appendix 23).

Marketing claim: Similar to the relative values for the attribute marketing claim, the preference shares of each level are relatively equal distributed with 35.1% for “Made in Germany”, 35.0% for “Natural protein source” and 29.9% for “Rich in taste”. Still, the marginal differences in the results reflect the ambivalence of the sample between both claims “Made in Germany” and “Natural protein source”. This finding highlights once more that a clear statement regarding the highest claim preference share is not possible to infer. Considering age, the marketing claim “Made in

Germany" is particularly preferred by the age group 26-35 with a preference share of 40.4% (average 35.4%) and "Natural Protein Source" particularly by consumers between 36-45 years-old with 46.8% (average 37.5%) (Appendix 23).

Contrary to Berger et al. (2018) who argues in favour of using hedonic claims (such as "Rich in taste" as expressed in this paper) instead of more abstract nutritional goals, the findings from the conjoint analysis revealed exactly the opposite. This also comes as a surprise considering the high importance attached to taste in comparison to e.g., healthiness (International Food Information Council 2020). One potential explanation could be that when consumers consider a product as intrinsically hedonic, the value of adding a hedonic product claim might be considered redundant (Arboleda 2022). Considering broader consumer trends, the preference for the environmental and nutritional claims is plausible. First, as mentioned earlier, the sustainability of products plays a critical role in consumer purchasing decisions (Simon-Kucher & Partners 2021). Second, especially due to Covid-19, the consciousness of a healthy nutrition has increased by 22% among the German population, paving the way for functional products (Mintel 2021). Moreover, health claims were perceived as beneficial in a prior study (Urala, Arvola, and Lähteenmäki 2003). Finally, it should be noted that merely one claim was tested per subcategory "health", "sustainability" and "taste" and different results could be incurred when testing other claims.

In conclusion, a bar based on nuts with chocolate flavour, eco-label, the marketing claim "Natural protein source", priced at €1.69 and without insect illustration is the preferred concept across the overall sample.

Willingness to pay

The **WTP** reveals how much consumers are willing to pay for a specific feature on average (Conjointly 2022g). The marginal willingness is considered since it is put into relation to a baseline

as seen in figure 12. The baseline can be identified by the 0.00 that is written next to the x-axis in the diagram below. Besides for the attribute marketing claim, the baseline corresponds to the most preferred level that was evaluated under the section preference levels. Negative values indicate that the feature is less preferred than the baseline and the consumer needs to be compensated by reducing the price when switching to the inferior feature. The output points out a linear relationship between price and preferences because consumers prefer a lower price more than a higher price. It must be noted that the WTP is specific to the context and varies with demographics, customer segments and with time (Conjointly 2022g).

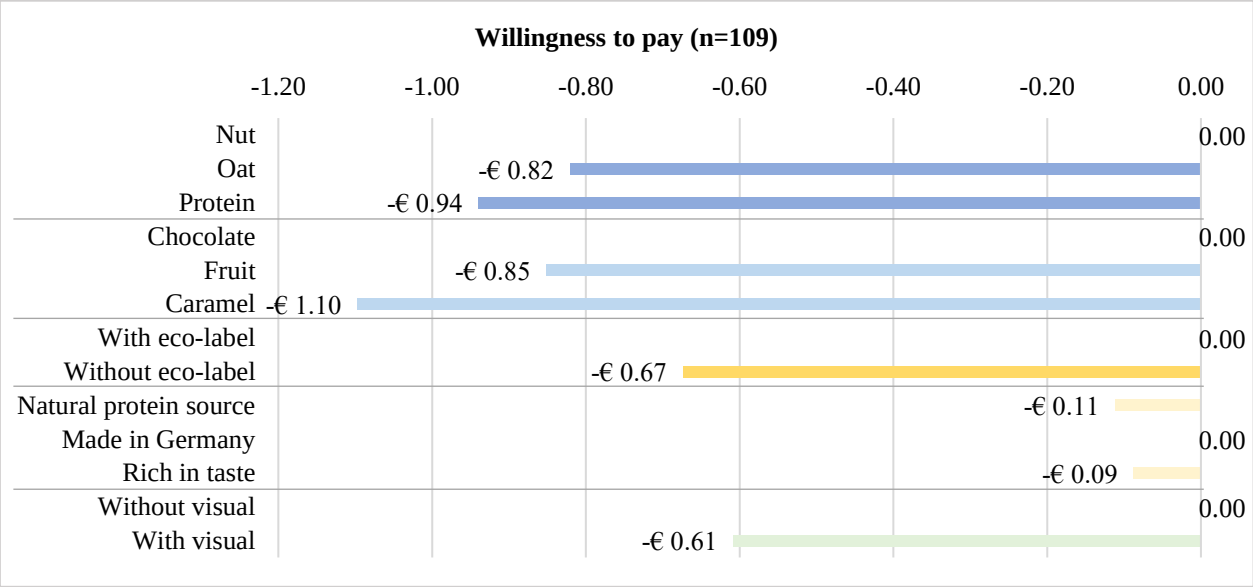

Figure 12: *Willingness to pay for overall sample (α = 0.05)*

Base and flavour: The output underlines that nut is preferred over protein and oat and indicates that a reduction of price by €0.94, respectively €0.82 is required when changing from nut to protein or oat. The results demonstrate a high dispreference of women and the oldest age group (above 46) towards the protein base (table 8). In comparison to men, women would need a compensation of €1.22 which is €0.66 more than for men. With €-1.78, the oldest age group has the highest negative WTP for the protein base. They would need €1.16 more in compensation than the lowest age group

(<=25) when switching from nut to protein. Interestingly, the strong aversion towards a protein base is less pronounced in the above-mentioned distribution of preferences.

Attribute	Level	Gender: Female	Gender: Male	Age: <=25	Age: 26-35	Age: 36-45	Age: 46-80	Target Group
Base	Nut	0.00	0.00	0.00	0.00	n/a	0.00	0.00
	Oat	-0.82	-0.71	-0.84	-0.52	n/a	-1.04	-0.49
	Protein	-1.22	-0.56	-0.62	-0.92	n/a	-1.78	0.57
Flavour	Chocolate	0.00	0.00	0.00	0.00	n/a	0.00	0.00
	Fruit	-0.67	-1.23	-0.85	-0.57	n/a	-0.85	-0.91
	Caramel	-0.94	-1.71	-0.68	-1.00	n/a	-1.88	-0.78
Eco-Label	With Eco-Label	0.00	0.00	0.00	0.00	n/a	0.00	0.00
	Without Eco-Label	-0.74	-0.67	-0.81	-0.48	n/a	-0.72	-0.56
Marketing Claim	Natural Protein Source	-0.13	-0.05	-0.17	-0.24	n/a	0.28	-0.26
	Made in Germany	0.00	0.00	0.00	0.00	n/a	0.00	0.00
	Rich in Taste	-0.09	-0.08	-0.09	-0.25	n/a	0.12	-0.17
Design	Without visual	0.00	0.00	0.00	0.00	n/a	0.00	0.00
	With visual	-0.58	-0.77	-0.33	-0.60	n/a	-1.02	-0.62

Table 8: *Marginal WTP per age and gender segment. The marginal WTP for the age group 36-45 could not be calculated due to respondents do not necessarily prefer lower price.*

A switch from the most valued level, chocolate, to fruit or caramel would require a compensation of €0.85 and €1.10 for the overall sample. With €-1.10, caramel has the highest negative WTP value in comparison to all attribute levels. Together with the strong negative value for fruit, the high preference for chocolate is emphasized with this result. Further, it is important to highlight that the oldest age group has the highest negative WTP (€-1.88) for the flavour caramel. It is more than twice as negative as for the respondents <=25. The older age group's strong aversion against caramel that is reflected in the WTP is not equivalent to the results of the distribution of preference shares. Similar to the protein base, the WTP reveals a stronger aversion than reflected in the distribution. This leads to the conclusion that the preference shares itself alone do not provide a thorough picture of the overall liking and acceptance of a feature. The success of a product highly depends on the actual purchases by consumers that is inter alia reflected in the WTP and at best, the perceived value should be above the actual price (Dolan and Gourville 2014). In addition, the WTP reflects the strong aversion of men towards the flavours fruit and caramel. As the price

reduction to compensate for a switch from chocolate to fruit or caramel would be higher for men than for women, the strong preference of men for chocolate is emphasized again (table 8).

Eco-label: For the overall sample, a downgrade to an insect bar without eco-label is equal to an increase of price by €0.67. When comparing the WTP for an eco-label to the WTP for the other attributes' levels in the diagram above, the rather low importance of an eco-label becomes evident. In line with the average preference scores, people <=25 have a higher WTP for an eco-label than people above 46 (table 8). This finding confirms that Gen Z[6] has the highest WTP for sustainable products (McKinsey & Company 2021b).

Design: When changing from a design that contains an insect illustration, a reduction in price of €0.61 would be demanded by the overall sample. Similar to the insight regarding the eco-label, the WTP reflects the relatively low importance for the insect visual itself. The dispreference towards an insect visual is strongest for the oldest age group with €-1.02 and the least strong for people <=25 (€-0.33). An explanation for this finding might be that older people are generally less open towards insect food than younger people (cp. 3.2.1). Thus, they might have an even stronger aversion towards being confronted with the insect itself (B. 2021).

Marketing claim: As highlighted above, the top one ranked level is "Natural protein source" and therefore, one could expect that for the other two claims a compensation would be necessary when switching from this claim. However, this is not the case as an overall higher WTP for the claim "Made in Germany" but also for "Rich in taste" can be found in table 8. This further underpins the ambivalence between the claims, especially for "Natural protein source" and "Made in Germany" as described above. Looking at the age groups, the respondents above 46 years are the only segment that have the highest WTP for the "Natural protein source". In turn, the younger age groups (<=25

[6] Gen Z refers to the generation born between 1997 and 2012 (Dimock 2019).

and 26-35) both are willing to pay more for the claim “Made in Germany” than for “Natural protein source”. Yet, the poor performance of the claim “Natural protein source” is striking since the younger age group’s demographics is akin to those from protein supplement products (B. 2021). Set against this, though, older age groups tend to attach a greater importance to health in general (Mintel 2021; Roininen, Lähteenmäki, and Tuorila 1999).

The contrary results for the attribute marketing claim obtained in the sections Preferences for levels and Willingness to pay clearly stand out. On the one hand, taking the contrary results together with the fact that the attribute importance for marketing claim is the lowest, the findings reveal that claims are not a decisive factor for the purchase of an insect bar. On the other hand, it underlines the assumption regarding the survey fatigue (cp. 4.3.2.2) that occurs when many questions are asked. Although the order-effect was aimed to reduce this bias, it was still difficult for respondents to compare the marketing claims and thus, no clear preference between “Made in Germany” and “Natural protein source” could be found. It can be concluded that the participants did not make logical decisions for the attribute marketing claim.

Price elasticity

To get more insights regarding the sensitivity to price changes, the price elasticity is analysed. Price elasticities of demand are calculated by dividing the percentage of the change in demand through the percentage of the change in price (Gallo 2015). Values of one and above are called elastic while values between zero and one are deemed inelastic (Perloff 2008). Taking the three different price points into consideration, the price elasticity between €1.69 and €2.29 is -1.50 and for €2.29 and €3.29 -1.10 implying that a 1% decrease in price will result in a 1.5% and 1.1% increase in demand. Hence, the overall demand is elastic for the optimal insect bar. In contrast to the finding of the insect bar’s price elasticity, the elasticities of other food categories are often inelastic (Andreyeva,

Long, and Brownell 2010). This might be explained by the insights of Parker and Neelamegham (1997): For products that are at the beginning of a product life cycle, the demand is elastic due to uncertainties and low repeat purchases; the further the product is in the life cycle, the more inelastic becomes the demand (Parker and Neelamegham 1997). Market research, preliminary interviews and the empirical methods showed that insect bars are at the early stages in the life cycle. In general, insect-based food is not available in German supermarkets and people do not actively think about buying insect-based products. At the same time, price elasticity is dynamic and depends on various other variables. Consumers may not necessarily behave as indicated in surveys once they are in front of the POS shelf. Other influencing factors are the income, the overall economic health, and the competitive setting, which is why price elasticities cannot be considered in isolation (Gallo 2015).

The demand for both younger age segments is elastic. The segment between 36 and 45 years-old have an inelastic demand for both price changes and the respondents between 46 and 80 years-old have an inelastic demand for the price points €2.29 and €3.29 (Appendix 24). Especially for the oldest age groups, 36-45 and 46-80, small price changes result in small changes in demand. This might be due to the fact that older age groups' households have a higher financial means than younger aged people (Taylor et al. 2011). Henceforth, a higher purchasing power can be expected by the older age groups implying that their demand would not decrease by much when a higher price than the most preferred one of €1.69 would be charged.

Bringing the insights of the WTP and the price elasticity together, it can be concluded that the demand for insect-based bars is responsive and a high sensitivity to price exists. According to Dolan and Gourville (2014), price sensitivity is high when reference prices are available and when prices are easily comparable, high in a relative sense and not needed as a quality indicator. This is the case for insect-based bars as they can be directly compared to traditional bars that might serve

as a reference product for consumers. However, the results should be considered with caution as a previous study found that price sensitivity is specific to the situation (Wakefield and Inman 2003). Consumers' price sensitivity for a product category may vary dependent on the situation they are in. As a result, insect bars might be valued with a higher price consciousness when they are considered as functional (e.g., satisfy the appetite) than as hedonic (e.g., snack for pleasure) (Wakefield and Inman 2003). Not only does the level of involvement play a role, but also whether the bars are consumed alone or together with other people (Wakefield and Inman 2003). This is confirmed by the findings of prior research stating that the context is an influencing factor of the general perception and especially the willingness to try (cp. 3.2.4).

Simulations

In the next step, the researchers simulated different what-if scenarios to explore the impact of changes in the optimal product features or segment and rebuild different market dynamics with estimates on the preference shares of these offerings. Thereby, the preference shares may indicate an approximation towards markets shares, but also other factors such as product availability or shelf space play a role (Conjointly 2022h). As this conjoint analysis intends to find the optimal insect bar, the researchers built the following **scenarios**: (1) Optimal offering in the target segment; (2) Competitive environment; (3) Integration of an eco-label.

Scenario 1: Optimal offering in the target segment

Differences can be witnessed between the overall sample and the target group of insect-based products as per definition of the experts (i.e., male and aged between 18 and 39). Zooming in on the **attribute importance** within the typical target group, the base is valued slightly above average at 26.4%, followed by flavour with 26% (2.5pp. above average), and price at 19.4%. All further

attributes eco-label (12.0%), design (9.8%) and marketing claim (6.5%) play a below average role (Appendix 22).

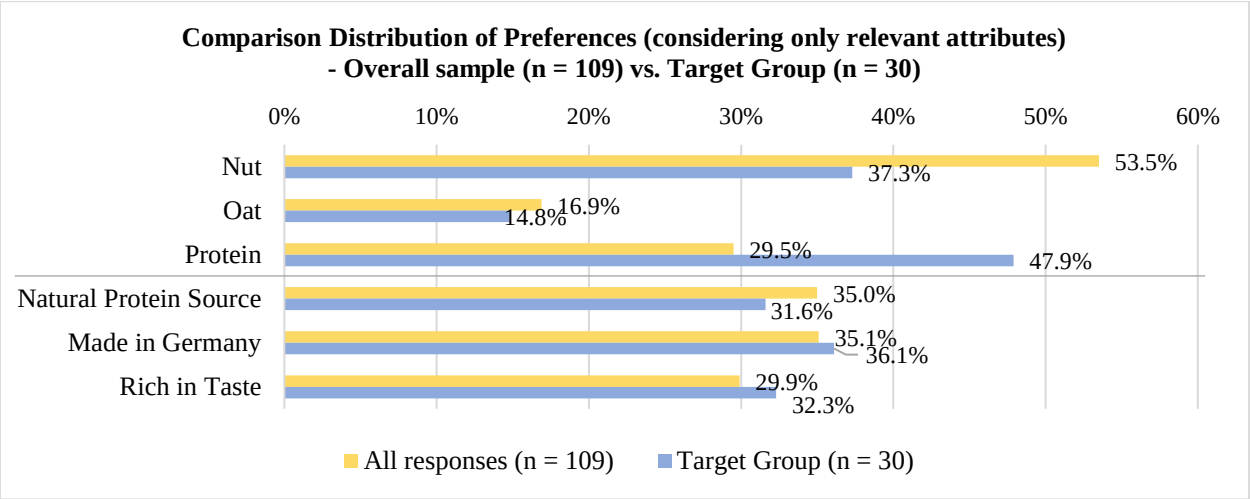

Figure 13: *Distribution of preferences comparison (α = 0.05)*

Regarding the **preference levels**, the most striking differences can be witnessed in terms of base and marketing claim (figure 13). This segment values protein as a base more than nut – 47.9% of this group prefers protein, 37.3% nut and 14.8% oat. The results for oat are ca. 2pp. below the overall sample whereas for nut it is ca. 16pp. below the average. In contrast to the distribution of preferences of an average consumer, the lowest share (31.6%) of total preference is assigned to the marketing claim "Natural protein source" and thus, the claim "Rich in taste" is more preferred (32.3%). "Made in Germany" is with 36.1% the most valued claim. This is in stark contrast to the base preference protein. This is consistent with a study that found no evidence of health claims regarding the acceptance of protein bars. Instead, consumers place higher importance towards criteria such as taste or the flavour (Thakur et al. 2022). No salient differences can be reported regarding the other level preferences (Appendix 23).

With regard to the **WTP**, two major differences were identified for base and marketing claim. In contrast to the average consumer, the most preferred level is protein and a price reduction of €0.57 would be needed for switching to nut. In addition, respondents prefer "Natural protein source" the

least. When setting the most preferred claim “Made in Germany” as the baseline, a compensation of ca. €0.20 would be needed for “Natural protein source” and “Rich in taste”. Coming back to the segments, the target group would need the highest compensation for a change from their preferred claim “Made in Germany” to “Natural protein source”, followed by the two younger age segments aged until 39 years. This observation is in line with the strong commitment of younger people regarding the climate change in Germany (Huttunen and Albrecht 2021; Marquardt 2020).

Overall, these variations in comparison with the overall sample further underpin the importance of offering the ideal product for specific targets consumers.

Scenario 2: Competitive environment

Having examined the product preferences, the features need to undergo a feasibility test since the optimal bar would not be the only player when entering the market. Hence, leveraging the attributes and levels in the conjoint analysis, the competitive environment was simulated. Available offerings on the market need to be transferred into the attribute language and levels chosen to use in the survey. A set of insect bar competitors that are available online in Germany was considered. Different categories were built to cover the flavour diversities and approximate the German insect bar market. As the conjoint analysis survey was completely based on querying insect bar preferences, solely competitors in the insect bar market were considered (cp. reasons on p. 56f.).

Concept name	Base	Flavour	Eco-label	Marketing claim	Price per 40g	Design
JiMiNi’S 1 (Caramel/Fruit)	Nut	Caramel/Fruit	Without	Natural Protein Source	€2.00	Without insects
JiMiNi’S 2 (Fruit/Choco)	Nut	Fruit/Choco	Without	Natural Protein Source	€2.00	Without insects
Catch-Your-Bug	Nut	Fruit	Without	Natural Protein Source	€2.49	With insects
Bug-Break	Nut	Caramel	Without	Natural Protein Source / Made in Germany / Rich in Taste	€3.32	With insects
isaac nutrition 1 (Choco)	Oat & Protein	Choco	Without	Made in Germany	€1.66	With insects
isaac nutrition 2 (Fruit)	Oat & Protein	Fruit	Without	Made in Germany / Natural Protein Source	€1.46	With insects
isaac nutrition 3 (Caramel)	Oat & Protein	Caramel	Without	Made in Germany / Natural Protein Source	€1.46	With insects
None of the above	N/A	N/A	N/A	N/A	N/A	N/A

Table 9: *Configuration of baseline scenario*

An overview of the competitive brand configurations can be seen in table 9 and a detailed derivation of the categories can be found in Appendix 25. It should be noted that the allocation of the bars comes with caveats, with its characteristics being subjectively matched with the (non-brand-based) attributes and levels. These configurations will form the baseline scenario when considering the competitive environment.

Figure 14 illustrates the preference shares of the competitive landscape of the insect bar market as described in table 9. Compared to the baseline scenario, the introduction of the optimal bar leads to a significant shift in the market dynamics. While the optimal bar configuration achieved 50.2% in preference shares, the initially first ranked bar JiMiNi'S 2 (Fruit/Choco) faced a decline in preference shares by 17.2% and the previous second ranked isaac nutrition 1 (Choco) decreased by 8.6%. The simulation hence further corroborates the ideal configuration as described before. In turn, this proves that the configuration is unique in the insect bar market and can assert itself in the competitive environment. What is more, the existing offer fails to meet the needs of the customers.

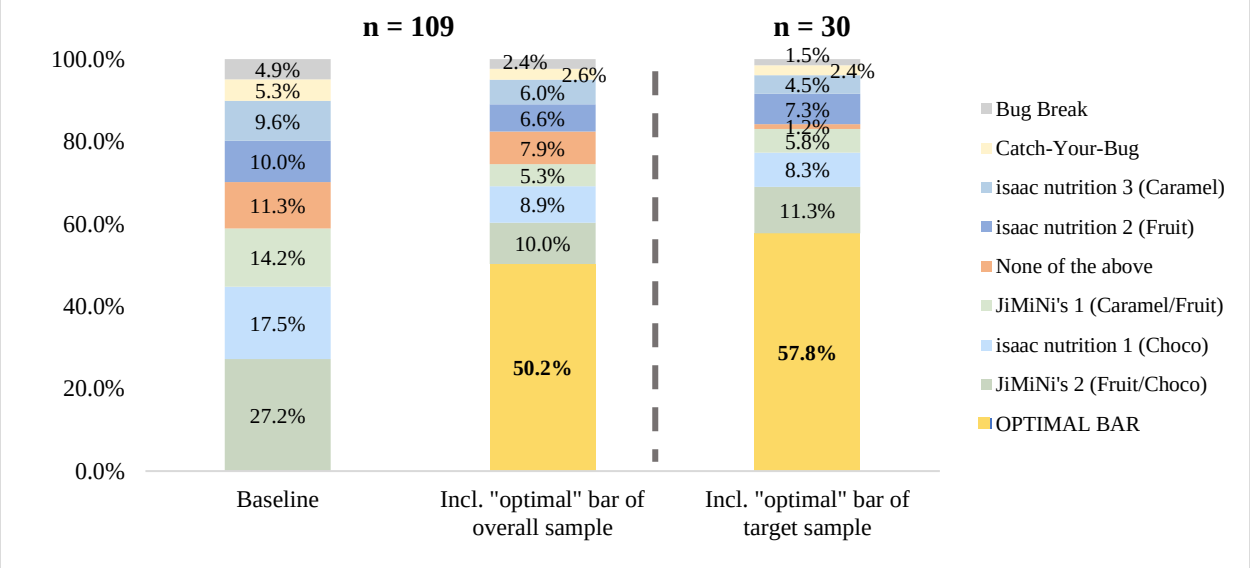

Figure 14: *Preference shares of baseline scenario vs. introduction of optimal bar scenarios (α = 0.05)*

Since significant attribute and level differences between the overall sample and the target segment were found, the focus is now on the role of the optimal bar configuration in the target segment male and aged 39 or younger. Therefore, the optimal configuration has been adjusted by changing the base type from nut to protein and the claim from "Natural protein source" to "Made in Germany", as preferred by the target segment. As a result, when introducing the optimal bar with the preferred configurations of the target segment, the bar would capture 57.8% of preference shares (figure 14). Interestingly, the preference shares for the optimal bar of the target sample are higher in the target segment than in the overall sample, underpinning the importance of tailoring the product to the respective target segment's preferences.

Scenario 3: Integration of an eco-label

Having identified the preferences, a feasibility test needs to be undertaken. As described in the level preferences, the overall sample values insect bars including an eco-label. However, including an eco-label comes e.g., with additional cost such as auditing fees and a higher cost of production according to organic standards (Yenipazarli 2015). Taking this into account, the preferred configuration of both the lowest price of €1.69 and production at eco-label standards (baseline scenario) seems unfeasible. Hence, in the following scenario, the focus will be on analysing two configurations: the performances of the optimal bar in the same competitive setting as described above for €1.69 without an eco-label (downgrade scenario), and for €2.29 with an eco-label (upgrade scenario), all other factors being equal (table 10). The simulation is based on the same competitive environment as in scenario one, where no competitor offers a bar with an eco-label.

	Preference Share
Baseline (€1.69/with eco-label)	50.2%
Upgrade scenario (€2.29/with eco-label)	38.9%
Downgrade scenario (€1.69/without eco-label)	31.7%

Table 10: *Reaction of integration of eco-label – entire sample (α = 0.05)*

Naturally, the preference shares decline when considering the upgrade and downgrade scenarios since they represent a deviation from the optimal configuration. Yet, the downgrade scenario is the least preferred version despite the lower price, leading to a sharp drop in preference shares of 18.5% compared with the baseline. The upgrade scenario is the second most preferred concept (highlighted in green in table 10), after the baseline. This illustrates the importance of the eco-label and derived from that, the wish for premiumization and quality. Although this finding is contrary to the research paper of Yenipazarli (2015) stating that an eco-label integration does not automatically translate into a higher WTP while creating higher cost, it corroborates the findings from both the expert and consumer interviews. Hence, the integration of an eco-label to a higher price may prove likely to further underpin the high-quality association as laid out in the perceptual map analysis.

4.4 Field Trial

100% of participants in the perceptual map survey indicated that they have never eaten insect bars (Appendix 9). Similar results can be assumed for the conjoint survey. Consequently, all previous analyses on perceptions and preferences are not based on the consumers' experiences or expertise but instead on instinct and intuition. That is why a field trial including an insect bar tasting was carried out. The field trial aims to validate and enrich the conjoint analysis findings in terms of preferred product attributes to find out how insect-based bars can be positioned in the upper right corner of the perceptual map and thus be more appealing. Furthermore, the tasting will contribute to answer and validate RQ2, "*What are the preferred product attributes of insect-based bars in the German market?*".

4.4.1 Methodology

A field trial is characterized by consumers trying or testing new products in a "real life" setting. In contrast to an experiment, a field trial is not conducted under artificial laboratory conditions and does not involve a treatment and control group (Rauterberg n.d.). For this research, a field trial including a tasting represents a critical step since insect-based bars are a novel food category that the majority of consumers have not eaten yet.

4.4.2 Field Trial Design

Eight insect bars from three brands (Bug-Break, isaac nutrition, and Portugal Bugs) were purchased to have a variety of bar bases and flavours available. Bug-Break and isaac nutrition are German start-ups, while Portugal Bugs is Portuguese based and sold in selected Continente shops. The bars were cut into small pieces and placed on separate plates sorted by brand. Additionally, the packages were displayed on a separate tray (figure 15). The field trial was conducted on November 14th from 9am to 12pm at the Nova School of Business and Economics campus, where the researchers randomly approached students.

Figure 15: *Field trial setup*

A survey was administered via the Qualtrics platform to track the results. To enable the participants to focus on the tasting experience, the researchers filled in the questionnaire together with the students. The questionnaire consisted of five sections, which are illustrated in figure 16.

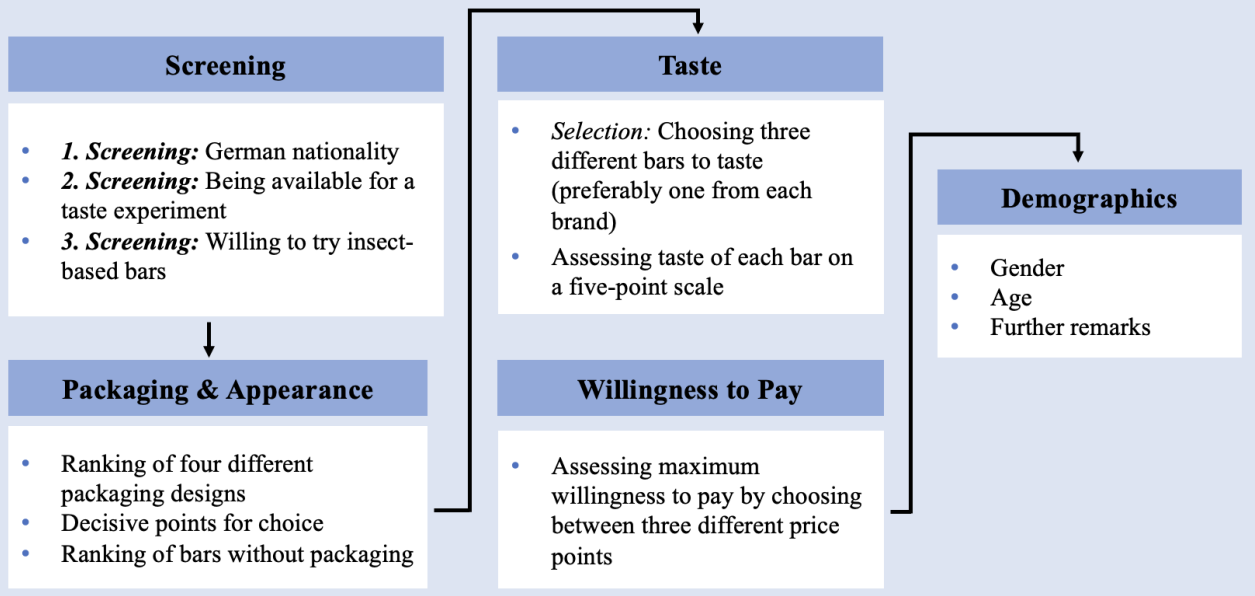

Figure 16: *Field trial survey outline*

Each participant had to fulfil three different selection criteria: (1) German nationality; (2) Be available for a tasting and (3) Be willing to try insect-based bars. Before the tasting, students were asked to rank the four different types of packaging (figure 17). They were also instructed to explain the reasons for their decision. In the next step, the participants had to rank the bars without packaging (Appendix 26). For the tasting, each student had to choose three different flavours, preferably one from each brand. Tasting one flavour of isaac nutrition and Portugal Bugs was mandatory, while tasting the Bug-Break bar was not. This was because the Bug-Break bar was the only one that contained insects in their unprocessed form that were also clearly visible (Appendix 26 – Bug-Break). The taste was rated on a five-point scale ranging from not tasty at all to very tasty. Afterwards, the maximum WTP for each selected bar was asked. For consistency, the same three price points as in the conjoint analysis were used. In addition, participants had to indicate their gender and age. Finally, further comments from the participants were noted down. A total of

34 German students were available to participate in the tasting, however only 30 (~88%) were willing to try insect bars. The reasons for refusal were gluten intolerance and previous negative insects tasting experiences.

4.4.3 Results

The following part will first describe the sample characteristics, followed by an analysis of the preferred packaging, appearance, taste, and WTP.

Sample characteristics

Of the 30 participants, 56% were female and 44% male. The age of the students ranged from 22 to 28 years, with an average age of 24.6 years (Appendix 27). Based on the selection criteria, all participants were German. Within this field trial, the willingness to consume insects was exceptionally high (88%). The reasons might lie in the setting of the field trial. On the one hand, only students were asked to participate. As stated in 3.2.1 socio-demographic factors like age[7] play a role in the acceptance to try insect-based food. Since young people (18-39 years) tend to try insects more than older people the sample only represented the target age and excluded people that are more entrenched to their eating habits. On the other hand, the researcher observed that many participants were only willing to take part in the field trial if their friends participated as well. As seen in 3.2.4 social contexts such as being around friends is influencing the likelihood to consume insect-based food. Therefore, both factors should be considered before making biased conclusions about the willingness to try.

Packaging & appearance

In terms of packaging, it is striking that opinions diverged strongly. Overall, the Bug-Break packaging was the most appealing, with 63% choosing it as number one (37%) or two (26%).

[7] German students are on average 23.4 years old (Forschung & Lehre 2020).

Students pointed out that they especially liked the clean and simple design. In particular, the colours (green and white) were positively highlighted because the participants associated them with natural and healthy products. Further, the vertical shape of the Bug-Break bar was perceived favourably because it differentiates from the competition (figure 17).

Figure 17: *Insect bars packaging*

Moreover, the creative and modern insect illustration was emphasised. The fact that it depicts an insect did not bother most students, which contradicts the conjoint analysis results, where the packaging without an insect visualisation was preferred. However, 17% of participants voted the Bug-Break packaging in the last rank, explaining their aversion through the prominent insect illustration. The colourful isaac nutrition design was perceived as highly controversial among the students. In total, 56% voted it in the first (23%) or second (33%) place, whereas 44% voted it in the third (34%) or fourth (10%) place. On the one hand, participants indicated they like the colours because they are catchy, appealing, and differentiated from existing bar brands. On the other hand, participants mentioned that the packaging was too colourful and generally too crowded with many design details. Furthermore, it was pointed out that it was challenging to distinguish between the

flavours due to the very colourful design. In addition, most students agreed that the colourful isaac nutrition bar was too big (85g) for a snack. Similar to the colourful isaac nutrition bar design, the opinions about the black isaac nutrition version were very mixed. 46% put it on the first (23%) or second (23%) rank, while 54% put it on the third (34%) and fourth (20%) rank. It is striking that the black design was more appealing to men. Women emphasised that the colouring is not attractive because it is too dark. In contrast, male students stated they perceived it as a premium bar and associated the black colouring with high-protein products. This might be driven by the fact that "high protein" products are often coloured black and require a higher price from consumers (Verbraucherzentrale Bremen 2021). This result is in line with the findings from the conjoint scenario analysis where the defined target group (male and aged between 18 and 39) preferred protein as a base. Overall, the bar's name, "Feel Good Bar", attracted positive attention because it did not reveal whether it contained insects compared to the other offered bars. Interestingly, the Portugal Bugs packaging is the least appealing, although it is the only one that does not illustrate insects. 66% ranked it in third (14%) or fourth (53%) place, and only 34% in first (17%) or second (17%) place. The main reasons the Portugal Bugs packaging was ranked last by more than half of the participants were the name, size, and design. Its name, "Mealworm Bites", was not well received because the wording evoked disgust which would present a barrier to purchase. Regarding the size, students stated that the bar is too small (35 g) to serve as a filling snack. The design was often described as too clean, boring, and inconspicuous. Furthermore, some participants perceived the packaging as cheap. However, the students who ranked the packaging first or second emphasised that they particularly liked the clean design because they associate it with healthy products (similar to the Bug-Break design). Moreover, they highlighted positively that each flavour is associated with a different colour, which makes decision-making easier. Altogether, it is preferred if the bar's name does not mention insects and differentiates from existing bars through

e.g., a vertical shape or distinct colouring. In addition, the bar size should be bigger than 35g but smaller than 85g. However, regarding the colouring and insect illustration, no clear preference can be identified due to the controversial opinions.

When analysing the results of the bars' appearance without packaging, very different, partially even contradictory findings are obtained. For example, the Bug-Break bar was ranked last by 53% even though its packaging was the most appealing (Appendix 28). A justification for the disparity is the visibility of the buffalo worms (Appendix 26 – Bug-Break). Many researchers have identified an increased level of disgust when insects become apparent (cp. 2.2). Since Bug-Break is the only bar brand that includes unprocessed insects, it is reasonable why this bar type performed worse in appeal without packaging than the other two bar brands. In contrast, 63% of the participants voted the isaac nutrition bars' appearance as number one. A reason for this outcome is their chocolate coating which was favoured by the participants. This also supports the output of the conjoint analysis, revealing that chocolate is the most preferred flavour. The opinions about the Portugal Bugs bars' appearance were mixed as 80% voted it on second (57%) or third (23%) place and only 20% on the first one (Appendix 28). The majority of students mentioned they dislike the appearance of fruity consistency (Appendix 26 – Portugal Bugs), yet for most it was not as bad as the visible insects of the Bug-Break bar.

Taste

Overall, only 9% did not like the taste of the bars, 8% were neutral and 73% perceived them as tasty or very tasty (Appendix 29). When breaking it further down, it becomes visible that Bug-Break was the tastiest brand among the participants (88% for tasty and very tasty), although it was ranked as the least appealing bar when displaying it without the packaging as it contains visible insects. However, the taste was preferred due to the crunchiness of the bar and the nut mixture.

This finding perfectly validates the previous findings of the conjoint analysis pointing out that a nut bar base is the most preferred product attribute's level (cp. 4.3.3). Isaac nutrition was the second tastiest brand (71% declared it as tasty and very tasty), yet some students pointed out the taste was too dominated by the protein flavour. Out of the isaac nutrition bars most respondents decided to try the macadamia salted-caramel bar, confirming the salted caramel trend within the last years (RedRabbit 2021). Particularly, cashew-blueberry (80%) and macadamia-salted caramel (72%) were found to be the tastiest flavours of isaac nutrition, whereas hazelnut-cacao scored last (40% declared it as not tasty and neutral) (Appendix 29). The least tasty insect-based bar brand was Portugal Bugs (69%) (Appendix 29). The students' selection among the Portugal Bugs flavours was relatively equal. Its flavour apple cinnamon performed best in terms of taste, whereas honey & peanut butter recorded the most entries for not having a pleasant taste. Reasonable arguments that this bar brand is least tasty can be the fruit flavour and the consistency of a fruit bar are not preferred, also aligning with the results of the preference shares of the conjoint analysis and the low frequency consumption proven by the perceptual map survey (cp. 4.2.3; 4.3.3). Ultimately, one can say that the bar is least appealing when insects are visible and is less tasty when the protein flavour is too dominant and too fruity. But a crunchy consistency, a chocolate coating, and flavours like cashew-blueberry and macadamia-salted caramel are preferred, yet it requires a tasty implementation.

Willingness to pay

The majority of the participants (51%) would not pay more than €1.69 for a 40g bar, 43% would spend €2.29 maximum, while only a small share of 6% are willingly paying €3.29. This proportional distribution makes up an average WTP of €2.04 per bar being really similar to the average WTP of €2.09 conducted in the conjoint analysis. Given that still 49% would pay more

than the minimum price per bar it indicates that some aspects motivate consumers to pay more than necessary. Interestingly, for a Bug-Break bar, the participants are willing to pay a higher price than for the other bar brands (Appendix 30). About 59% indicated paying up to €2.29 per bar and even 12% are willing to spend €3.29. Taste is a critical determinant for consumer consumption of bars (cp. 3.2.6). Thus, a reason for a higher WTP could therefore be traced back to the taste, as Bug-Break was by far perceived as the tastiest bar. Concerning Portugal Bugs 69% indicated that they would not pay more than the minimum price. As Portugal Bug's packaging was the least appealing, the field trial participants mentioned among others a boring and too clean design as well as a too small size, it can be argued that the packaging appeal also influences the WTP.

Based on the findings one can conclude that the WTP is affected by the perceived taste and the appeal of the bar.

5 Discussion & Managerial Implications

The following part consolidates and discusses the findings of the two RQs, inferring meaningful recommendations.

RQ1: How do German consumers perceive insect-based bars against existing bar alternatives?

Insect-based bars are highly associated with good quality in terms of having good ingredients and being healthy and sustainable. In that respect, insect-based bars are the undisputed market leader. However, the bar's appeal is perceived to be the lowest compared to the other bar types (oat, nut, protein, fruit). The low appeal is explained by the insect bars' perceptions of not being tasty, not having enough information about it and being considered disgusting and high in protein. To be competitive among the vast number of non-insect bars already available, it is crucial to enhance the appeal of insect bars. The perceptual map analysis revealed that especially oat and nut bars pose

a risk to introducing insect-based bars because both bar types are located in the upper-right quadrant and are thus associated with a positive quality and appeal. Yet, their positioning not only presents a threat but is also a strong indicator of what consumers are looking for regarding taste. Since nut and oat bars are considered the tastiest and second-tastiest bars, their ingredients can be used to improve the appeal of insect bars. In contrast to the oat and nut bar, the protein bar is perceived negatively in both dimensions (low appeal and low quality). Nevertheless, it is the most frequently consumed bar, implying that consumers buy protein bars to fulfil a need instead of experiencing a pleasant taste. It is striking that consumers perceive protein and insect bars as disgusting and rich in protein. Hence, insect bars could also fulfil consumers' needs for a high protein bar. However, unlike the protein bar, the insect bar is perceived as high in quality (healthy, sustainable, and free of harmful ingredients). Consequently, the insect bar could potentially fill a current white space in the snack bar market by being branded as a "natural protein bar" that is not only rich in protein but also contains healthy and sustainable ingredients. Fruit bars are directly opposite to insect-based bars since they are low in quality but positive in appeal. In total comparison to insect bars, consumers feel informed about fruit bars and perceive them as unhealthy. Therefore, consumers that are informed about fruit bars are probably more informed about the negative health attributes rather than about a non-existing good quality. However, since the high availability of information positively influences appeal, it can be assumed that consumers still prefer to have negative information instead of no information. This finding points out that information is desirable for the appeal, independent of positive or negative information. Thus, consumers wish to be elucidated about the (dis-)advantages of insect-based bars to be perceived as an informative bar. Ultimately, insect-based bars need to become more appealing while maintaining the level of quality to be perceived as the best-performing bar in the market compared to the existing alternatives.

The perceptual map revealed that the appeal of insect-based bars does not meet consumer needs. Hence, the insect bar's appeal must be enhanced to be positioned in the upper right corner of the perceptual map. Based on the obtained insights, the following actionable recommendations are provided:

1) Improve taste association

a) Taste is a crucial factor for insect consumption. Thus, insect-based bars should take nut and oat bars as inspiration since they are perceived as the tastiest bars. It is recommended that insect bars are based on nuts or at least include nuts and oats.

b) Given that protein is opposite to taste and the second least tasty bar, it is advisable to minimise the typically associated protein taste in insect bars to in turn, increase the perceived taste. As insect-based bars contain a high level of protein, it is impossible to entirely exclude protein from insect-based bars, but the taste should not be dominated by protein.

2) Increase available information

a) Since consumers perceive not having enough information about insect bars the presence of the bars in retail stores would be beneficial to increase its visibility and subsequently the available information. Besides, the consumers' attention can be easily caught by using POS marketing material like wobblers, banners, and shelf displays in retail stores. Hence, more consumers can get informed about the insect bars and their positive effects.

b) Influencers can serve as a useful touchpoint to inform consumers about insect-based bars. To target the right consumer groups and be a credible brand, influencers focusing on either fitness, sustainability or adventure should be cooperated with. The goal of influencer marketing is to sensitise the target group about insect-based bars and likewise to inform consumers about the benefits of insect bars to "regular" ones.

3) Decrease the level of disgust

Educating consumers is not sufficient to reduce disgust. To tackle the high perceived disgust of insect-based bars, tastings are required. Supermarkets (e.g., organic stores), fitness studios, and outdoor stores represent suitable venues to offer free trials to the target group. Thereby, consumers can experience the taste of insect-based bars and consequently reduce the expected disgust.

4) Maintain and confirm the high perceived quality

a) Since consumers perceive insect bars to be of high quality, even though they have never consumed them, this perception should be confirmed by an official label on the packaging to verify sustainable production and healthy ingredients. Options could be an eco-label or nutri-score[8].

b) Support the positioning with a favourable pricing strategy. An agile pricing approach should be pursued that allows to adjust the prices in line with the market development. The price should not be below the WTP, to maintain a high perceived quality.

5) Brand the product as "natural protein bar"

The fact that protein bars are perceived as disgusting and low in quality, concluding that consumers only consume protein to fulfil a need, can favour insect-based bars to enter a white space. Insect bar consumers would benefit from consuming protein and healthy ingredients fulfilling two separate needs. Hence, it is recommended to brand insect-based bars as "natural protein bar" to stress the fulfilment of both and have a competitive advantage against the frequently consumed traditional protein bars.

[8] The Nutri-Score is an additional and simplified display of nutritional information on the front of food packaging and is intended to make it easier for consumers to choose healthy foods (eurofins 2022).

6) Gain popularity and increase visibility through cooperation

Among the perceptual map survey sample, two-thirds of participants named "Corny" as the bar brand they could recall. Due to the extremely high popularity of the bar brand "Corny" in Germany, it is recommended to cooperate with the company for launching insect bars. Corny represents the ideal partner as it already has a wide range of bars available. They offer 36 flavours across three different bar types (oat, nut, protein) in their product portfolio (Corny 2022). The overall appeal of insect-based bars could be leveraged by building up on Corny's credibility and experience.

RQ2: What are preferred product attributes for insect-based bars in the German market?

Customers place the highest value on the product attributes base, closely followed by flavour and price. These factors are most critical in influencing consumer preferences and should be considered to the utmost extent to create a higher market acceptance of insect bars. Lower importance is ascribed to the attributes eco-label, design respectively, insect illustration and lastly, marketing claims. Yet, it should not be concluded that these attributes can be disregarded since they implicitly may help to solve persistent barriers around insect bar consumption, such as the consumers' lack of knowledge or providing a competitive advantage. When breaking it down to the product attribute levels, the following becomes evident: Among the bases, nut bars are preferred, chocolate is the most liked flavour and the lowest price of €1.69 is favoured over the medium and high prices. Consumers further prefer an eco-label integration, a design without an insect illustration and the claims "Made in Germany" and "Natural protein source". Hence, in the following, major findings of the conjoint analysis will be discussed and put into relation with each other. Moreover, insights from the trial will be taken into account for the discussion.

Taste, consisting of base and flavour, is the most important attribute, implying that consumers predominantly base their purchasing decision on taste. Set against conventional snack bars, insect

bars must exceed expectations regarding taste and added value. Failing to do so, a product category currently associated with unfavourable perceptions such as disgust or low appeal cannot provide sufficient (re-)purchase incentive and establish itself as a viable market player. That is why, insect bar producers should tackle the discrepancy between taste as the major purchase criterion and the currently perceived unsatisfying taste of insect products. To provide an answer on how to solve this issue, a discussion about the respective taste level preferences will follow. The sample prefers nut bases. This finding is reinforced by the field trial in which the Bug-Break bar – the only nut-based bar in the tasting - was ranked highest in terms of taste, where especially the crunchiness was highlighted. In terms of flavour, chocolate was the unequivocal favourite in the conjoint analysis, and in the field trial, chocolate-coated bars were favoured when ranking the bars' appearance without packaging. In the tasting, among the chocolate-flavoured bars, macadamia-salted caramel was the most selected and one of the tastiest bars. It can be concluded that consumers are most receptive towards chocolate and trend flavours in general. Concludingly, the **recommendations** are as follows:

1) Reserve a high investment in R&D to match the desired taste. Consult and integrate consumer feedback early in the product development process (e.g., in the form of a blind tasting to reduce bias on packaging and appearance to capture taste preferences).
2) The bar should come with either a nut or crunchy consistency and in either a chocolate flavour or with a chocolate coating. Moreover, offering a flavour variety, including trend flavours, that do not yet exist in the conventional snack bar category should be considered to gain a unique selling point (USP) against competitors.
3) When selecting the raw materials for the bar, the value should be placed on using high-quality ingredients to fulfil the high-quality associations. Nevertheless, this should be carried out to the extent that is feasible with the subsequent discussion about the **price**.

Attributes cannot be viewed detached from each other, instead, they are intertwined. For instance, the better the taste, the higher the willingness to pay a higher price, as concluded in the field trial. An overall price sensitivity towards insect-based bars exists. This can be seen by the elastic demand but it is also reflected in the preference for the lowest price of €1.69. Still, ca. 45% of the respondents favoured a price of €2.29. The preference of price is relatively balanced with a little tendency toward €1.69. To reflect the consumers' WTP in the best way, the average prices of €2.04 in the field trial and €2.09 in the conjoint analysis are crucial to consider. A price of €2.09 seems more favourable because of the psychological effect of having a nine on the second decimal place and the bigger sample size of the conjoint analysis. For the price-sensitive respondents, the demand for an insect bar responds to price. Thus, it is essential to pay attention to the changes in the competitors' prices that consumers consider. Since there is no availability of insect bars in stores and only a few online players exist, the direct competition are the traditional snack bars. Not only the reference price but also the context impacts the consumers' price sensitivity. Regarding the respondents preferring a price of €2.29 or higher, it can be assumed that the high perceived quality of insect bars is reflected in their WTP. Further, it can be argued that they view price as a proxy for quality. Hence, two types of participants exist: participants sensitive to price and participants who associate price with quality.

The researchers did not consider the costs of production as it was out of the study's scope. One might argue that the production costs are higher for insect-based bars due to the innovative ingredient and especially when an eco-label is included, but still, the price should rather be defined resting upon a value-based approach. This will ensure that the consumers' perceived value, expressed in their WTP, is met.

4) Follow a value-based pricing strategy for the insect-based bar that reflects the consumers' WTP. Do not disregard competitive pricing, as reference prices affect the price evaluations.

5) A price range between €1.69 and €2.09 is recommended. This range is based on the following findings: (1) The overall most preferred price of €1.69; (2) The average price of €2.09; (3) The fact that a large part of the sample is willing to pay a price of €2.29 or higher.
6) Provide incentives to both types of respondents

a. Keep an agile pricing approach that allows to react to changes in the overall WTP and to adjust the price towards maintaining high quality to retain the association of quality with price.
b. Introduce temporary price promotions in the form of small price reductions (e.g., product bundling) to incentivize sensitive consumers to try the insect-based bar. Reduce price consciousness by promoting the insect bar in the context of feeling good and having a pleasant experience when consuming it.

The following two paragraphs deal with the **packaging** of an insect-based bar. Almost three-quarters of the sample preferred an **eco-label** on the insect bar's packaging. However, both the importance and the consumers' WTP were relatively low. This contrasting finding points to a discrepancy between the survey responses and the actual consumer behaviour. Selecting a bar with an eco-label is the more socially accepted response. However, two out of three analyses showed rather low importance, so it can be assumed that an eco-label does not drive the purchase of an insect bar. Nevertheless, other aspects need to be considered. To maintain a high-quality positioning, the eco-label might be essential to communicate and emphasise the high standards. As it is still challenging to receive an eco-label, implementing the label might provide a point of difference regarding non-insect-based bars. This might lead to a USP that allows to position the brand as sustainability concerned. Following this approach would probably attract sustainability-conscious people. Hence, a broader customer base might be generated. Concerning the financials, it seems unrealistic to offer an insect bar with an eco-label at the most preferred price of €1.69. However, the findings reveal that the sample would be willing to pay a premium for the label. This

leads to the conclusion that in case of offering an insect bar with an eco-label it should be done with a price at the higher end of the proposed price range of €1.69 and €2.09.

7) Aim to realize the implementation of an eco-label, although higher costs might occur. Mitigate the higher costs by selling the insect bar at a price of €2.09. This might lead to a USP and underlines the insect bar's high quality.

Next, the packaging aspects are further discussed. The **design** in form of an insect illustration is even lower in importance. The main reasons for that finding might be the general aversion towards insects and the disgust association that is predominant by most Western consumers. The conjoint analysis and field trial revealed contradictory results: For the conjoint analysis, the respondents did not favour a packaging that contained an insect illustration, whereas, for the trial, the participants did not bother whether the packaging contained an insect. However, the field trial participants did not prefer a brand or product name that mentions the term "insect". Nevertheless, given the bigger and more homogeneous sample size of the conjoint analysis, a packaging without an insect illustration is advisable. This is surprising as one might argue that consumers value transparency during the purchase process and would want to know at first glance if the product contains insects. Another contrary aspect is that the insect bar is perceived as a high-quality product mainly due to the healthy ingredients. In conclusion, the illustration of an insect does not incentivise the consumer to buy the insect bar. What is more, the packaging should be distinctive from other products to stand out from the crowd. Lastly, the respondents have controversial opinions on the colouring and the size of the bar.

8) A trade-off between the dispreference of being confronted with an insect illustration and the objective to position the product with an USP exists. As a compromise, it is recommended to not place an insect illustration on the packaging but implement the term "based on insects" in the product's name.

9) Offer an insect bar with a vertical shape and a distinct colouring that differentiates the bar from others. A clean design and green colour coding are favourable to evoke health associations and emphasize the high quality of the insect bar. The size of the bar should be bigger than 35g but smaller than 85g.

Next, the paper found that the sample places the least value on **marketing claims** which can be, in turn, considered irrelevant to their purchase decisions. Also, in the field trial, participants did not pay attention to the claims when making up their decisions about the packaging. A major reason for this could be e.g., the association of claims as a marketing trap. Nonetheless, due to the prevalent use of marketing claims among competitors, renouncing on including an on-pack claim could weaken the shelf effect besides the traditional competitors. Moreover, adding a claim can further help to improve the current prevailing lack of knowledge about the benefits of insect-based nutrition. Having said this, the studies revealed ambivalence between the claims "Natural protein source" (representative claim for health) and "Made in Germany" (representative claim for sustainability) when it comes to the preferred claim. Yet, among these exemplary claims, consumers prefer sustainability and health over hedonic claims.

10) Companies should include health and sustainability claims to withstand competitors. An eye-catching visualization of the marketing claim may further help to stand out from other players.
11) It should be considered to test more claims within each category to identify the most impactful claims.

While the previously discussed preferences refer to the overall sample, the conjoint analysis allows drawing conclusions on the **targeting**. There is a pronounced discrepancy in preferences between the overall sample and the typically described insect food target group demographics (i.e., male and aged 18-39). This provides ample evidence that targeting makes sense in the case of insect-based bars.

12) Offer tailored bars answering different target segments' needs and wants while striving for product-target group fit. First, it is recommended to enter a niche segment, such as the target group mentioned in this paper before gradually expanding to a broader target group of sustainability and health-conscious people.

While most of the discussed preferences are also valid for the target demographics, there are distinct differences among the preferences for the attributes base and marketing claim. Firstly, the target group favours protein instead of nut bases. At the same time, the target places above-average importance on taste attributes. Given the importance of satisfying and exceeding taste expectations, taking these preferences into account is critical to reach the target group. In terms of marketing claim, it is striking that the target group prefers the sustainability-related claim "Made in Germany" by far, despite their interest in protein bases. Yet, it can be argued that the target demographics have a general interest in healthy, natural, and local ingredients, tying in with the recommended branding as "natural protein bar".

13) Launch a protein-based bar for the target segment with the claim "Made in Germany".

6 Conclusion

To the researchers' best knowledge, this is the first study that sheds light on the comparison among perceptions of insect-based bars against traditional bars. A further original contribution is the configuration of the optimal insect-based bar, including unexplored aspects such as the impact of an eco-label integration, as well as detailed insights on the willingness to pay for insect bars. The study results further suggest that insect-based bars can be an appropriate entry category to familiarize German consumers with entomophagy. Once established, the extension of insect products into other categories can be considered.

Yet, the study has **limitations**, paving the way for **future research**.

Since 99% of the respondents in the perceptual map survey had never eaten insect bars, the participants lacked the experience to evaluate them thoroughly. Furthermore, given that insect-based bars are hardly available at German retailers, consumers lack information and knowledge about them. Consequently, the participants' perception is based on instinct, intuition, or expectations which limits the validity of the study. Once German consumers know more about insect-based food, future research on consumers' perceptions will be insightful.

The conjoint analysis survey was only based on insect-based bars and hence, does not reflect the entire snack bar market. Ultimately, consumer reactions in the entire bar segment cannot be modelled. However, incurring this limitation was essential to identify the genuine insect bar preferences. For future research, a comprehensive market study including traditional and insect-based snack bar brands is useful as soon as insect-based bars are more established.

The main limitation of the field trial is its small sample size of 30 participants. In addition, the sample was very homogenous since it consisted exclusively of business or economics students aged between 22 and 28. Moreover, each participant tasted only three of the eight available bar flavours, which limited the comparability of results. However, given this research study's scope and financial constraints, it was not feasible to obtain a larger sample. For future research, it is recommended to conduct a bar tasting with a more heterogenous sample, a bigger sample size, and in which each participant tastes all flavours available.

Concludingly, an investigation of other processed and unprocessed insect-based food product categories might be helpful for future research to identify which products are suitable to arouse more interest and acceptance for entomophagy.

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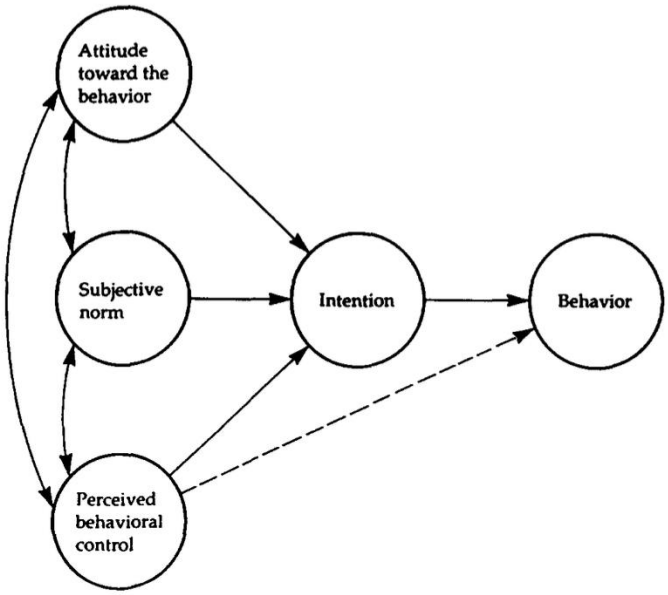
8 Appendix

Appendix 1: Theory of reasoned actions model



(Ajzen 1991)

Appendix 2: Expert interview profiles

Name	Role	Company / Institution	Company / Institution Info
Nicolas Viegener	Co-founder & General Manager	isaac nutrition	"We set out to establish insect protein in Europe. We process our finely ground insect protein into protein-rich snacks and foods that combine outstanding taste with top nutritional values and sustainable production. Founded in 2018." (isaac nutrition 2022)
Peter Prislin	Director Marketing Strategy & Communication	Hans im Glück	"Fresh ingredients every day, the best quality and an ambience to feel good in the middle of real birch trunks - this is the recipe for success of HANS IM GLÜCK Burgergrill & Bar since 2010. With over 90 burger grills throughout Germany, Switzerland, Austria and Singapore, the brand continues to grow." (Hans im Glück 2022)
Tânia Calçada	Product Innovation Area Manager	Sonae MC (Continente Food Lab)	"The Continente Food Lab is the reflection of the constant bet on the food innovation of the Continent. In this pioneering concept in Portugal, you can get to know in an easy way the most innovative products and the new world food trends. The products are launched from an experimental and dynamic perspective, in which your feedback is crucial to save them and keep them in our stores." (Continente Food Lab 2022)

Baris Özel	Department Manager of Alternative Protein Products	Kupfer Innovative Food (Acquired Bugfoundation)	"New Generation - New Food! More and more people are giving up meat, at least sometimes. This means that meat substitutes are more and more popular and will continue to play a greater role in nutrition in the future. As Kupfer, we want to help shape this transformation process. To this end, we founded Kupfer Innovative Food GmbH in 2014. in which we bundle our decades of food expertise." (Kupfer Innovative Food GmbH 2022)
	Previously: Founder & Managing Director	Bugfoundation	"As the first German company Bugfoundation GmbH creates tasty, healthy and sustainable food - made of insects. The idea evolved during the world trip of two friends and an adventurous dinner in South East Asia and is now an awardwinning and EU-funded company. Founded in 2014." (Bugfoundation 2022)
Dr. Mark Lohmann	Head of the Section Risk Sociology and Risk-Benefit Assessment	German Federal Institute for Risk Assessment	"The central task of the BfR is the independent scientific risk assessment of food and feed as well as substances and products as the basis for the consumer health protection activities of Germany's federal government." (BfR 2022)
Dr. Florian Fiebelkorn	Researcher	Chair of Biology Didactics at the University of Osnabrück	"The overall goal of Dr. Fiebelkorn's research is to encourage people to adopt sustainable behaviors. To achieve this goal, my research focuses on investigating the ideas and attitudes that prospective biology teachers and students have about biodiversity and sustainable food." (Universität Osnabrück 2022)

Appendix 3: Benefits about insect-based food consumption

Background Information
Prior research studies state that the world's population will grow to approximately nine billion people by 2050 (Orsi, Voege, Stranieri 2019). As a result, current food production will have to double to meet the ever-growing demand for food (FAO 2009). Insects could provide a solution to these challenges, as they need fewer natural resources such as water, feed and land than conventional animal farming (Dunkel and Payne 2016; Gamborg, Röcklinsberg, and Gjerris 2018; Van Huis et al. 2013). They also produce far fewer greenhouse gas and ammonia emissions (Halloran et al. 2016; Oonincx 2017; Van Huis and Tomberlin 2017). Approximately 80% of most insects can be eaten and digested; this compares to about 55% for chickens and pigs and only 40% for cow (Heckmann et al. 2018; Van Huis et al. 2013). (cp. Introduction).

Appendix 4: Consumer interview profiles

Consumer Type	Age	Occupation	Interests
Sports- and nutrition Hardliner	33	Key Account Manager e-Commerce (Beauty Industry)	Heavily involved in CrossFit for ten years. She practices several times a week and is also a trainer of CrossFit.
Sustainability-concerned person	25	Event & Tour Manager	Environmental consciousness impacts decision making in most aspects of life: completely renounces on plastics, avoids traveling by plane, vegetarian diet, frequently shopping in zero waste shops.

Sustainability-concerned person	48	Self-employed	Has become more and more eco-aware over the past years: Reduced meat consumption over the past years and is now vegetarian. Tries to shop in zero waste shops more often and only uses a car when really necessary.
Adventurous & curious person	29	Student (Master's in Sociology)	Interested in social activism, techno and traveling, meeting other cultures.
Adventurous & curious person	22	Student (Master's in Economics)	Very open-minded mindset. Loves to try out new things, learn about unknown topics and experience new cultures around the world.

Appendix 5: Perceptual map survey questions

Introduction Text:

Dear participant,
Thank you for taking part in the survey and supporting our final thesis. This study is about the perceptions regarding insect-based foods. The questionnaire will take 5 minutes to complete. For the success of the study, it is important that you fill out the questionnaire completely and do not omit any question. Please answer all questions as spontaneously and honestly as possible, there are no right or wrong answers.

Your information will be used for purely scientific purposes, will be collected anonymously and will be kept strictly confidential at all times. If any questions arise, please feel free to contact us by email: 49260@novasbe.pt. Thank you for your participation in this survey!

Disclaimer/explanation text: Includes a definition of our understanding of the bar sub-categories & a visualization

Before you start the survey, please read the following section carefully so that you have a common basic understanding of the types of bars.
In the following you will see an explanation of the bars. The selection of the pictures has no meaning, it is only for exemplary visualization.

Nut bar: The base of the bar consists of nuts. The nuts are often coated with honey or glucose syrup. Other ingredients of the bar can be chocolate and/or fruits.
Oat bar: The base of the bar consists of oat flakes. Further ingredients of the bar can be e.g. fruits, cocoa and/or nuts.
Protein bar: The bar is characterized by a homogeneous consistency and is often based on milk protein and additives.
Fruit bar: Between two wafers there is a fruit filling made of different types of fruit.
Insect bar: The base of the bar consists of processed insects, which are not visible (e.g. crickets). The bars also often consist of oatmeal, dates, raisins, pea protein, nuts, honey and/or chocolate.

Category	Number	Type	Question	Answer Options	Comments
Pre-Screening	1	Single Choice	Have you lived in Germany for at least 5 years?	Yes	Respondents selecting no get excluded automatically
				No	
Prominence of bars	2	Open Text	When you think of bars: which brands come to your mind?	Brand 1: Open Text	Not mandatory to fill in
				Brand 2: Open Text	
				Brand 3: Open Text	
	3	Single Choice (for each subcategory)	How often do you consume the following bar types?	Nut bar (never, less than once a month, once a month, once a week, every day)	Pictures of respective bars shown here (not packaging but bar itself)
				Oat bar (never, less than once a month, once a month, once a week, every day)	
				Protein bar (never, less than once a month, once a month, once a week, every day)	
				Fruit bar (never, less than once a month, once a month, once a week, every day)	
				Insect-based bar (never, less than once a month, once a month, once a week, every day)	

Perceptions	4	N/A	In the following, you will be asked about your perception of several properties of different bars. You don't have to have already consumed the bar - it's just about your personal assessment (with the help of the previous texts and pictures).	Usage of Likert Scale 1-5 (1 "Strongly disagree", 5 = "Strongly agree")	Randomize order of characteristics (except for the last two statements)
	4.1	Single Choice	**Taste** (The bar has a pleasant taste.)	Nut bar	
				Oat bar	
				Protein bar	
				Fruit bar	
				Insect-based bar	
	4.2	Single Choice	**Healthy** (The bar is healthy.)	See 4.1	
	4.3	Single Choice	**Protein** (The bar is a source of protein.)	See 4.1	
	4.4	Single Choice	**Diversity** (The bar has a sufficient flavor diversity.)	See 4.1	
	4.5	Single Choice	**Good ingredients** (The bar is free from harmful ingredients - excluding sugar/sweeteners.)	See 4.1	
	4.6	Single Choice	**Sustainable** (The ingredients of the bar are sustainable.)	See 4.1	
	4.7	Single Choice	**Information** (I know sufficient pros and cons about the bar.)	See 4.1	
	4.8	Single Choice	***Attention Check:*** Please always select the option "Neither agree nor disagree" to confirm your attention.	See 4.1	
	4.9	Single Choice	**Disgust** (The bar is repulsive.)	See 4.1	
Likelihood of consumption	5	Single Choice	Have you ever consumed insects (in any form) before?	Yes	
				No	
	6	Single Choice	How likely is it that you would consume insect-based bars in the future?	Very unlikely	
				Unlikely	
				Neutral	
				Likely	
				Very likely	
	7	Single Choice	Are there any restrictions on the consumption of bars?	No	
				Yes (e.g. intolerances / allergies)	
Demographics	8	Single Choice	What is your gender?	Female	
				Male	
				Diverse	
				Prefer not to answer	
	9	Text Field	How old are you?	Open Text	
	10	Single Choice	What is your highest educational qualification?	No formal education	
				Lower secondary education	
				Higher secondary education	
				Apprenticeship	
				Academic degree (Bachelor's, Master's or Doctorate)	
				Prefer not to answer	
	11	Single Choice	What is your professional situation?	Student	
				Employee	
				Civil servant	
				Freelancer	
				Jobseeker	
				Other	
Demographics	8	Single Choice	What is your gender?	Female	
				Male	
				Diverse	
				Prefer not to answer	
	9	Text Field	How old are you?	Open Text	
	10	Single Choice	What is your highest educational qualification?	No formal education	
				Lower secondary education	
				Higher secondary education	
				Apprenticeship	
				Academic degree (Bachelor's, Master's or Doctorate)	
				Prefer not to answer	
	11	Single Choice	What is your professional situation?	Student	
				Employee	
				Civil servant	
				Freelancer	
				Jobseeker	
				Other	

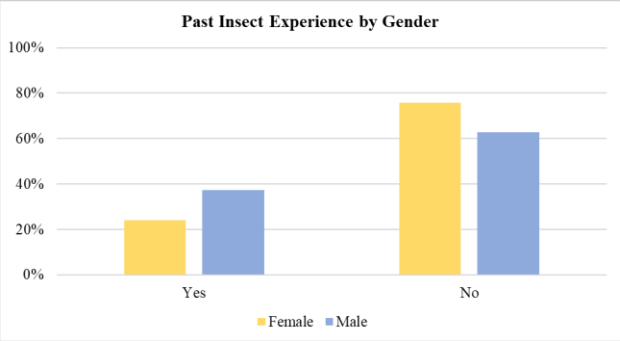
Appendix 6: More detailed description of bar types

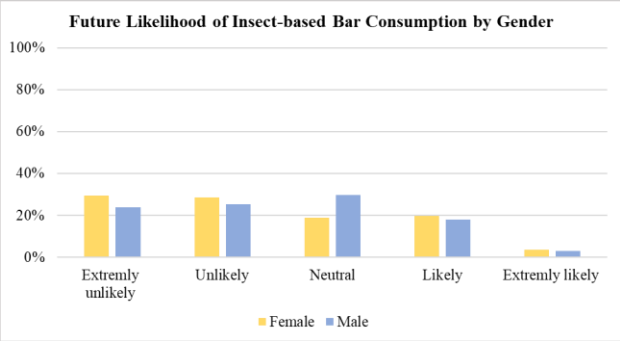
	**Nut bar:** The base of the bar consists of nuts. The nuts are often coated with honey or glucose syrup. Other ingredients of the bar can be chocolate and/or fruits.
	**Oat bar:** The base of the bar consists of oat flakes. Further ingredients of the bar can be e.g. fruits, cocoa and/or nuts.
	**Protein bar:** The bar is characterized by a homogeneous consistency and is often based on milk protein and additives.
	**Fruit bar:** Between two wafers there is a fruit filling made of different types of fruit.
	**Insect bar:** The base of the bar consists of processed insects, which are not visible (e.g. crickets). The bars also often consist of oatmeal, dates, raisins, pea protein, nuts, honey and/or chocolate.

Appendix 7: Demographic profile perceptual map survey

n = 185	**Characteristic**	**Frequency**	**Percent**
Gender	Male	67	36.2%
	Female	116	62.7%
	Diverse	2	1.1%
Age	0 - 25	95	51.6%
	26 - 35	32	17.4%
	36 - 45	4	2.2%
	46 - 80	53	28.8%
Education	Secondary Education	25	13.5%
	Apprenticeship	22	11.9%
	Academic degree	137	74.1%
	Prefer not to answer	1	0.5%
Occupation	Student	2	1.1%
	University student	82	44.3%
	Employee	71	38.4%
	Civil servant	10	5.4%
	Freelancer / Self-employed	10	5.4%
	Jobseeker	1	0.5%
	Other	9	4.9%

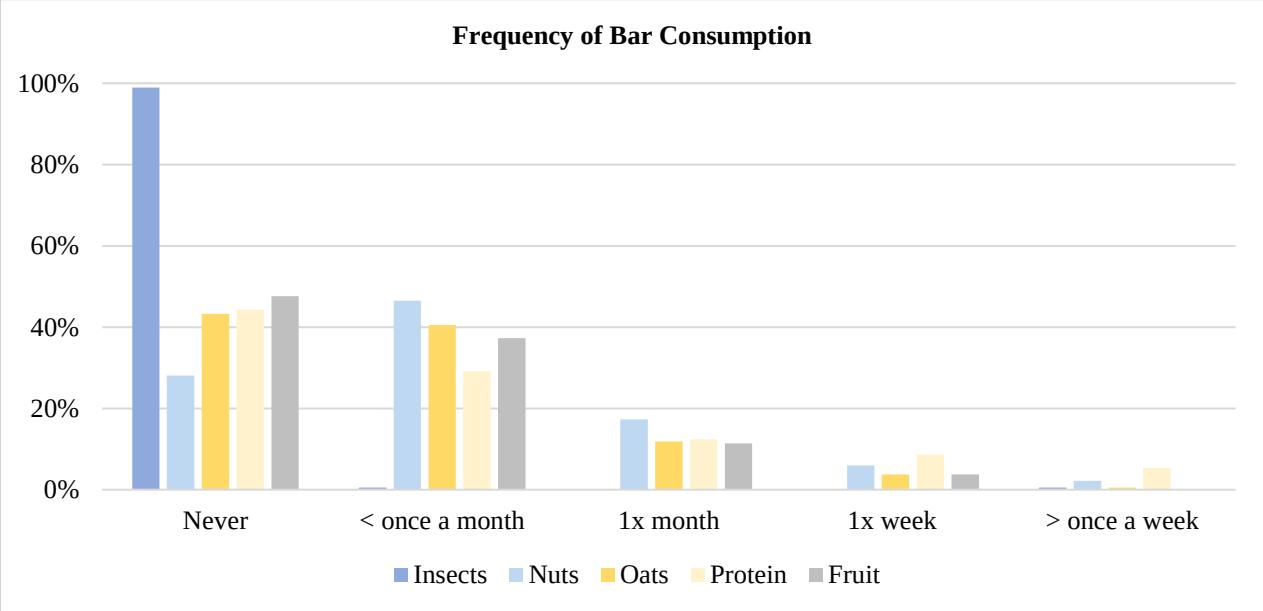
Appendix 8: Past insect experience by gender & future likelihood of insect-based bar consumption by gender





*The Gender "Diverse" was excluded from the analysis, as it only represented a fraction (<1%) of the sample size.

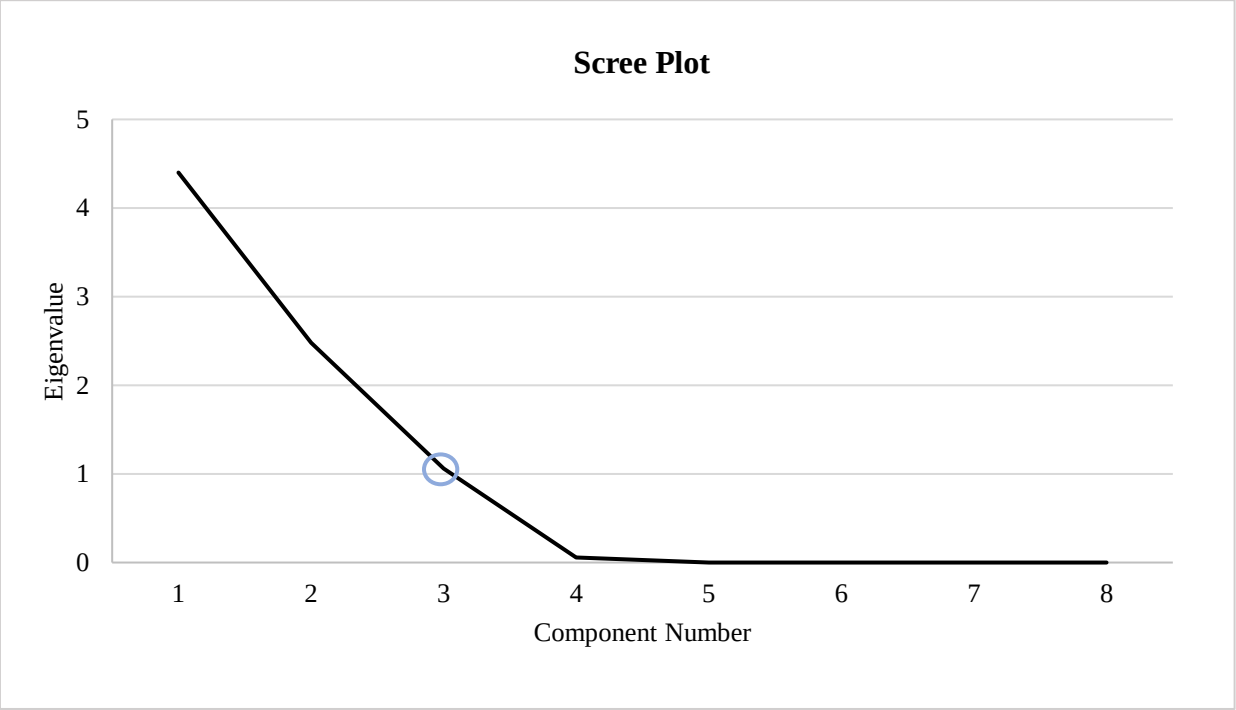
Appendix 9: Frequency of bar consumption



Appendix 10: Average values per attribute (used for SPSS)

	Taste	Health	Protein	Diversity	Good Ingredients	Sustainability	Information	Disgust
Nutbar	4.08	3.34	3.41	3.68	3.28	3.07	3.31	1.55
Oatbar	3.65	3.42	3.02	3.45	3.31	3.39	3.07	1.72
Proteinbar	3.08	3.02	4.46	3.75	2.57	2.61	3.20	2.24
Fruitbar	3.45	2.83	2.24	3.64	3.00	3.18	3.05	2.03
Insectbar	2.62	3.43	4.12	2.81	3.28	3.55	2.25	3.38

Appendix 11: Scree plot



Appendix 12: Factor loadings with unlimited number of factors

Without Rotation			
	Components		
	1	2	3
Taste	-.712	.664	.187
Disgust	.866	-.467	-.147
Information	-.974	.117	.192
Protein	.337	-.650	.679
GoodIngredients	.466	.875	.077
Sustainability	.734	.632	-.236
Health	.576	.464	.667
Diversity	-.997	-.072	.028

With Rotation OBLIMIN			
	Components		
	1	2	3
Taste	-.963	.316	-.195
Disgust	.990	-.096	.121
Information	-.955	-.147	.112
Protein	.233	.189	.954
GoodIngredients	-.011	.821	-.416
Sustainability	.463	.528	-.561
Health	-.027	1.02	.329
Diversity	-.818	-.404	.072

With Rotation PROMAX			
	Components		
	1	2	3
Taste	1.003	.351	-.150
Disgust	-.993	-.099	.131
Information	.912	-.212	.033
Protein	-.233	-.010	.938
GoodIngredients	.155	.969	-.205
Sustainability	-.352	.705	-.385
Health	.175	1,009	.531
Diversity	.739	-.472	-.056

= attribute loads on component one
= attribute loads on component two
= attribute loads on component three
= cross-loading: if attribute mainly loads on component one or three but also high on component two
= cross-loading: if attribute mainly loads on component two or three but also high on component one
= cross-loading: if attribute mainly loads on component one or two but also high on component three

Appendix 13: Perceptual map coordinates of bars

	Dimension 1	Dimension 2
Nut bar	.93	.12
Oat bar	.55	.68
Protein bar	-.40	-1.52
Fruit bar	.49	-.33
Insect bar	-1.56	1.05

Appendix 14: Communalities of two- and three-factor solution

Communalities	
Three-factor solution	
	Extraction
Taste	.984
Health	.991
Protein	.997
Diversity	.999
Good Ingredients	.989
Sustainability	.994
Information	.999
Disgust	.989

Communalities	
Two-factor solution	
	Extraction
Taste	.948
Health	.547
Protein	.536
Diversity	.999
Good Ingredients	.983
Sustainability	.938
Information	.962
Disgust	.968

Appendix 15: Competitor prices

	Brand	Original price	Price per 40g	Source
Insect bars	Sens Protein Bar	€2,79 per 60g	€1.86	(Sens 2022)
	Sens Protein Bar	€2,90 per 60g	€1.93	(Sens 2022)
	JiMiNi'S High Protein Bar	€2,00 per 40g	€2.00	(JiMiNi'S 2022)
	Bug-Break Insect Bar	€2,99 per 36g	€3.32	(Bug-Break 2022)
	isaac nutrition	€2,49 per 60g	€1.66	(isaac nutrition 2022)
	Essento	€2,73 per 35g	€3.12	(Essento 2022)
	Catch-Your-Bug	€2,49 per 40g	€2.49	(Catch-Your-Bug 2022)
	Portugal Bugs	€1,79 per 35g	€2.05	(Portugal Bugs 2019)
Average price			€2.30	
Maximum price			€3.32	
Minimum price			€1.66	

Appendix 16: Marketing claims competitors

Brand	Marketing claims from source	Marketing claims translated	Source
isaac nutrition	Handgemacht in Deutschland Proteinriegel der Zukunft 20g nachhaltiges Eiweiß, Laktosefrei & sättigend	Handmade in Germany Protein bar of the future 20g sustainable protein, lactose-free & filling	(isaac nutrition 2022)
Essento	Vitamin B12 High in Fibres Lactose-Free	Vitamin B12 High in Fibres Lactose-Free	(Essento 2022)
JiMiNi'S Protein Bar	Source of Protein High in Fibre No Additives Palm Oil Made in France	Source of Protein High in Fibre No Additives Palm Oil Made in France	(JiMiNi'S 2022)
Bug-Break	Proteinreich, Nachhaltig / Lecker (nur Rückseite)	Protein-rich, Sustainable / Delicious (reverse side only)	(Snack-Insects 2022)
Catch-Your-Bug	Hoher Proteingehalt Ballaststoffquelle	High protein content Source of dietary fibre	(Catch-Your-Bug 2022)
Portugal Bugs	17% (15% / 18%) Protein Environmentally Friendly – Sustainable Product	17% (15% / 18%) Protein Environmentally Friendly – Sustainable Product	(Portugal Bugs 2019)

Appendix 17: Conjoint survey – design illustration

A: Without insect illustration

B: With insect illustration

Appendix 18: Advantages and disadvantages generic vs. brand-specific conjoint

Generic Conjoint	Brand-Specific Conjoint
It is the most commonly used discrete choice experiments Used for: • Feature selection for new or redesigned products • Marginal willingness to pay for certain features relative to others • Setting prices for a product, particularly in mass markets, where product characteristics do not vary substantially by brand or SKU • Tests of branding, packaging and promotional claims (Conjointly 2022b)	It is a discrete choice method for markets where potential features of the product vary by brand or SKU Used for: • Feature selection for new or redesigned products • Setting prices for a product, considering competitors' offers and prices • Tests of branding, packaging and promotional claims (Conjointly 2022i)

Appendix 19: Conjoint analysis survey questions

Introduction Text:
Dear participant,
Thank you for participating in the survey and supporting our final project. This study is about the preferences regarding insect-based bars.

The questionnaire will take 7 minutes to complete. For the success of the study it is important that you complete the survey to the end and do not omit any question. In the following, you will be shown 3 different variants of a product. Choose your preferred option from each of these 3 choices. It is strongly recommended that you complete the survey on a PC/laptop/tablet!

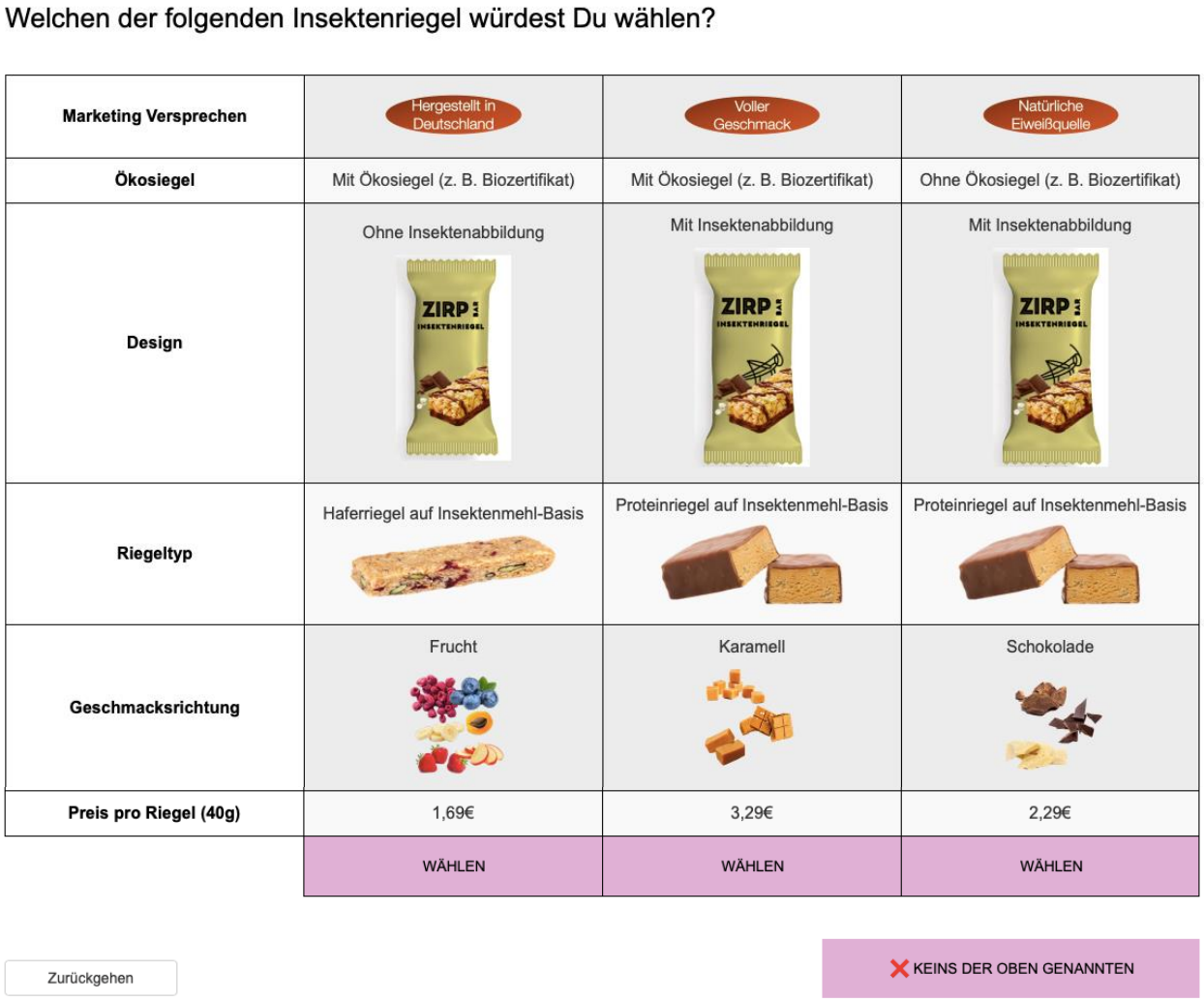
Please answer all questions as spontaneously and honestly as possible, there are no right or wrong answers. Your data will be used for purely scientific purposes, will be collected anonymously and will be kept strictly confidential at all times.

Thank you for your participation!

Category	Number	Type	Evaluation Criteria	Characteristics	Comments
Pre-Screening	1	Single Choice	What is your nationality?	German	
				Austrian	
				Swiss	
				Other	
Block of conjoint questions	2	Single Choice (participant is shown 3 possible bar configurations)	Bar basis	Nut bar based on insect flour; Oat bar based on insect flour; Protein bar based on insect flour	Pictures of respective characteristics shown here for base, packaging, and flavour Configurations
			Flavour	Fruit; Chocolate; Caramel	
			Design	With insect illustration; Without insect illustration	

			Marketing Claim	Rich in taste; Natural protein source; Made in Germany	are shown to participant randomly
			Eco-label	With eco-label (e.g., bio certification); Without eco-label (e.g., bio certification)	
			Price	€1.69; €2.29; €3.29	
	3	Single Choice	What is your gender?	Female	
				Male	
				Diverse	
				Prefer not to answer	
	4	Single Choice	How old are you?	Open Text	
	5	Single Choice	What is your highest educational qualification?	No formal education	
				Lower secondary education	
				Higher secondary education	
				Completed apprenticeship	
				Academic degree (e.g., Bachelor's, Master's or Doctorate)	
				Prefer not to answer	
				Other	
	6	Single Choice	What is your professional situation?	Student (school)	
				Student (university)	
				Employee	
				Civil servant	
				Freelancer	
				Jobseeker	
				Other	
	7	Single Choice	Which device did you use to participate in the survey?	Computer / Laptop / PC	
				Smartphone	
				Tablet	

Appendix 20: Conjointly interface



Appendix 21: Demographic profile conjoint analysis

n = 109	**Characteristic**	**Frequency**	**% (Percent)**
Gender	Male	43	39.4%
	Female	66	60.6%
Age	0 - 25	51	47.3%
	26 - 35	21	19.6%
	36-45	3	2.7%
	46-80	34	30.4%

Education	Lower secondary education	2	1.8%
	Higher secondary education	10	9.2%
	Completed apprenticeship	15	13.8%
	Academic degree (e.g., Bachelor's, Master's or Doctorate)	82	75.2%
Occupation	University student	46	42.2%
	Employee	40	36.7%
	Civil servant	4	3.7%
	Freelancer / Self-employed	11	10.1%
	Jobseeker	1	0.9%
	Other	7	6.4%
Device	Computer / Laptop / PC	72	66.1%
	Smartphone	30	27.5%
	Tablet	7	6.4%

Appendix 22: Attribute importance within segments

Attribute	Gender: Female	Gender: Male	Gender: Average	Age: <=25	Age: 26-35	Age: 36-45	Age: 46-80	Age: Average	Target group, (Male, 18-39), n=30	All responses, n=109
Base	26.2%	25.6%	25.9%	27.9%	25.7%	26.5%	23.1%	25.8%	26.4%	26.0%
Flavour	21.4%	26.6%	24.0%	22.6%	24.2%	20.0%	24.6%	22.9%	26.0%	23.5%
Eco-label	14.9%	11.2%	13.1%	13.3%	12.2%	17.4%	14.0%	14.2%	12.0%	13.5%
Marketing claim	7.6%	6.8%	7.2%	7.0%	6.5%	10.3%	8.0%	8.0%	6.5%	7.3%
Price per 40g	18.7%	18.8%	18.7%	19.4%	21.4%	13.1%	16.5%	17.6%	19.4%	18.7%
Design	11.2%	10.8%	11.0%	9.6%	9.9%	12.8%	13.8%	11.5%	9.8%	11.1%

App 23: Distribution of preference for levels within segments

Attribute	Level	Gender: Female	Gender: Male	Gender: Average	Age: <=25	Age: 26-35	Age: 36-45	Age: 46-80	Age: Average	Target group (Male, 18-39)	All responses (N = 109)
Base	Nut	59.6%	44.3%	51.9%	52.2%	51.0%	77.7%	54.9%	59.0%	37.3%	53.5%
	Oat	17.2%	16.6%	16.9%	13.6%	21.3%	10.2%	19.8%	16.2%	14.8%	16.9%
	Protein	23.3%	39.1%	31.2%	34.1%	27.7%	12.1%	25.3%	24.8%	47.9%	29.5%
Flavour	Chocolate	52.4%	58.2%	55.3%	58.9%	52.1%	51.5%	50.2%	53.2%	55.6%	54.7%
	Fruit	27.6%	23.4%	25.5%	21.8%	33.7%	19.7%	28.0%	25.8%	25.1%	25.9%
	Caramel	20.0%	18.4%	19.2%	19.3%	14.2%	28.8%	21.9%	21.0%	19.3%	19.4%
Eco-label	With eco-label	75.0%	69.2%	72.1%	73.9%	73.0%	81.8%	70.1%	74.7%	71.9%	72.7%
	Without eco-label	25.0%	30.8%	27.9%	26.1%	27.0%	18.2%	29.9%	25.3%	28.1%	27.3%
Marketing claim	Natural protein source	34.6%	35.5%	35.0%	33.6%	31.5%	46.8%	38.1%	37.5%	31.6%	35.0%
	Made in Germany	36.2%	33.5%	34.8%	35.3%	40.4%	34.3%	31.7%	35.4%	36.1%	35.1%
	Rich in taste	29.2%	31.0%	30.1%	31.1%	28.1%	18.9%	30.1%	27.1%	32.3%	29.9%
Price per 40g	€1.69	53.8%	55.0%	54.4%	52.6%	60.2%	59.3%	52.9%	56.2%	53.4%	54.3%
	€2.29	33.3%	33.6%	33.5%	36.3%	31.8%	17.2%	31.7%	29.2%	36.1%	33.5%
	€3.29	12.8%	11.4%	12.1%	11.2%	8.0%	23.5%	15.4%	14.5%	10.5%	12.2%
Design	Without visual	64.9%	68.6%	66.8%	63.2%	69.4%	72.4%	68.9%	68.4%	65.1%	66.4%
	With visual	35.1%	31.4%	33.2%	36.8%	30.6%	27.6%	31.1%	31.6%	34.9%	33.6%

App 24: Price elasticity conjoint analysis

Segment		Price	Elasticity
Total	**Total**	€1.69	
		€2.29	-1.50
		€3.29	-1.10
Gender	**Women**	€1.69	
		€2.29	-1.53
		€3.29	-1.07
	Men	€1.69	
		€2.29	-1.45
		€3.29	-1.17
Age	**<=25**	€1.69	
		€2.29	-1.54
		€3.29	-1.15
	26-35	€1.69	
		€2.29	-1.68

		€3.29	-1.53
	36-45	€1.69	
		€2.29	-0.81
		€3.29	-0.71
	46-80	€1.69	
		€2.29	-1.30
		€3.29	-0.77

App 25: Competitor overview for simulation configuration

Concept name	Based on competitor's products	Source
JiMiNi'S 1 (Caramel/Fruit)	Insect Protein Bar Apple-Caramel	(JiMiNi'S 2022)
JiMiNi'S 2 (Fruit/Choco)	Insect Protein Bar Banana & Chocolate/ Insect Protein Bar Fig & Chocolate/	(JiMiNi'S 2022)
Catch-Your-Bug	Insect Protein Bar Hazelnut-Tangerine	(Catch-Your-Bug 2022)
Bug-Break	Insect Energy Bar Roasted Buffalo Worms, Sesame & Almond	(Snack-Insects 2022)
isaac nutrition 1 (Choco)	Feel Good Protein Bar Fudge Brownie Feel Good Protein Bar Espresso-Dark Chocolate	(isaac nutrition 2022)
isaac nutrition 2 (Fruit)	Oat+Protein Bar Cashew-Blueberry/ Oat+Protein Bar Peanut-Cranberry/ Oat+Protein Bar White Almond-Coconut	(isaac nutrition 2022)
isaac nutrition 3 (Caramel)	Oat+Protein Bar Macadamia-Salted Caramel	(isaac nutrition 2022)

Appendix 26: Insect bars without packaging

isaac nutrition

Portugal Bugs

Bug-Break

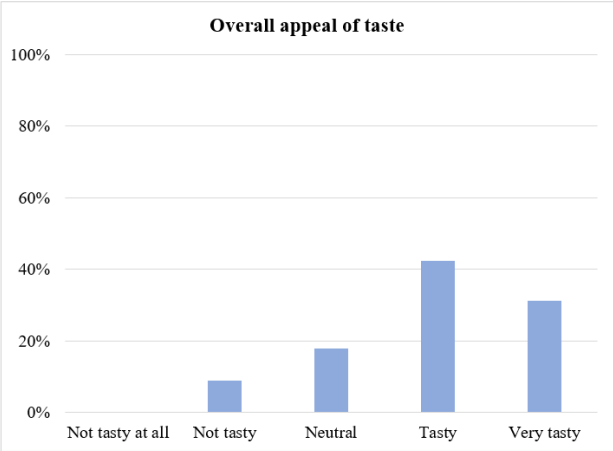
Appendix 27: Field trial (tasting) demographic profile

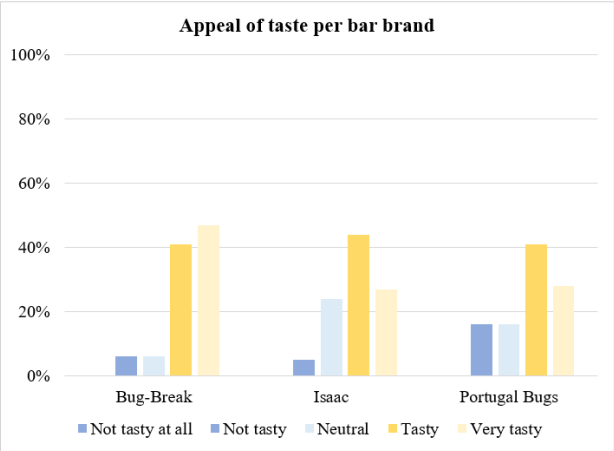
n = 30	**Characteristic**	**Frequency**	**Percent**
Gender	Male	13	43.3%
	Female	17	56.7%
Age	22-24	16	53.3%
	25-18	14	46.7%

Appendix 28: Appeal with and without packaging

Ranked #	Appeal with packaging				Appeal without packaging		
	Bug-Break	isaac nutrition colourful	isaac nutrition black	Portugal Bugs	Bug-Break	isaac nutrition colourful	Portugal Bugs
1	36.7%	23.3%	23.3%	16.7%	16.7%	63.3%	20%
2	26.7%	33.3%	23.3%	16.7%	30%	13.3%	56.7%
3	20%	33.3%	33.3%	13.3%	53.3%	23.3%	23.3%
4	16.7%	10%	20%	53.3%	-	-	-

Appendix 29: Taste





Appeal of taste per bar brand flavour

	Isaac				Portugal Bugs			Bug-Break
	Macadamia-salted caramel	Cashew-blueberry	Peanut-cranberry	Hazelnut-cacao	Honey & peanut	Apple & cinnamon	Fig & orange	Sesame-almond
Not tasty at all	0%	0%	0%	0%	0%	0%	0%	0%
Not tasty	0%	0%	0%	20%	36%	0%	9%	6%
Neutral	28%	20%	0%	20%	9%	20%	18%	6%
Tasty	44%	40%	100%	40%	45%	30%	45%	41%
Very tasty	28%	40%	0%	20%	9%	50%	27%	47%

Appendix 30: WTP

WTP	Bug-Break	isaac nutrition	Portugal Bugs
€1.69	29.4%	58.8%	11.8%
€2.29	46.3%	48.8%	4.9%
€3.29	68.8%	28.1%	3.1%
Total	51.1%	43.3%	5.6%