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Entomophagy in Vienna – a Vision for Our Future?

Are the Viennese Ready to Eat Insects?

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Abstract

Insects, the *food of our future*? Insects present a more ecologically attractive source of protein in comparison to conventional meat as they require less water and feed, and a greater proportion of their bodies can be eaten. Also, they provide an energy supply two to three times higher than conventional meat.

Many people worldwide have had a long tradition of consuming insects, which are high in valuable proteins and healthy polyunsaturated fatty acids. However, Europeans still seem to show reluctance due to a culturally induced feeling of disgust towards those *dirty* and *infectious* creatures. If more people were educated about these misconceptions, they might be more easily convinced to ingest insects.

Are the Viennese ready to eat insects? We asked them. A survey with over 2,000 participants showed that roughly a quarter have already tried insects, mostly grasshoppers or mealworms, and in general the taste was described as good. We also found that approximately 20 to 25 percent plan to regularly consume insects in the future; this willingness to consume insects positively correlates with the participants' knowledge about the ecological advantages of eating insects, having already been offered insects, and being in one's twenties or thirties.

Yes, some Viennese are ready, more might follow soon.

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1. Introduction

Eating insects?! Why would anyone write a paper about entomophagy, the human consumption of insects? What might seem revolting and absurd at first may turn out to be a valuable chance for our future: Insects could be consumed as a cheap, sustainable, and high quality source of protein, replacing a lot of our conventional meat. Already a part of human diet in many parts of the world today, and presumably known as food since the dawn of humanity, insects certainly are worth being considered as an innovative part of our diet as well.

“Yet among the winged insects that go on all fours you may eat those that have jointed legs above their feet, with which to hop on the ground.” - Leviticus 11:21

This paper is aimed at evaluating both...

- ...whether eating insects is reasonable in principle, and,
- ...specifically, to what extent and depending on what factors the Viennese might want to consume insects in the future.

First, the paper lists ecological, economic and sociological information regarding insects as food for humans retrieved from several books and online sources, as well as from an interview with a purveyor of insects. Then, a survey about people’s attitudes towards entomophagy with over 2,000 participants will be presented and the results analysed. The paper finally concludes with a discussion concerning the future of entomophagy in Vienna and ideas for improvements to promote entomophagy.

2. Ecological, Economic and Sociological Aspects of Insects as Food for Humans

2.1 Ecological Aspects of Consuming Insects

2.1.1 Chemical Composition of Insects with Regard to Their Nutritive Value

Of all species of animals described until today, it is estimated that more than half (1,000,000 of 1,730,725) are insects (International Union for Conservation of Nature and Natural Resources, 2014, p. 1). Of those, between 1,000 (G. R. DeFoliart, 1997, p. 110) and 1,900 species (Jongema, 2015) have been reported to be suitable for human consumption. Accordingly, the quantity of nutrients contained in insects varies, depending on the respective species. Apart from that, other factors like the metamorphic state of an insect, its habitat, diet and how it was processed or prepared (Van Huis et al., 2013, p. 67) also alter an insect's nutrient content even within one species. This explains the wide range of nutritional values stated in the following.

2.1.1.1 Proteins

Proteins are vital components in our diet, as they are essential in assembling enzymes, hormones, haemoglobin and antibodies, shifting important substances in the human body and supplying energy (Chen, Feng, Zhang, & Chen, 2010, p. 86).

In general, insects consist of substantial amounts of raw proteins, ranging from 20 to 70 percent (Berghofer, Schönlechner, & Schmidt, 2016, p. 43) or, as yielded by a Mexican study, even from 15 to 81 percent (Ramos Elorduy et al., 1997). Moreover, they appear to contain about 35 to 50 percent of all types of amino acids (Chen et al., 2010, p. 86), which contributes positively to a balanced diet. According to G. DeFoliart (1992, p. 396) they are also high in the essential amino acids lysine, which, for instance, aids in the production of antibodies (Hawwa, 2013), and threonine, which can help combat depression, digest fat and speed wound healing (ibid.).

2.1.1.2 Fat

Apart from shielding and supporting organs as well as storing energy, fat also plays an important role in the absorption of vitamins (Chen et al., 2010, p. 87).

While on average 10 to 50 percent of an insect consist of fat (Mlcek, Rop, Borkovcova, & Bednarova, 2014, p. 150), this varies depending on the insect's metamorphic state: During imago its fat content is lower than during its larva or pupa state (Chen et al., 2010, p. 87). Apart from that, oil derived from insects seems to be rich in polyunsaturated fatty acids and frequently contains the essential linoleic (or omega-3) and α -linolenic (or omega-6) acids (Womeni et al., 2009, p. 234), which the body cannot produce by itself and which can, therefore, only be obtained through food.

2.1.1.3 Carbohydrates

Producing heat, aiding in detoxification and being a constituent material in the human body, carbohydrates are vital for living. However, too large quantities of them should be avoided (Chen et al., 2010, p. 89).

Other than protein and fat, only small amounts of carbohydrates may be found in insects: Not taking the polysaccharide chitin into account (which in literature is mostly considered as fibre despite its chemical classification), insects have a carbohydrate content between 1 and 10 percent (Berghofer et al., 2016, p. 43; Chen et al., 2010, p. 89).

2.1.1.4 Fibre

The most common form of fibre in insects is chitin, which is a major constituent of insects' exoskeletons (Van Huis et al., 2013, p. 74). It is claimed to, for example, enhance wound healing as well as prevent thrombus (Chen et al., 2010, p. 89).

Between 5 to 20 percent of a dried insect might consist of Chitin (Chen et al., 2010, p. 89; Goodman, 1989, p. 2; Mlcek et al., 2014, p. 151; Ramos-Elorduy, 2005). However, should consuming protein concentrates made out of insects become common, insects might be dechitinised, leaving a valuable by-product (G. DeFoliart, 1992, p. 397), which could find its use in several areas, which will be further discussed in Chapter 2.2.5.

2.1.1.5 Minerals

Minerals are vital for the constitution of enzymes, hormones and body cells. Iron is contained in the haemoglobin in blood cells, which shift oxygen from the lungs to the whole body. Zinc is essential in the clotting process of blood and improves the function of the immune system (Sukhsatej, n.d.).

Depending on the species, insects can be high in iron, copper, magnesium, manganese, phosphorous, potassium, selenium and zinc and also include smaller amounts of sodium and calcium (Chen et al., 2010, p. 90; G. DeFoliart, 1992, p. 396; Rumpold & Schlüter, 2013; Chen & Feng, 1999, p. 23).

According to the WHO (World Health Organisation), due to their substantial iron content, insects could play an important role in fighting the iron deficiency anaemia, the “most common and widespread nutritional disorder” (WHO, 2016), currently affecting 2 billion people worldwide (ibid.).

2.1.1.6 Vitamins

Vitamins, which cannot be synthesised in the human body and, therefore, need to be supplied by food, are, among other things, necessary for metabolism (Chen et al., 2010, p. 91) and maintaining healthy teeth (Wax, 2015).

Insects might contain thiamine (vitamin B1), riboflavin (vitamin B2), pantothenic acid (vitamin B5), pyridoxine (vitamin B6), biotin (vitamin B7), folic acid (vitamin B9), cobalamin (vitamin B12) as well as vitamin D, E, K and C (Bukkens, 2005, pp. 545–577; G. DeFoliart, 1992, p. 396; Mlcek et al., 2014, p. 151; Rumpold & Schlüter, 2013).

2.1.2 Insects in Comparison to Conventionally Bred Meat in Europe

It is often claimed that insects¹ are a ‘super-food’, due to having an extraordinarily high protein content and energy supply in comparison to the meat Europeans are used to consuming (which will be referred to as ‘conventional meat’ in the following).

Moreover, they might require only very few resources for rearing. This chapter will try to evaluate, whether those claims are actually true.

2.1.2.1 General Nutrient Content

Chart 1 shows absolute nutrient contents. It is of special importance to point out that the insects listed were analysed after being dried, whereas conventional meat still contains a lot of water. Apart from that, information regarding the water², vitamin and ash content of the insects was not available.

Nutrient Content per 100g [g]								
	grasshoppers	mealworms	crickets	buffaloworms	beef	pork	chicken	fish
protein	48.20	45.10	69.10	56.20	31.10	22.30	27.24	22.25
fat	38.10	37.20	18.50	24.70	1.93	8.30	4.50	2.84
carbohydrates	1.10	5.40	0.00	6.70	2.75	0.30	0.59	0.00
fibre	8.40	6.50	7.70	5.20	0.00	0.00	0.00	0.00
minerals	0.43	0.37	1.03	0.38	3.30	1.65	1.05	0.86
vitamins	-	-	-	-	0.01	0.01	0.01	0.23
water	-	-	-	-	53.79	65.10	65.53	74.62
ash	-	-	-	-	10.39	4.00	2.14	1.58

Chart 1: Nutrient Contents of Insects in Comparison to Conventional Meat
(created by Leo Stöger (2016), data retrieved from “Calorie Calculator: beef, pork, chicken, fish”, 2015; Damman, 2016)

¹ According to Christoph Thomann, an expert for health management who sells insects in Vienna, four types of insects are currently (as of 2016) permitted to be bred and sold for consumption in Europe and will therefore receive special attention in this chapter: “These are mealworms, buffalo worms, grasshoppers and crickets.” (cf. *Appendix C: “Interview with Christoph Thomann”*, p. 5, translated by Leo Stöger).

² presumably almost zero due to having been dried

The results show that the insects dealt with contain larger amounts of protein and fat than the conventional meat due to the higher water content in the latter. To eliminate those disparities regarding different processing and data available, *Chart 2* does not take water, ash and vitamins into account, but only compares to which percentage the different kinds of meat and insects consist of the other contents, assuming they were the sole components.

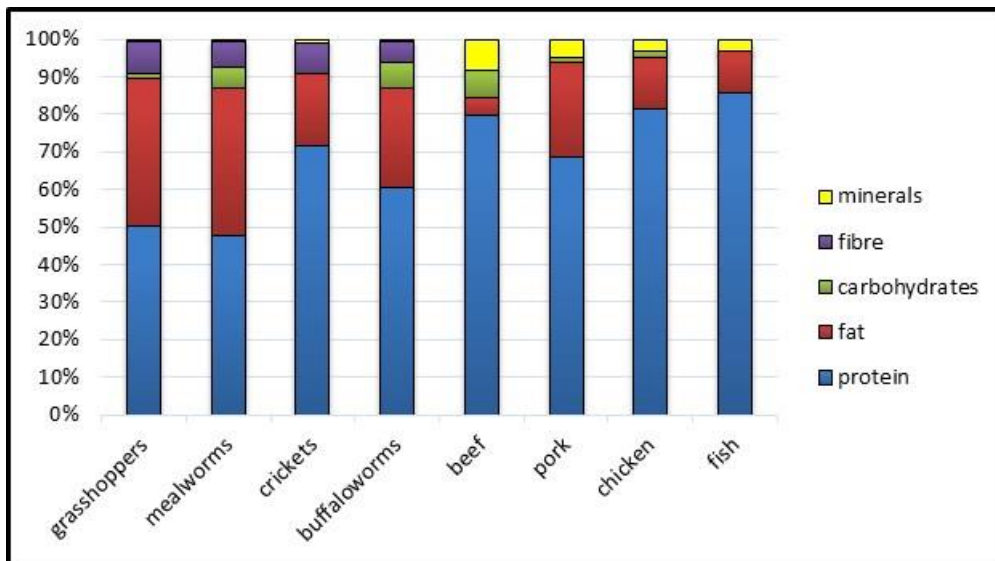


Chart 2: Nutrient Contents of Insects in Comparison to Conventional Meat
 (created by Leo Stöger (2016), data retrieved from "Calorie Calculator: beef, pork, chicken, fish", 2015; Damman, 2016)

This chart makes it obvious that the above-mentioned insects and most of the other types of meat are high in protein and fat, except for beef which appears to be especially low in fat.

2.1.2.2 Fatty Acids

To indicate the quality of the fats in these foods, *Chart 3* analyses the contents of saturated and unsaturated fatty acids: The higher the degree of unsaturation, the healthier the food (Van Huis et al., 2013, p. 71). Polyunsaturated, or essential fatty acids, are of special importance as they cannot be produced by the human body, but, instead, have to be provided by food (Weber, 2011). '100%' in *Chart 3* is defined as all the fat contained in the respective type of food.

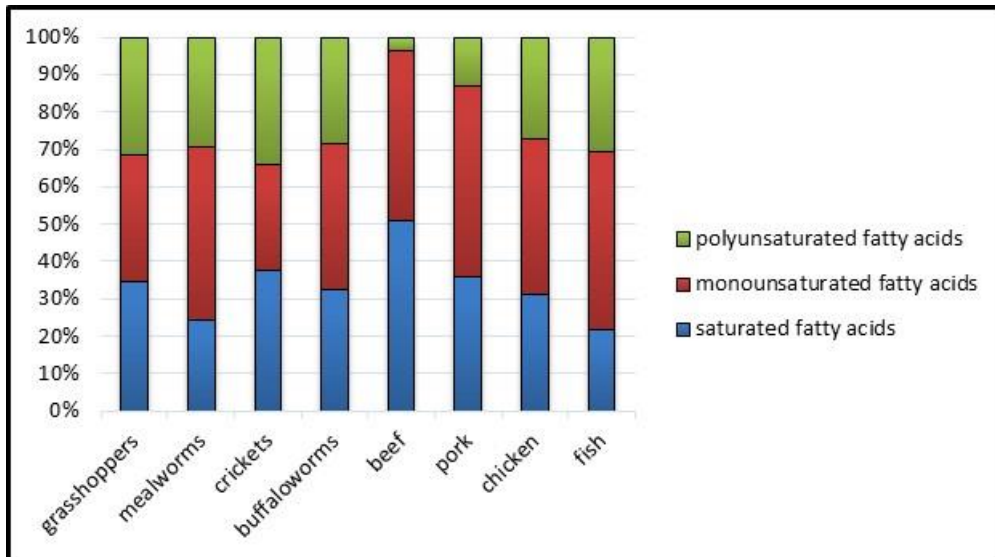


Chart 3: Fatty Acid Content of Insects in Comparison to Conventional Meat
 (created by Leo Stöger (2016), data retrieved from "Calorie Calculator: beef, pork, chicken, fish", 2015; Damman, 2016)

Together with fish and chicken, insects contain many polyunsaturated fatty acids, which makes them significantly healthier than pork and beef in this aspect.

2.1.2.3 Energy Supply

The amount of energy supplied by food is measured in kilocalories. As visible in *Chart 4*, which is based on the same sources as *Chart 1, 2* and *3* and therefore deals with dried insects versus non-dried meat, insects provide three or almost four times as much energy as conventional meat.

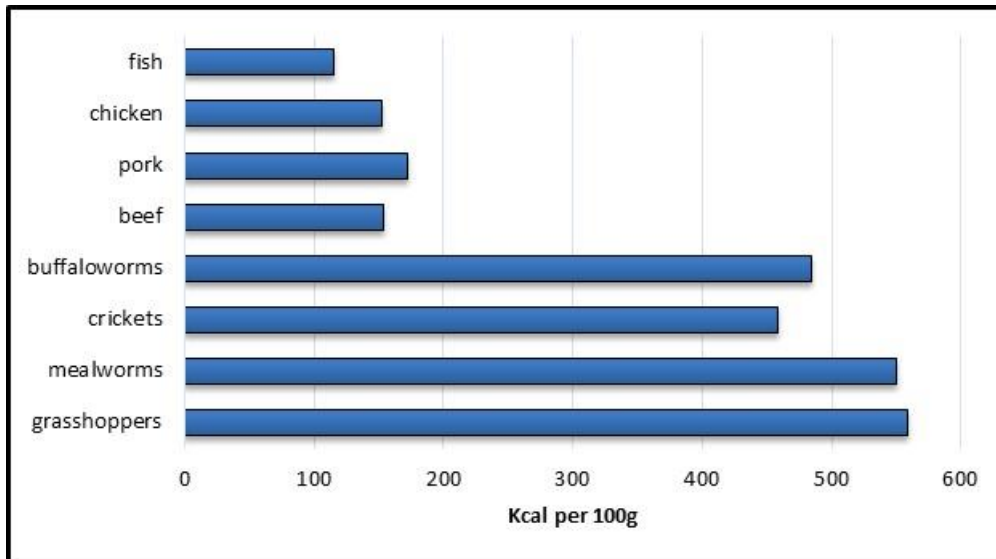


Chart 4: Energy Supply Measured in Kilocalories per 100g of Body Mass – Differences between Insects and Conventional Meat (created by Leo Stöger (2016), data retrieved from “Calorie Calculator: beef, pork, chicken, fish”, 2015; Damman, 2016)

2.1.2.4 Resources Required for Rearing

Chart 5 aims to compare insects with conventional meat by considering how both are reared: For building one kg of high-quality animal protein, insects require substantially less food than conventional meat. Despite no precise data being available so far, the insects’ use of water is estimated to be considerably lower, too. Whilst gaining one kg of body mass, insects produce either slightly less than or roughly the same amount of CO₂, which is assumed to trigger global warming, as conventional meat. However, data differs depending on the respective source; some experiments even yield that insects emit far smaller amounts of CO₂ and other greenhouse gases when reared (Thomann, 2016b; cf. Van Huis et al., 2013, p. 63). Additionally, a significantly larger proportion of the insects’ bodies is edible.

	crickets	mealworms	locusts	chicken	pigs	beef cattle
food [kg/kg weight increase]	1.7	-	-	2.5	5.0	10.0
water [l/kg of animal protein]	-	-	-	2,300	3,500	22,000 - 43,000
CO ₂ -emissions [g/weight increase]	1,468 ±971	1,031 ±349	734 ±119	-	865-1,194	2,835
edible parts [%]	80	-	-	55	55	40

Chart 5: Rearing Insects in Comparison to Conventional Meat (created by Leo Stöger (2016), data retrieved from Oonincx et al., 2010; Van Huis et al., 2013, pp. 59–64)

Higher feed-conversion efficiencies³ of insects in comparison to conventional meat (cf. *Chart 5*) might stem from insects being poikilotherms and, therefore, not using their metabolism to maintain a certain body temperature (Oonincx et al., 2010).

2.1.3 Slaughtering Process

Insects are “low animals”, lacking a well-established nervous system. Therefore, according to the current standard of knowledge, they do not experience pain or stress. Insects are poikilotherm animals and adapt to the ambient temperature. In nature, most insects die from cold during winter. When they are killed for food, they are simply frozen and after one to two hours they “pass away peacefully” (cf. *Appendix C: “Interview with Christoph Thomann”, p. 6*).

2.2 Economic Aspects of Edible Insects

2.2.1 Insect Farms and Prices in Europe

Today, a number of insect farms have been established in Europe:

For instance, in the south of France “Micronutris” rears insects (Auriol, 2015), in Ermelo (NLD) the “Proti-Farm” claims to be the “world’s first fully automated high-tech lesser mealworm production facility” (de Bruin, 2016), in Feldkirch (AUT) the “Perfect Insect Insektenfarm Kohlberger e.U.” (WKO, 2015) has about 100.000 insects in their breeding boxes (cf. *Appendix C: “Interview with Christoph Thomann”, p. 5*) and in the UK both the “Edible Bug Farm” in Birmingham (Matt, 2015) and “Zophobas Red” in Cornwall (“Zophobas Red”, 2014) breed mealworms and other insects.

Altogether, there are currently only very few insect farms, which causes the price of edible insects to be quite high and, in further consequence, curbs demand (cf. *Appendix C: “Interview with Christoph Thomann”, p. 2*). To give an example, on August 17th, 2016, only 100g of mealworms cost 17,90€ in Vienna (Thomann, 2016a), which

³ “an animal’s capacity to convert feed mass into increased body mass” (Van Huis et al., 2013, p. 59)

was about six times the price of the most expensive organic beef available at “Billa Online Shop” on that day, a tenderloin at 4,49 per 100g (Billa Online Shop, 2016).

2.2.2 Bred at Home

If insects could be bred at home, they would provide a cheap source of food for everybody, thus making them particularly attractive to less affluent parts of the population. In spring 2017, at \$699 the “world’s first desktop hive for edible insects”, a device designed for easily rearing mealworms at home, will be placed on the market, “empowering you to grow a food revolution straight out of your kitchen” (Unger, Kaisinger, Vance, & Reed, 2016).

2.2.3 Statutory Regulations

Until 2018 the EU “Novel Food Regulation” is in place:

“«Novel Food» means any food that was not used for human consumption to a significant degree within the Union before 15 May 1997” (“Regulation (EU) on Novel Foods”, 2015, p. 7). It is important that “the food does not, on the basis of the scientific evidence available, pose a safety risk to human health” (ibid.).

If insect salesmen wish to place insects on their country’s market for the first time, they will have to prove that those insects are safe for human consumption through a complex and protracted procedure. Briefly put, they have to apply for authorization, hand in all the information necessary to support their application and finally, once the European Union agrees, they still have to submit to the respective approval process of the EU member state where they want to distribute their product (ibid.).

According to Christoph Thomann, who apparently already went through that process, someone who wants to sell insects for human consumption has to “abide by the same laws and conditions that apply to all types of foods in Austria, for example, with regard to the cooling chain”. (cf. *Appendix C: “Interview with Christoph Thomann”*, p. 2, translated by Leo Stöger)

2.2.4 Cheap in Rearing

Feeding insects might be extremely cheap: “You can feed the mealworms with your kitchen scraps!” (Unger et al., 2016). However, according to Christoph Thomann “we cannot be sure yet, whether we will be allowed to actually use organic waste. [...] Nevertheless, if we call it ‘agricultural surplus’ instead of waste and use only the things that we throw away, while they are still good, then we have a huge potential here, because in Europe large amounts of food that would have been perfectly edible for us are thrown away.” (cf. *Appendix C: “Interview with Christoph Thomann”*, p. 1, translated by Leo Stöger). In addition, insects require high temperatures during rearing causing high energy costs (ibid., p. 2). However, if they are bred in the South of Europe, in Greece for instance, those costs would be remarkably lower (ibid., p.4).

2.2.5 Chitin as a By-Product

If insects are bred for their protein only, the chitin left over may be utilized for different purposes, for example for producing “tough, highly mouldable, transparent, water absorbing contact lenses” (Goodman, 1989, pp. 7–8) or it could help remove metallic pollutants from industrial waste water, due to chitin derivatives interacting with those harmful substances (ibid.).

2.3 Sociological Aspects

“My mother told me that I mustn’t eat what crawls on the floor.” (cf. *Appendix C: “Interview with Christoph Thomann”*, p. 3, translated by Leo Stöger)

It is often assumed that Europeans feel scared and disgusted when they even think of insects. Despite that not being totally true (as seen in *Chapter 4*), it cannot be denied that many people from developed countries tend to dislike the idea of being offered packed insects in the supermarket and eating them for dinner. The following chapter will try to determine, where this attitude stems from.

2.3.1 Cultural History of Entomophagy

The history of entomophagy dates back thousands of years: As early as the eighth century BC, servants in the Middle East used to prepare locusts arranged on skewers for royal banquets (Bodenheimer, 1951). According to Van Huis (2013, p. 41), eating insects, cicadas in particular, on European soil first became popular in Greece, as Aristotle (384–322 BC) mentioned in his “*Historia Animalium*”. However, since the tenth century AD arthropods, including insects, have been considered carriers of disease and illness in Europe (Davey, 1994, p. 17).

People from other continents are often not so biased against eating insects, due to having had insects on their plates for a long time, which is the case in parts of Central and South America (for example in Mexico, Brazil and Columbia), Africa (Zimbabwe, Congo, Zambia) and Asia (Thailand, Indonesia, Vietnam) (G. DeFoliart & Emeritus, 2002).

Europeans, however, did not use to eat insects. When sushi was introduced to the European market twenty years ago, it caused hesitation and disgust and a lot of effort was needed to dispel the prejudices of the prospective customers. Therefore, new products like insects, especially when they remind one of revolting, slick worms and huge hairy spiders, might raise suspicion and opposition even if they are actually clean, tasty and served in an appealing way.

2.3.2 ‘Rational’ Reasons

Even if people do not find insects disgusting, they might dislike eating them due to hygiene concerns. As a matter of fact, insects may carry germs. However, the domestic animals we are used to deriving our meat from are also potential fomites (poultry, for instance, may carry salmonella germs). Nevertheless, during processing those pathogens are killed by heat (Harris, 1988, p. 174).

Nevertheless, it should be mentioned that allergies might exist:

“People who are allergic to proteins, crustaceans, shellfish and house dust mite, could show allergic reactions to insects. However, I have invited several thousand people to try so far and nothing has ever happened.” (cf. Appendix C: “Interview with Christoph Thomann”, p. 5, translated by Leo Stöger)

Concluding, Bequaert effectively sums up, why the Europeans dislike insects:

“[It] can be attributed only to prejudice, that civilized man of today shows such a decided aversion to including any six-legged creatures in his diet. [...] What we eat and what we do not eat is, after all, more a matter of custom and fashion than anything else.” (Bequaert, 1921)

3. Methodology of the Survey

3.1 Gathering the Data

In order to collect as much data as possible regarding people's attitude towards insects as food, different ways of interviewing were used: 153 people filled out a print-out questionnaire (cf. *Appendix B*). Three online questionnaires⁴ with identical contents in German (accessible as *Appendix A*), English and French, which were distributed over social networks (*Facebook* and *WhatsApp*) and other messenger services (*Email* and *SMS*) and by their internet link being pullerly displayed in Vienna⁵, received about 1,882 answers altogether. (The French questionnaire was answered by two people, the English by 76 and the German by 1,804.)

The whole survey lasted from March 13 to August 9, 2016, however, the online questionnaire was not available before the 6th of June.

3.2 Information Asked

Every participant was asked to state their gender, age, origin and, although not used during the evaluation, job. As an indicator of his or her state of knowledge regarding insects as food, the interviewees then specified whether they knew that insects required less water and emitted fewer greenhouse gases during rearing than conventional meat, consisted of valuable proteins and were consumed in many parts of the world.

After that, the participants had to portray their attitude toward insects as food, describe their taste experiences, if applicable, and, moreover, estimate how often in the future they planned to consume insects. Finally, they were asked to assess, which

⁴ created with *Google Forms*

⁵ mostly in tram stations in the 1st, 9th and 18th district

precondition they found necessary to be fulfilled, before they would be prepared to consume insects.

3.3 Evaluation of the Data

To simplify the analysis of the data assembled, all non-German online answers were transferred into the German online version of the questionnaire by hand. The same process was applied to the answers of the printed questionnaires. Answers in English and French were translated to German during that process. Then the 2,035 answers were exported to and later evaluated in *Excel*. After deleting all dubious and identical streams of data, 2,006 were left. Those will be dealt with in the following chapters.

3.4 Inaccuracies in Measurement

Of course, those 2,006 answers do not properly reflect the attitude and experience of the average Viennese citizen. This is exemplified by the fact that 73 of those interviewed were surveyed during a tasting, where grasshoppers, mealworms, crickets and buffalo worms were available, which, therefore, exaggerates the ratio of participants who have already been offered insects as food.

Moreover, the kind of people interviewed cannot be considered representative in comparison to the composition of the Viennese population. For instance, the average age of the participants of the survey is 28.8 years, while the average age of Vienna's inhabitants is 42.3 years ("Bevölkerung nach Alter und Geschlecht", 2016). The standard of knowledge, which might influence people's attitude towards living environmentally friendly is not representative, too, due to a large percentage of the interviewees coming from rather well educated backgrounds.

Apart from that, illogical answers might distort the results of the evaluation. To give an example, people claimed that they were not content to eat insects, but planned to consume them 'rarely' in the future.

Significantly, one should consider that people who feel disgusted by insects would rather not wish to answer a questionnaire dealing with them. Conversely, those who

consider the topic relevant and reasonable will certainly be more willing to fill in the questionnaire, which creates the impression that the readiness to eat insects is higher than the average willingness of a more representative, better-strewn sample.

4. Results of the Survey

Of the 2,006 streams of valid data, 1,126 stem from Viennese respondents. *Chapter 4.1* will deal only with their experiences, concerns, and attitudes, while *Chapter 4.2* is going to have a look at both the willingness of the Viennese to ingest insects and how that willingness differs depending on several factors, like gender, age and origin.

4.1 The Viennese View on Entomophagy

4.1.1 Experiences with Insects Prepared for Food

Of all 1,126 Viennese interviewed more than a third (436) stated that they had already had the opportunity to taste insects at least once in their life. Roughly two out of three of those who had already had the chance, took advantage of it, wherefore, the percentage of those who had been willing to try insects when they were offered some is almost 66%. In contrast, the theoretical willingness to try insects among those who had not been offered insects as food so far was significantly lower: Less than half said they would be willing to try insects, if they had the possibility (cf. *Chart 6*).

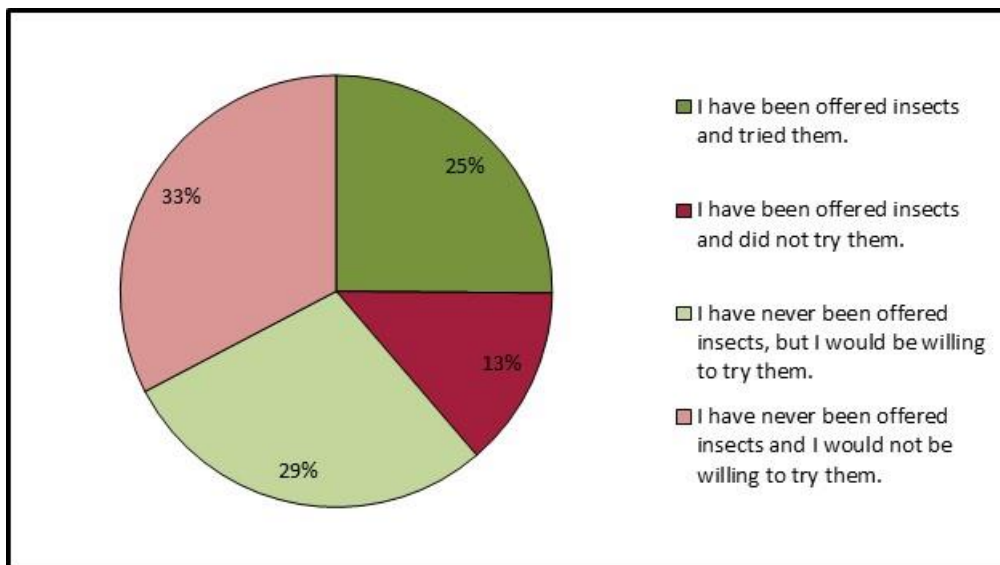


Chart 6: The Experiences of the Viennese with Insects as Food
(created by Leo Stöger (2016))

Of those who had already eaten insects, slightly more than two out of three had tried them only once. The majority of the others had eaten them several times (cf. *Chart 7*). Therefore, 8% of all Viennese interviewed have already eaten insects more often than just once.

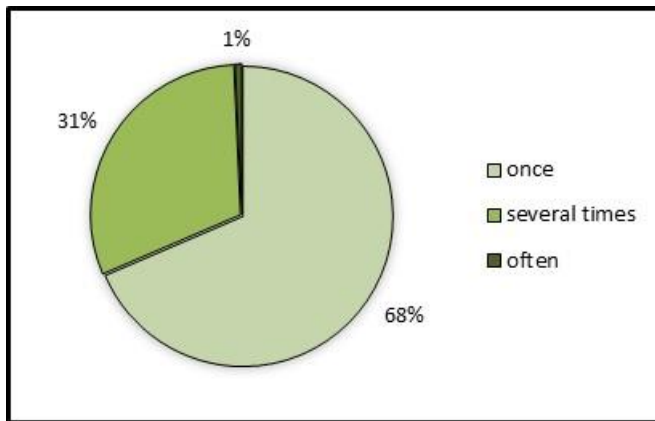


Chart 7: Frequency of Having Tried Insects for Food
(created by Leo Stöger (2016))

When the 436 interviewees who had already had the chance to try insects were asked which species of insects they had been offered, grasshoppers were mentioned by more than half and mealworms by slightly more than a quarter of them. In comparison, only a small number of people (95) had been offered crickets, ants or buffalo worms. The category 'other' consists of flies, grubs, termites, beetles and other insects as well as 'unclear' answers, provided by people who had been offered something, but could not exactly remember what it was (cf. *Chart 8*).

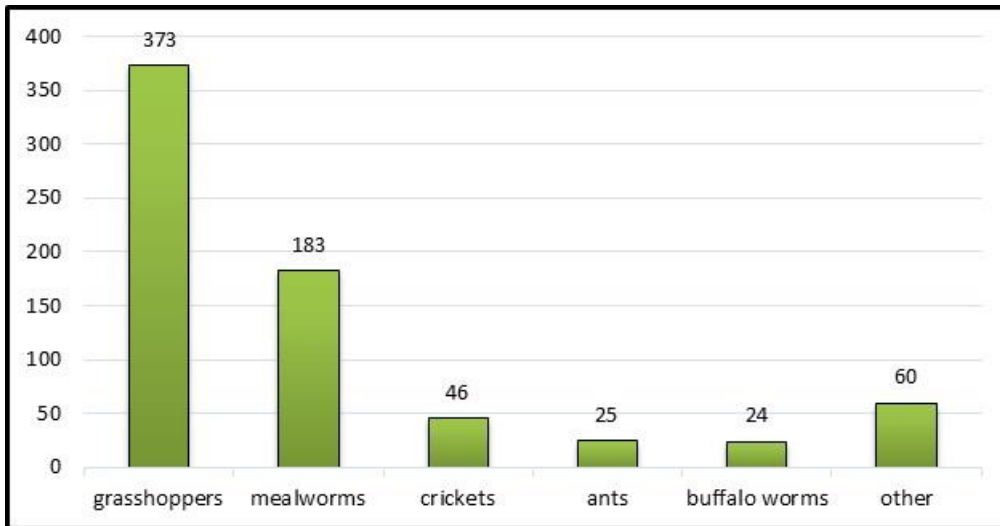


Chart 8: Species of Insects Offered
(created by Leo Stöger (2016))

Some of those who had already tried grasshoppers described their taste experience by selecting what the grasshoppers' taste, smell and visual impression was like on a scale from 'very good' to 'very bad'. As visible in *Chart 9*, the taste was considered quite appealing, mostly described as either good or neutral. In contrast, the grasshoppers' look was perceived as rather unappetizing. People had the clearest opinion with regard to the locusts' smell: Approximately two thirds characterized it as neutral.

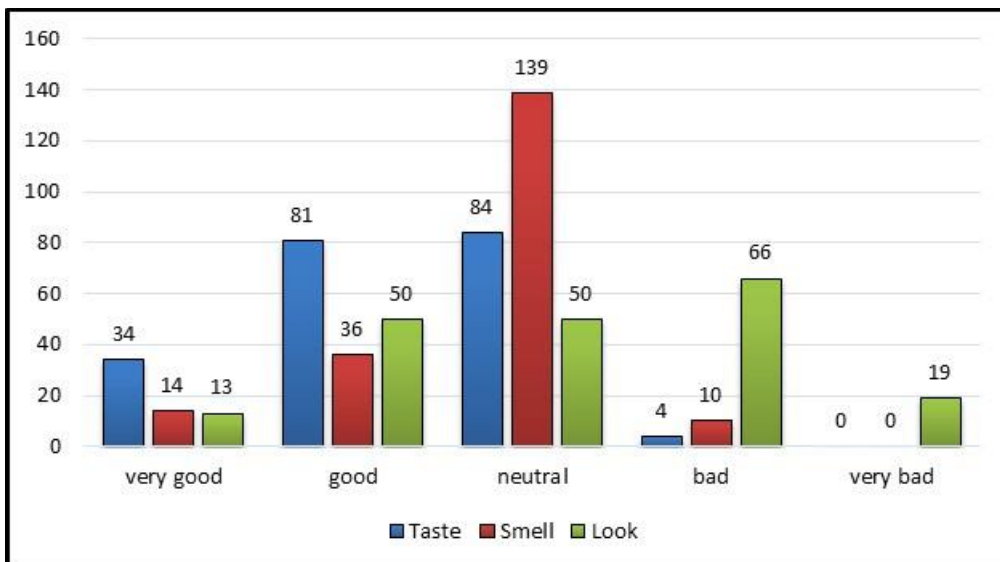


Chart 9: Grasshoppers – Taste Experience
(created by Leo Stöger (2016))

Despite the test sample of the taste experience with mealworms being four times smaller sized than the grasshoppers' it displays similar results: Mealworms taste rather good, look bad and smell neutral.

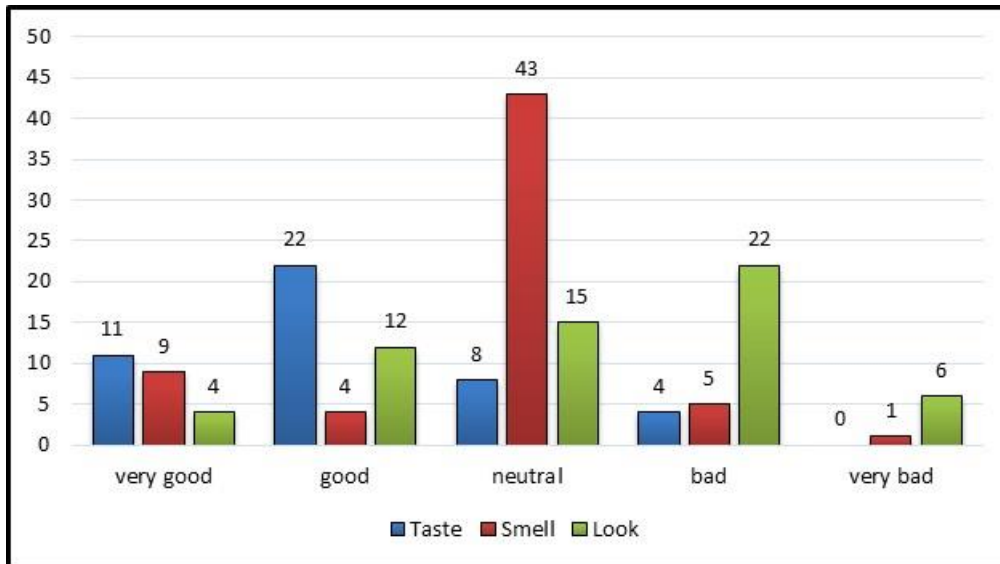


Chart 10: Mealworms – Taste Experience
(created by Leo Stöger (2016))

4.1.2 Reasons for Not Wanting to Consume Insects

All Viennese participants of the survey who had declared that they did not want to eat insects were asked for their reason(s). Quite popular causes apart from feeling disgusted, which more than half of those who did not want to try selected, were either concerns pertaining to the insects' impacts on the human body, like that insects might carry germs, or taking the attitude that eating insects was ethnically objectionable and should, therefore, be avoided (cf. *Chart 11*).

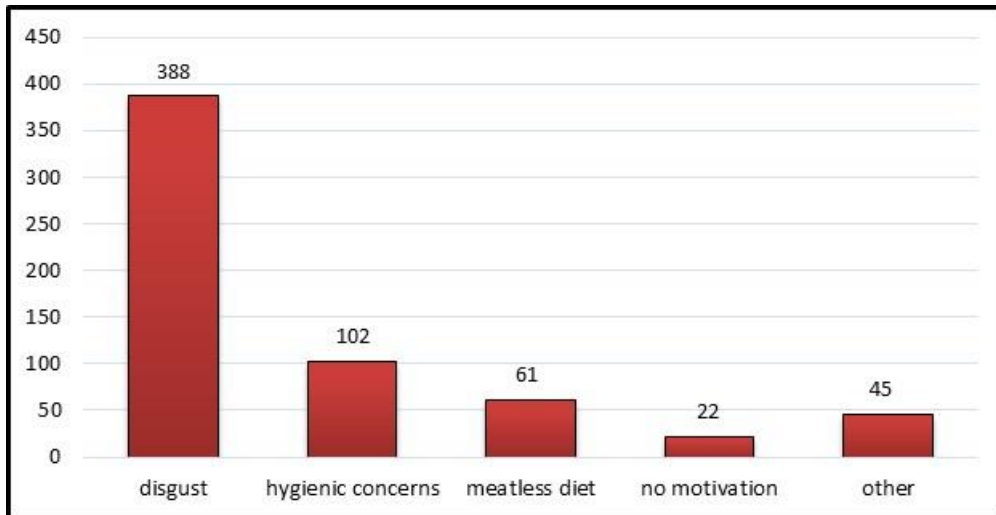


Chart 11: Reasons for Not Wanting to Eat Insects
(created by Leo Stöger (2016))

In order to point out what prejudices and misconceptions some Viennese have when thinking of insects here are some chosen answers:

- “Tot würde ich sie schon essen.”
- “Warum sollte ich?”
- “Ich finde es nicht sinnvoll, Insekten zu essen, da diese nicht nahrhaft sind.”
- “Ich kann mir nicht vorstellen, dass der Keratin [sic!] Panzer gut für die Verdauung ist.”
- “Wieder so ein Hype, Hauptsache schockierend, widerlich und ekelhaft!”
- “Ich würde sie nicht essen, wenn sie lebendig wären.”
- “[Ich würde Insekten nicht essen,] solange es noch genug Fleisch von Vieh, Schweinen und Hühnern gibt. Mein Fleisch isst Insekten.”
- “Von denen wird man nicht satt.”

Obviously, some people assumed that insects might be eaten while they are still alive, and others thought that they were harmful to or not nutritious enough for humans. Still others appeared not to be informed about the valuable substances some insects contain. Therefore, it is not surprising that those people are reluctant to try insects.

4.1.3 Preconditions for Eating Insects

At the end of the survey, everyone theoretically willing to eat insects at least ‘rarely’ in their future was asked which preconditions he or she felt needed to be fulfilled to ensure that eating insects would actually become a feasible option for them.

Mentioning several preconditions was possible. From the 658 willing Viennese, over

three out of four claimed that the insects had to taste appealing. For 68.4 percent it was necessary that the insects were safe for human consumption regarding hygiene. Less than every third person named availability at a reasonable price as a precondition and only every fifth mentioned that it was important for them that the insects could not be spotted in the food. While 26 people outlined that for them no preconditions at all were of importance, some also stated that the insects should be bred locally and appropriately for their species as well as travel only short distances to the consumer (8 people). Moreover, 9 people declared that they would theoretically readily consume insects, given that this was vital for surviving. (cf. *Chart 12*)

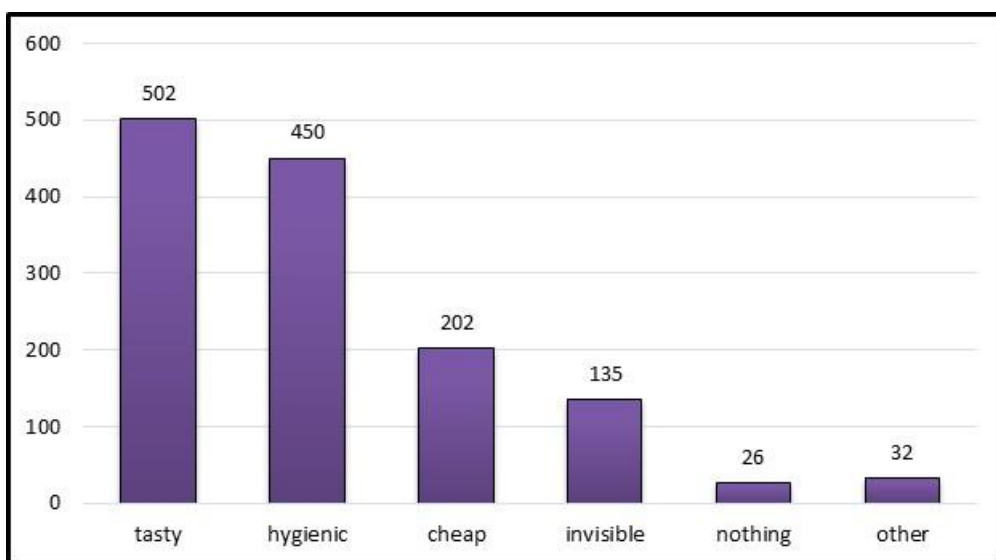


Chart 12: Preconditions for Eating Insects
(created by Leo Stöger (2016))

4.2 General Results and Correlations with Regard to the Readiness to Consume Insects in the Future

4.2.1 General Readiness in Vienna

As already mentioned in the previous chapter, at the end of the survey each participant was asked how often in the future he or she planned to eat insects. Not considering that the results shown in *Chart 13* do not properly reflect the view of the average Viennese inhabitant, but only the unweighted answers of those surveyed, more than a third of the Viennese might be willing to 'rarely' consume insects in their future. Moreover, almost a fourth wants to eat insects 'now and then' or even 'more

often’: If so many people were regularly going to purchase edible insects in the future that would put insects in huge demand.

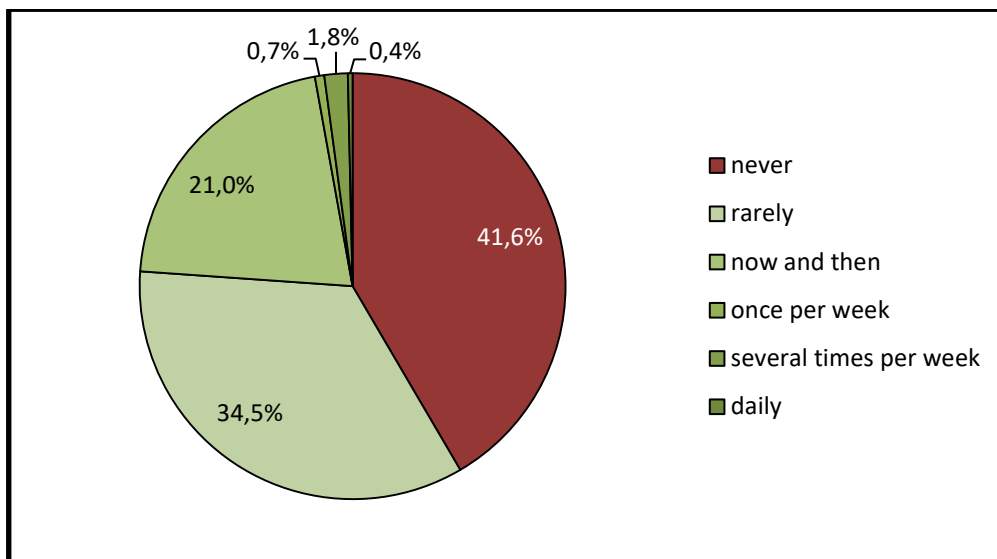


Chart 13: General Willingness of the Viennese to Eat Insects in the Future (created by Leo Stöger (2016))

4.2.2 Impact of Gender on the Willingness to Consume Insects

Of all the 1,126 data results from Viennese people, 430 were answered by men and 696 by women. When separately analysing them with regard to their willingness to eat insects in the future, there is a strong correlation between the male gender and an increased willingness: While almost every second woman interviewed planned not to eat any insects in her future, only a third of the men shared that attitude. The ratio of men and women who want to consume insects ‘rarely’ in the future differs within only five percent in favour of the men. Males who plan to eat insects ‘now and then’ (25.3%) are more common than women assuming that (18.4%). Also, there are more than twice as many men than women who plan to eat insects several times a week when projecting the percentages to a group with equal numbers of each gender. Therefore, men are significantly more willing to eat insects than women.

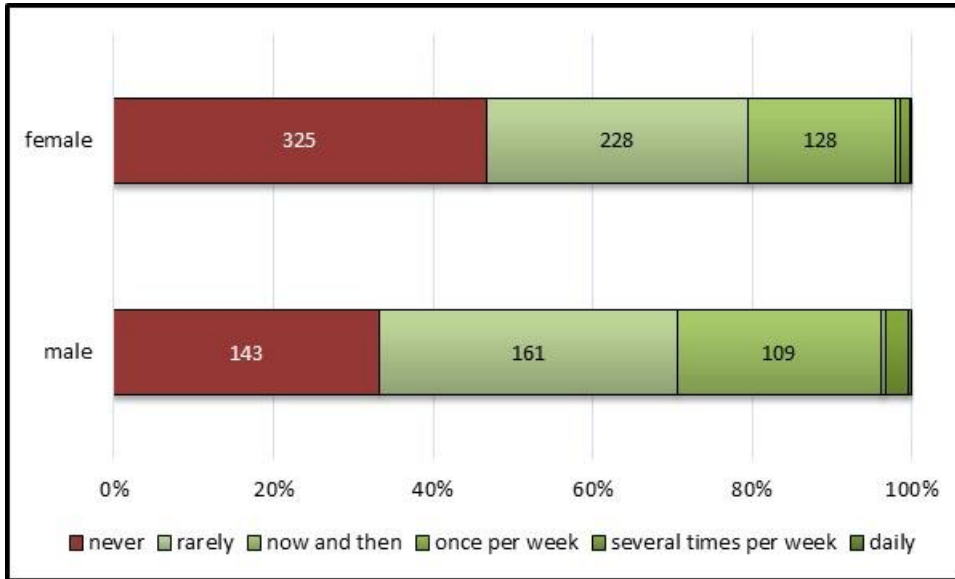


Chart 14: Dependency of the Willingness to Eat Insects in the Future (Vienna): Gender (created by Leo Stöger (2016))

4.2.3 Impact of Age on the Willingness to Consume Insects in the Future

Despite the author’s initial assumption that the readiness to consume insects decreases with higher age the results of *Chart 15* do not picture a clear trend. This might also be due to the fact that the participants dealt with in some categories are quite low in number.

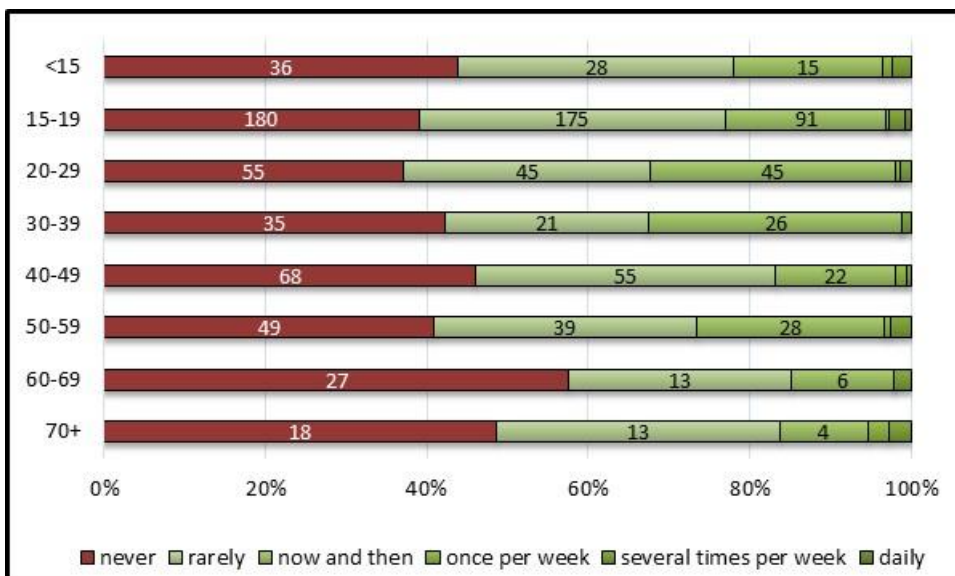


Chart 15: Dependency of the Willingness to Eat Insects in the Future (Vienna): Age (many categories) (created by Leo Stöger (2016))

Therefore, in *Chart 16* the categories were combined to better visualise a trend, if existing. Although not too prominent, there seems to be a slightly negative correlation between higher age and planning to eat insects in the future.

It should also be noted that there is a stronger differing within the age group of 20 to 49 years: In comparison to the younger age group, they less often said they planned to 'rarely' eat insects in their future, but more often chose 'never' or 'now and then'. This might be explained by the hypothesis that the older one gets, the more distinguished his or her point of view becomes: Either one finds insects inedible and selects 'never' or one has come to the conclusion that insects are, for example, ecologically beneficial and should therefore be eaten more often than just 'rarely'.

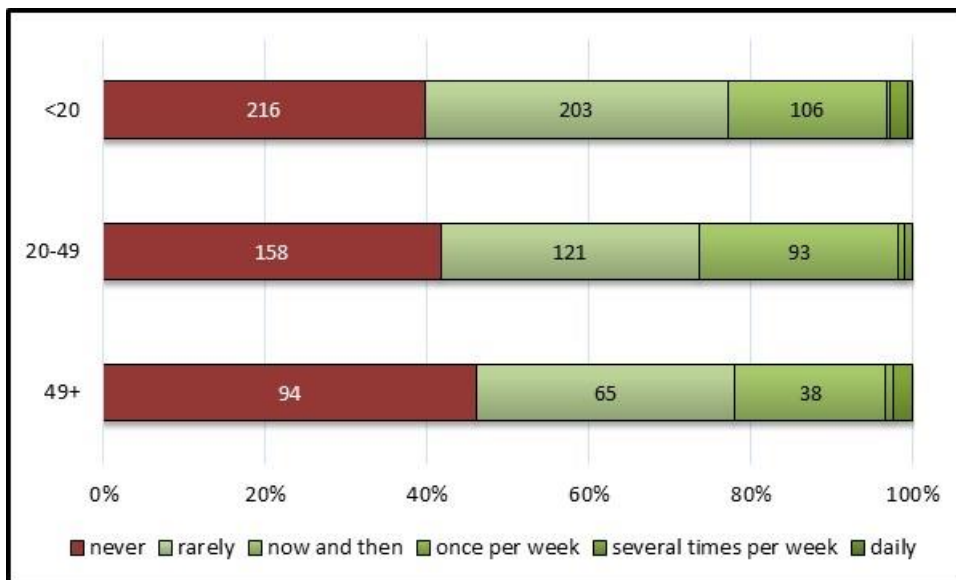


Chart 16: Dependency of the Willingness to Eat Insects in the Future (Vienna): Age (few categories) (created by Leo Stöger (2016))

4.2.4 Influence of Knowledge on the Willingness to Eat Insects in the Future

As entomophagy is linked to substantial ecological benefits (as outlined in *Chapter 2*) it was also analysed whether and how knowledge about those advantages influences the willingness to consume insects in the future. Therefore, during the survey each participant was asked which of the following statements he or she had already known to be truthful. Depending on the statements, the interviewees were assigned points: For knowing that insects consisted of valuable proteins they got two points. For being aware of the fact that insects are already eaten in many parts of the world also two

points were accredited. For being conscious of insects requiring less water and emitting fewer greenhouse gases they were awarded three points each. Altogether, the participants' points, therefore, ranged from zero to ten (without the numbers 1 and 9), which made it possible to form categories visualising how much their knowledge influenced their willingness to eat insects in the future. Everyone who had reached zero to three points was put in *category A*, those with four to seven points were assembled in *category B* and the 'elite' with eight or ten points were dealt with as *C*.

As visible in *Chart 17*, the readiness of the Viennese to eat insects in the future seems to be directly connected to the amount of knowledge the interviewees had: While 67.1 percent of those from *category A* claimed they planned to 'never' eat insects, that attitude was shared by only 42.7 percent of those from *category B* and by only 23.3 percent of those from *category C*. It is worth mentioning that of the latter more than a third (37.1 percent) planned to eat insects 'now and then' or even 'more often' in the future. The more people know about insects, the more willing they are to integrate them into their diet. In other words, the better the education of the public regarding the benefits of eating insects, the larger the number of potential consumers.

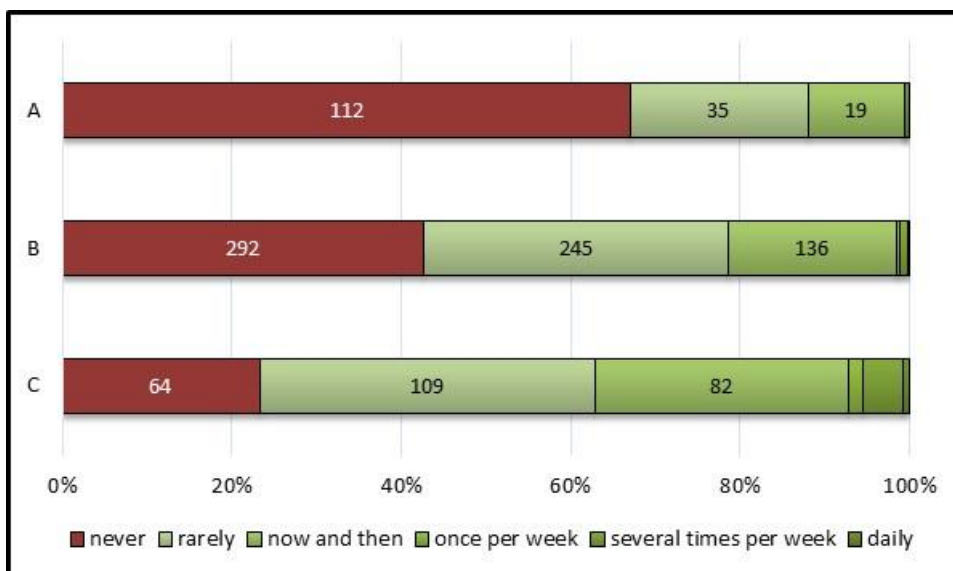


Chart 17: Dependency of the Willingness to Eat Insects in the Future (Vienna): Knowledge (created by Leo Stöger (2016))

4.2.5 Influence of Having Been Offered Insects as Food

As the results of the analysis in *Chapter 4.1* clearly pointed out, the willingness to eat insects seems to differ depending on whether the person interviewed had already had a chance to try insects or only imagines how being offered insects might appeal to them. This chapter will try to have a more detailed look at this matter and attempts to determine if having tried certain species of insects also has an influence on the readiness to consume them in the future.

To start, if there had been a 'face-to-face' encounter with insects prepared for food, the future willingness to eat them more frequently than 'never' was above two thirds (68.3 percent). However, almost one in two of those who had had no chance to try insects so far planned 'never' to eat insects in the future (47.8 percent) (cf. *Chart 18*).

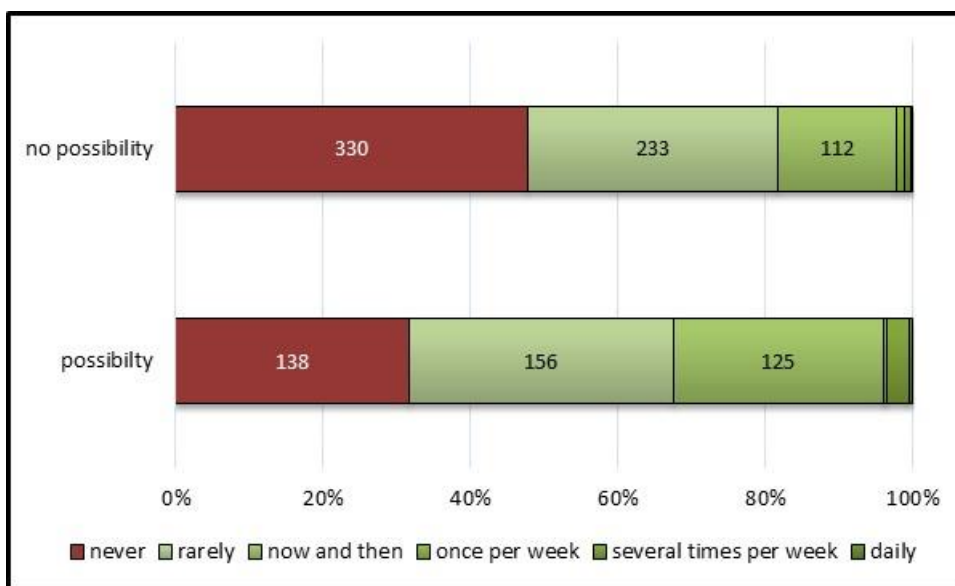


Chart 18: Dependency of the Willingness to Eat Insects in the Future (Vienna): Possibility (created by Leo Stöger (2016))

Apart from this correlation, there also seems to be a clear trend regarding the species of insects offered so far (cf. *Chart 19*): Those who were offered grasshoppers show the lowest rate of unwillingness to eat insects in the future, considering that only 26.7 percent of them plan to 'never' consume insects. An only slightly higher rate of unwillingness is to be detected when analysing those who were offered any insects other than only mealworms or only grasshoppers or another combination of insects than only mealworms and grasshoppers together. However, when taking into account

that their willingness to eat insects ‘now and then’, as well as to eat them ‘several times per week’, is rather high in comparison to those who were offered grasshoppers only, their average willingness is the most pronounced. This might be due to some of those people having deliberately searched for different species of insects, perhaps also in other countries, because of personal interest in entomophagy.

Furthermore, those who had had no chance to try any insects were not as unwilling to consume insects in the future as those who were only offered mealworms, which establishes the hypothesis that mealworms make a rather negative impression in comparison to grasshoppers, as grasshoppers apparently trigger an increased willingness to eat insects in the future, while mealworms do not. Nevertheless, the fact that only a small number of people were offered mealworms might cause the results of that category to be statistically rather meaningless.

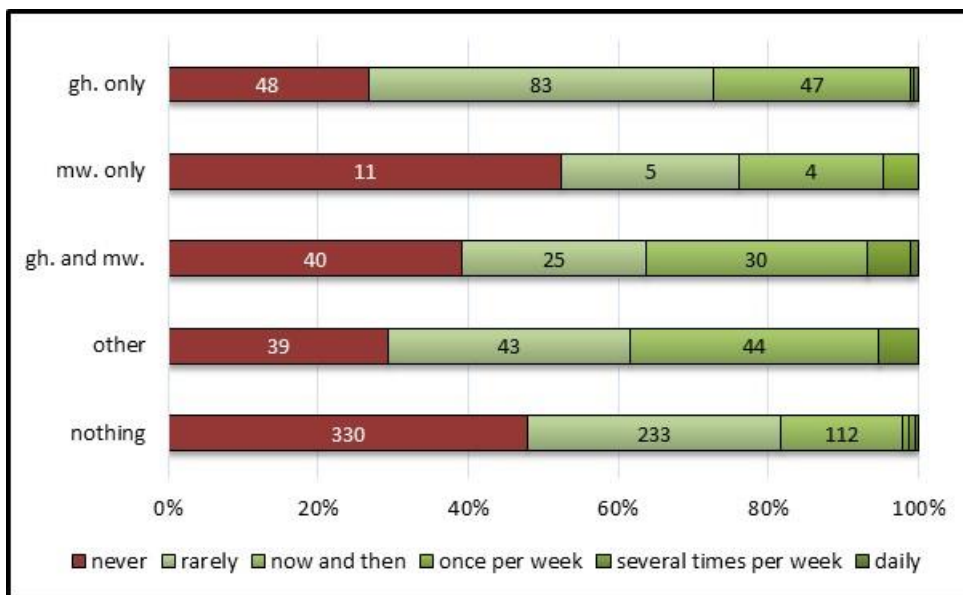


Chart 19: Dependency of the Willingness to Eat Insects in the Future (Vienna): Type of Insects (created by Leo Stöger (2016))

4.2.6 The Viennese in Comparison to People of Other Origins

Due to insects being a major constituent of many people’s diets worldwide, this chapter intends to analyse how the interviewees’ origins influence their willingness to consume insects in the future. In order not to have many small and statistically insignificant categories, people of certain origins were assembled into larger groups: Group ‘L1’ consists of Africans, Asians and Australians as well as people from North,

South, and Central America⁶. 'E\{A, G}' stands for people from European countries other than Austria or Germany; and 'A\{V}' contains Austrians from outside of Vienna.

Surprisingly, according to *Chart 20* the people from 'L1' show the most pronounced unwillingness to ever consume insects among all the groups, despite the author's prior expectation that they would be quite used to eating insects. Within the other categories, the willingness does not differ greatly: Slightly more than every second person surveyed stated they would be willing to consume insects in the future.

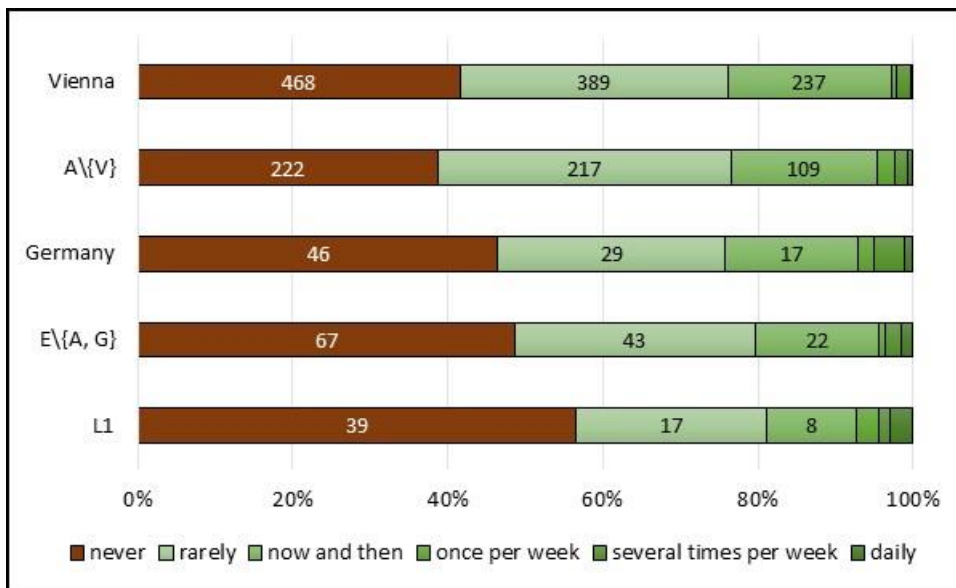


Chart 20: Dependency of the Willingness to Eat Insects in the Future: Origin (created by Leo Stöger (2016))

⁶ statistically insignificant due to only 69 participants

5. Discussion

5.1 Target Groups for Entomophagy in the Future

We have shown that men are more willing to eat insects in the future than women.

Despite no age group being totally unsuitable as a potential target group in the future, especially people aged from 20 to 39 can be expected to consume insects rather regularly; of all age groups, they were most inclined to include insects in their diet 'now and then' or 'more often' in the future.

Presumably, people better educated about the ecological benefits of insects as food will represent the most significant market for entomophagy in the future. We conclude that in Vienna well-educated men in their twenties and thirties are more likely to consume insects compared to any other parts of the Viennese population.

5.2 Ways of Promoting and Advertising Insects as Food

5.2.1 Overcoming Concerns

Considering that 'disgust' and 'hygienic concerns' were the main worries and reasons for resentment mentioned by those unwilling to ever try insects, those two inhibitors need to be eliminated from people's minds when aiming at making them more ready to try insects.

On the one hand, a certain feeling of fear or disgust or even greater revulsion can sometimes not be eradicated through being rationally proven wrong. For instance, some people are afraid of harmless little spiders even if they are being shown that the spider cannot cause any harm to humans.

On the other hand, disgust sometimes does vanish when one realises that there is nothing to be disgusted of. This is exemplified by the higher readiness to consume insects of the people who have already had the possibility to try insects in comparison to those who have not. Having seen the insects actually being available as food might have led to either the absence of disgust or, at least, some decrease of the disgust, making it possible to better consider other aspects of insects as food as well.

Therefore, providing such people with the chance to try insects significantly increases their willingness to try them, as well as the potential market for entomophagy.

To address the hygienic concerns, apart from seeing the clean and perhaps tasty-looking insect, proper information about methods of rearing and preparing insects under increasingly strict statutory regulations might also positively contribute to erasing the myth of the “dirty, creepy crawlies” when thinking of insects as food.

5.2.2 Fulfilling Important Preconditions

Whether insects are of an appealing flavour or not is a matter of personal taste. Therefore, as shown in *Chapter 4.1.1*, opinions on the experience of tasting insects diverge; nevertheless, on average the Viennese interviewed found the insects they had tried so far rather tasty. It will be the task of experts in the food industry to improve the taste of food containing insects even further.

While the price of insects needs to be dramatically reduced in order to make insects attractive for human consumption, the hygienic standards of insects are guaranteed just like those of any other food sold in Austria (cf. *Appendix C: “Interview with Christoph Thomann”*, p. 2). However, they also need to be more readily available to enable potential customers to purchase products containing insects.

Another way of decreasing people’s disgust of insects is to prepare the latter concealed from the eye: When the consumers are not able to identify the insects included in their food, they might be less reserved towards trying that food.

5.2.3 Educating the Viennese about the Advantages of Entomophagy

Our data shows a strong correlation between having knowledge of the ecological benefits of insects and being willing to consume them in the future. Clearly, better education about the ecological advantages of insects will strengthen their future importance on the market.

5.3 Outlook and Vision for the Future

5.3.1 Potential of Entomophagy in the Future

In the future, insects as food for humans will be of increasing importance due to their ecologically superior efficiency in resource utilisation and lower emissions of greenhouse gases, counteracting both upcoming food shortages and global warming. For instance, while cattle might die of thirst during a drought, insects, requiring substantially less water, are more likely to survive.

Apart from that, in rather rich industrial countries different insects of various contents of proteins could be reared to perfectly fit the requirements of either obese or slim people as protein supplements.

5.3.2 Outlook into the Viennese Habits of Eating Insects in the Future

First, with regard to *Chart 13*, certain doubt needs to be expressed: Despite only 41.6 percent declaring they would not eat insects in their future, the remaining 58.4 percent may not actually represent a large future market - many of those who selected 'rarely' presumably only plan to try insects once out of curiosity instead of regularly including them in their diet. Therefore, we would expect only about 20-25 percent of all Viennese (those who selected something from 'now and then' to 'daily' – cf. *Chart 13*) to be potential customers, when projecting the small, unweighted sample of people surveyed onto the Viennese population.

Due to some of the inaccuracies in measurement, as outlined in *Chapter 3.4*, the actual future market of Viennese purchasing insects might be smaller. Nonetheless, through proper education and the other measures mentioned in the previous chapter, the number of potential buyers could again be increased.

6. Conclusion

6.1 Ecological Benefits of Eating Insects

Insects are fairly high in protein (20-70 percent) and fat (10-50 percent), but low in carbohydrates. They also contain various vitamins and minerals as well as chitin (5-10 percent). Overall, they supply two to three times more kilocalories per 100 grams than conventional meat can provide. In comparison, insects also require substantially less water and food during rearing, are expected to produce less greenhouse gases, consist of edible parts to larger proportions and experience no stress or pain when being slaughtered. Therefore, insects as food are definitely more ecologically friendly than conventional meat and must be promoted as a sustainable food source in the future.

6.2 Current Situation in Europe

Insects for human consumption need to be reared according to the same strict hygiene regulations that apply to meat production in general. Only a few insect farms have been established in Europe so far; therefore, the price of the insects available is quite high. However, insects can be fed on kitchen scraps and reared at home so that the current shortage of insects might easily be overcome.

6.3 Entomophagy in Vienna

As estimated in the survey dealt with in *Chapter 3* and *4* featuring 1,126 Viennese participants, approximately every third Viennese has had the chance to try insects so far, mostly grasshoppers or mealworms, and two in three of those who were offered insects actually took the chance. It was stated that the insects tasted rather 'good', smelled more or less 'neutral' and looked slightly 'bad'.

When asked how often they planned to consume insects in the future, 42 percent of the Viennese interviewed selected 'never', over one third chose 'rarely', and almost a

fourth stated 'now and then' or 'more often', showing a potential target group for entomophagy of approximately 20-25 percent within the Viennese population.

The readiness of the Viennese to consume insects in the future positively correlates with their knowledge about the ecological advantages of insects as food for humans, being male, and having already been offered insects. Conversely, the unwillingness to consume insects in the future increases with higher age and lack of experience with insects as food for humans.

6.4 Improvements for the Future

To make insects more attractive for consumers, their price needs to be reduced and they need to become more easily available on the market. Moreover, regulations for insect salesmen trying to start a business should be loosened, in order not to scare entrepreneurs away, but to pave the way for insect farms all over Europe. In addition, a lot of research work needs to be conducted in order to find out how to feed and breed large quantities of insects properly. Apart from that, Europeans need to overcome their culturally induced feeling of disgust towards insects and understand that insects are not dirty and infectious provided that they are produced and consumed under hygienic conditions. Also, disguising the shape of the insects during their preparation will certainly decrease people's revulsion against consuming food that contains insects.

„Einfach probieren, sich eine eigene Meinung bilden, über den eigenen Schatten springen, Vorteile versuchen wegzutun und den Kopf ausschalten und dann, glaub ich, kann man diesem Ekel auch in weiterer Folge entgegentreten.“

(cf. Appendix C: "Interview with Christoph Thomann", p. 3)

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List of Abbreviations

AD	anno domini (after Christ)
BC	before Christ
cf.	compare
et al.	et alii (and others)
g	gram
ibid.	ibidem (in the same place)
kg	kilogram
l	liter
n. d.	no date (year unknown)
sic!	mistake from quote taken over
WHO	World Health Organisation

Appendix A: German Questionnaire (online version)

“Appendix A” shows the information asked in the German online questionnaire. The English and the French version featured the same contents.

Insektenverzehr in Wien

Diese Umfrage dient der Datenerhebung für eine vorwissenschaftliche Arbeit (ein Teil der Matura).

Die Fragestellung der Arbeit lautet: Ist die Wiener Bevölkerung bereit, Insekten zu essen? Alle Daten werden anonym und vertraulich behandelt.

Mit Ihrer Teilnahme leisten Sie einen wichtigen Beitrag. Vielen Dank für Ihre Mithilfe! :)

* Erforderlich

1) Geschlecht *

Bitte wählen Sie nur ein Feld aus.

- männlich
- weiblich

2) Alter *

Bitte wählen Sie nur ein Feld aus.

[Felder mit Zahlen von 6 bis 110 auswählbar]

3) Beruf *

4) Herkunft *

Bitte wählen Sie nur ein Feld aus.

- Wien
- anderes österreichisches Bundesland als Wien
- Deutschland
- anderes europäisches Land
- Asien
- Afrika
- Nord-, Süd- oder Mittelamerika
- Australien

- 5) Mir war schon vor dieser Befragung bekannt, dass Insekten (mehrere Kästchen auswählbar)

Wählen Sie alle zutreffenden Antworten aus.

- bei der Züchtung als Nahrungsmittel weniger Wasser als herkömmliches Fleisch benötigen.
- weniger Treibhausgase bei der Züchtung emittieren als herkömmliches Fleisch.
- zu einem Großteil aus wertvollen Proteinen bestehen.
- in vielen Teilen der Welt gegessen werden.

- 6) Hatten Sie schon jemals die Möglichkeit, Insekten zu essen? *

Bitte wählen Sie nur ein Feld aus.

- ja *Weiter mit Frage 7*
- nein *Weiter mit Frage 16*

Ich hatte schon die Möglichkeit, Insekten zu essen.

- 7) Welche Insekten wurden Ihnen schon angeboten? *

Wählen Sie alle zutreffenden Antworten aus.

- Mehlwürmer
- Heuschrecken
- Buffalowürmer
- Heimchen
- Sonstiges:

- 8) Haben Sie schon mindestens ein Insekt gekostet? *

Bitte wählen Sie nur ein Feld aus.

- ja *Weiter mit Frage 9*
- nein *Weiter mit Frage 17*

Mein Geschmackserlebnis

- 9) Ich habe bisher Insekten explizit als Speise *

Bitte wählen Sie nur ein Feld aus.

- einmal gegessen.
- ein paar Mal gegessen.
- oft gegessen.

- 10) Bitte nennen Sie ein Insekt, das Sie schon gegessen haben!

11) So war mein Geschmackserlebnis mit dem eben genannten Insekt:
 Markieren Sie nur eine Antwort pro Zeile.

	sehr gut	gut	neutral	schlecht	sehr schlecht
Geschmack					
Geruch					
optischer Eindruck					

12) Weitere Anmerkungen zum Geschmackserlebnis mit dem eben genannten Insekt (optional): _____

13) Bitte nennen Sie ein weiteres Insekt, das Sie schon gegessen haben (falls zutreffend)!

14) So war mein Geschmackserlebnis mit dem eben genannten Insekt:
 Markieren Sie nur eine Antwort pro Zeile.

	sehr gut	gut	neutral	schlecht	sehr schlecht
Geschmack					
Geruch					
optischer Eindruck					

15) Weitere Anmerkungen zum Geschmackserlebnis mit dem eben genannten Insekt (optional):

_____ *Weiter mit Frage 19*

Ich hatte noch nie die Möglichkeit, Insekten zu essen.

16) Wenn Sie die Möglichkeit hätten, Insekten zu probieren, würden Sie diese kosten? *
 Bitte wählen Sie nur ein Feld aus.

- Ich wäre dazu bereit. *Weiter mit Frage 19*
- Ich wäre nicht dazu bereit. *Weiter mit Frage 17*

Ich möchte keine Insekten essen.

17) Wieso möchten Sie keine Insekten essen? *

Wählen Sie alle zutreffenden Antworten aus.

- Ich finde Insekten ekelhaft.
- Ich esse grundsätzlich kein Fleisch.
- Ich habe hygienische Bedenken.
- Sonstiges: _____

18) Weitere Gründe (optional): _____ *Weiter mit Frage 19*

Meine Einstellung zu Insekten

19) Ich finde den Gedanken, Insekten zu essen:

Wählen Sie alle zutreffenden Antworten aus.

- ekelerregend
- neutral
- innovativ
- sinnvoll
- Sonstiges: _____

20) Optisch wirken Insekten auf mich:

Wählen Sie alle zutreffenden Antworten aus.

- ekelerregend
- beängstigend
- neutral
- Sonstiges: _____

Weiter mit Frage 21

Ein Blick in die Zukunft

21) In Zukunft habe ich vor, Insekten zu essen: *

Bitte wählen Sie nur ein Feld aus.

- nie
- selten
- ab und zu
- einmal pro Woche
- mehrmals pro Woche
- täglich

22) ... unter der Voraussetzung, dass diese

Wählen Sie alle zutreffenden Antworten aus.

- preiswert erhältlich sind.
- unter hygienisch unbedenklichen Umständen zu verzehren sind.
- mir schmecken.
- im Nahrungsmittel optisch nicht erkennbar sind.
- Keine Voraussetzungen sind für mich notwendig.
- Sonstiges: _____

GESCHAFFT! :)

Vielen Dank für Ihre Hilfe! Bei Fragen können Sie sich gerne an die folgende Mail-Adresse wenden: < WIRD AN DIESER STELLE AUS DATENSCHUTZGRÜNDEN NICHT ANGEZEIGT >.

23) Falls Sie möchten, haben Sie nun noch die Möglichkeit, einen Kommentar zu hinterlassen.

Appendix B: German Print-Out Questionnaires

Appendix B consists of two German questionnaires, both to be filled out in hardcopy, not electronically: one especially designed for people present at a degustation (*B1*), and another one for people who were not being offered insects at the moment of being surveyed (*B2*). However, the first version was also filled in by people not attending the degustation, due to the fact that the second questionnaire was created some time later.

Insekten – Die Nahrung der Zukunft?

1) Verkostung

Ich habe im Zuge dieser Befragung folgende Insekten angeboten bekommen:

<input type="checkbox"/> keine	<input type="checkbox"/> Mehlwürmer	<input type="checkbox"/> Heuschrecken	<input type="checkbox"/> _____
Zubereitungsform: (z.B. gegrillt, gekocht)			

Ich habe zumindest ein Insekt davon gekostet: ja nein

Wenn Sie (ein oder mehrere) Insekten gekostet haben:

	sehr gut	gut	neutral	schlecht	sehr schlecht
Geschmack	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Optischer Eindruck	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Geruch	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Wenn Sie keine Insekten gekostet haben: Warum nicht?

<input type="checkbox"/> Ich finde Insekten ekelhaft.	<input type="checkbox"/> Ich esse prinzipiell kein Fleisch.	<input type="checkbox"/> hygienische Bedenken	<input type="checkbox"/> _____
---	---	---	--------------------------------

Wenn Ihnen keine Insekten angeboten wurden: Wären Sie bereit gewesen, diese zu kosten? ja nein

2) Persönliche Erfahrungen

a) Ich habe Insekten explizit als Speise gegessen:

<input type="checkbox"/> noch nie	<input type="checkbox"/> erstmals im Zuge dieser Befragung	<input type="checkbox"/> schon vor dieser Befragung	<input type="checkbox"/> einmal	<input type="checkbox"/> ein paar Mal	<input type="checkbox"/> oft
-----------------------------------	--	---	---------------------------------	---------------------------------------	------------------------------

b) Ich finde den Gedanken Insekten zu essen [mehrere Felder ankreuzbar]:

<input type="checkbox"/> ekelhaft	<input type="checkbox"/> neutral	<input type="checkbox"/> innovativ	<input type="checkbox"/> sinnvoll	<input type="checkbox"/> _____	<input type="checkbox"/> _____
-----------------------------------	----------------------------------	------------------------------------	-----------------------------------	--------------------------------	--------------------------------

c) Optisch wirken Insekten auf mich [mehrere Felder ankreuzbar]:

<input type="checkbox"/> ekelhaft	<input type="checkbox"/> neutral	<input type="checkbox"/> beängstigend	<input type="checkbox"/> _____	<input type="checkbox"/> _____
-----------------------------------	----------------------------------	---------------------------------------	--------------------------------	--------------------------------

d) * Das Geschmackserlebnis mit diesem Insekt finde ich:

[mehrere Felder ankreuzbar, sofern Sie schon einmal Insekten gekostet haben]

Insekt: _____

<input type="checkbox"/> ekelhaft	<input type="checkbox"/> geschmacklos	<input type="checkbox"/> fleischig	<input type="checkbox"/> weich	<input type="checkbox"/> knusprig	<input type="checkbox"/> negativ	<input type="checkbox"/> positiv
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____

Insekt: _____

<input type="checkbox"/> ekelhaft	<input type="checkbox"/> geschmacklos	<input type="checkbox"/> fleischig	<input type="checkbox"/> weich	<input type="checkbox"/> knusprig	<input type="checkbox"/> negativ	<input type="checkbox"/> positiv
<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____	<input type="checkbox"/> _____

a) In Zukunft habe ich vor, Insekten zu essen:

<input type="checkbox"/> nie	<input type="checkbox"/> selten	<input type="checkbox"/> ab und zu	<input type="checkbox"/> einmal pro Woche	<input type="checkbox"/> mehrmals pro Woche	<input type="checkbox"/> täglich
------------------------------	---------------------------------	------------------------------------	---	---	----------------------------------

... unter den Voraussetzung, dass die Insekten [mehrere Antworten möglich] ___ sind:

<input type="checkbox"/> preiswert	<input type="checkbox"/> erhältlich	<input type="checkbox"/> hygienisch zu verzehren	<input type="checkbox"/> geschmacklich ansprechend	<input type="checkbox"/> _____
------------------------------------	-------------------------------------	--	--	--------------------------------

3) Über mich (notwendig für die statistische Auswertung)

Geschlecht: weiblich männlich | Alter: _____ | Herkunft: Wien _____

Mir war schon vor dieser Befragung bekannt, dass Insekten [mehrere Felder ankreuzbar]:

<input type="checkbox"/> bei der Züchtung als Nahrungsmittel weniger Wasser als herkömmliches Fleisch benötigen.
<input type="checkbox"/> weniger Treibhausgase bei der Züchtung emittieren als herkömmliches Fleisch.
<input type="checkbox"/> zu einem Großteil aus wertvollen Proteinen bestehen.
<input type="checkbox"/> in vielen Teilen der Welt gegessen werden.

Wo wurden Sie befragt: _____ (z.B. Straße/ Schule/ online) | Beruf: _____

Insekten – Die Nahrung der Zukunft?

1) **Schon probiert?**

Hatten Sie schon mindestens einmal die Möglichkeit, Insekten zu kosten?

ja und ich habe gekostet (weiter zu 4) ja aber ich habe nicht gekostet (weiter zu 3) nein (weiter zu 2)

2) **Ich hatte noch nie die Möglichkeit, Insekten zu kosten.**

Wären Sie bereit, Insekten zu probieren?

ja (weiter zu 5) nein (weiter zu 3)

3) **Ich möchte keine Insekten essen.**

Wieso möchten Sie keine Insekten essen?

<input type="checkbox"/> Ich finde Insekten ekelhaft.	<input type="checkbox"/> Ich esse grundsätzlich kein Fleisch.	<input type="checkbox"/> hygienische Bedenken	<input type="checkbox"/> _____
---	---	---	--------------------------------

→ weiter zu 5

4) **Wie war's?**

Wie oft haben Sie schon Insekten gegessen (einmal/ ein paar Mal/ oft)? Welche Insekten haben Sie schon gekostet und wie war Ihr Geschmackserlebnis (Geschmack, Geruch, optischer Eindruck) mit diesen?

5) **Ihre allgemeine Einstellung zu Insekten**

a) Ich finde den Gedanken Insekten zu essen [mehrere Felder ankreuzbar]:

ekelerregend neutral innovativ sinnvoll _____ _____

b) Optisch wirken Insekten auf mich [mehrere Felder ankreuzbar]:

ekelerregend beängstigend neutral _____ _____

6) **In Zukunft habe ich vor, Insekten zu essen:**

nie selten ab und zu einmal pro Woche mehrmals pro Woche täglich

... unter den Voraussetzung, dass die Insekten [mehrere Antworten möglich] ___ sind:

preiswert erhältlich hygienisch unbedenklich zu verzehren geschmacklich ansprechend
 optisch nicht im Nahrungsmittel erkennbar _____

7) **Über mich** (notwendig für die statistische Auswertung)

Geschlecht: weiblich männlich | Alter: ____ | Herkunft: Wien _____

Mir war schon vor dieser Befragung bekannt, dass Insekten [mehrere Felder ankreuzbar]:

<input type="checkbox"/> bei der Züchtung als Nahrungsmittel weniger <u>Wasser</u> als herkömmliches Fleisch benötigen.
<input type="checkbox"/> weniger <u>Treibhausgase</u> bei der Züchtung emittieren als herkömmliches Fleisch.
<input type="checkbox"/> zu einem Großteil aus wertvollen <u>Proteinen</u> bestehen.
<input type="checkbox"/> in vielen Teilen der Welt gegessen werden.

Beruf: _____

Appendix C: Interview with Christoph Thomann

On June 6th, 2016 Leo Stöger interviewed the Austrian purveyor of insect Mr. Thomann to gain an insight into several aspects of entomophagy.

Appendix C

*Interview mit Christoph Thomann am 21.6.2016
durchgeführt von Leo Stöger im „futurefoodstudio“ (Brunnengasse 17)*

Christoph Thomann über Insektenverzehr

Guten Tag, Herr Thomann! Vielen Dank, dass Sie sich Zeit nehmen für dieses Interview. Ich fange gleich an mit der ersten Frage: Was macht Insekten ökologisch wertvoll?

Thomann: Ja, nehme ich mir gerne Zeit für dich. Da gibt's natürlich grundsätzlich sehr viele Antworten auf diese Frage. Allem voran sind das sicher mal die Ressourcen von denen wir hier sprechen – das heißt Insekten brauchen im Vergleich zum Beispiel zu Rindfleisch oder zu anderen Säugetieren, Schweinen oder Hühnerfleisch, was wir so täglich verzehren in Europa, deutlich weniger. Das heißt weniger Futtermittel, weniger Wasser, weniger Platz, aber verursachen auch weniger Treibhausgase. Das heißt, das ist einmal so das Hauptargument im Prinzip auf diese Frage. Kann man im Großen und Ganzen so auch stehen lassen.

Das heißt zum Beispiel in Kontinenten wie in Afrika wäre es bei Wasserknappheit sehr empfehlenswert, Insekten zu züchten statt Kühen?

T: Allgemein, wir wissen bei Rindfleisch zum Beispiel braucht man etwa 7000 Liter Wasser, um einen Kilo herzustellen. Im Vergleich zu Insekten sind das deutlich deutlich weniger. Bei den Futtermitteln genauso – das heißt, das ist nicht nur in Afrika so, das muss man weltweit betrachten.

Bei meiner Umfrage gab es Antworten von Menschen, die gesagt haben, bei Insekten wäre das Problem, dass man so viele auf einmal züchten müsste und auch, dass man sie nicht tatsächlich mit Abfällen füttern dürfte, sondern dass man da hochwertiges Futter verwenden müsste, das wiederum kostenmäßig unpraktisch wäre. Stimmt das?

T: Natürlich müssen wir uns anschauen, welche Futtermittel man verwendet, aber jetzt grad im Vergleich zu Säugetieren, wie schon gesagt, brauchen wir bei Heuschrecken zum Beispiel zwei Kilogramm Futtermittel, um ein Kilogramm Fleisch herzustellen. Bei Hühnerfleisch sind das etwa vier bis fünf, bei Schweinefleisch weit über zehn Kilogramm. Das heißt das ist einmal sicher natürlich das Argument. Und von den Futtermitteln selber: Ob wir Abfälle verwenden können, das müssen wir uns jetzt in Zukunft anschauen. Da werden sicher die Gesetze und Regulierungen am Anfang sehr streng sein. Aber auch hier wiederum: Wenn man nicht „Abfall“ dazu sagt, sondern „landwirtschaftlicher Überschuss“ dann ist es sehr wohl ein großes Potential, das wir hier sehen, weil in Europa sehr viel weggeschmissen wird an Lebensmitteln, die eigentlich gut genug wären, um auch von uns gegessen zu werden. Das heißt das ist kein Abfall, sondern einfach ein Überschuss, der hier sehr wohl verwendet werden kann.

Wo Sie die Gesetzeslage schon ansprechen: Wie schaut es denn in Österreich aus? Welche Probleme gibt es beim Verkauf von Insekten als Nahrungsmittel momentan?

T: Ich würde gar nicht von Problemen sprechen, das ist einfach ein Thema, das noch ganz am Anfang ist. Das heißt wir müssen uns das jetzt am Anfang anschauen und „best-case“-Szenarien entwickeln, wie wir das in Zukunft am besten machen können. Das heißt heute Erfahrungen sammeln und herausfinden, wie das am besten funktioniert. Probleme gibt es keine. Weil du die rechtliche Situation angesprochen hast: Auch hier schauen wir uns mit den Ministerien und den Behörden gemeinsam die gesetzlichen Regulierungen an und entwickeln gemeinsam Standards, wie Insekten am Ende des Tages dann gezüchtet und auch verkauft werden können.

Und wie lange denken Sie, wird es circa dauern, bis Insekten markttauglich sind?

T: Markttauglich sind sie de facto heute schon, wenn wir davon sprechen, dass 2 Milliarden Menschen das tagtäglich schon essen. Nur in Europa ist das natürlich noch nicht ganz so weit. Markttauglich im Sinne von dass das jeder isst, das wird sicher noch 30 bis 40 Jahre dauern. Aber wir sehen jetzt schon großes Interesse und die Nachfrage ist da. Die wird mit steigendem Angebot natürlich auch wachsen. Der Preis muss sich reduzieren. Also es gibt noch viele Hürden, viele kleine Sachen, die wir jetzt andenken müssen und die umgesetzt werden müssen und dann wird das sicher nicht ewig dauern, bis Insekten hier im Supermarkt auch landen und vom Konsumenten angenommen werden sie, wenn man sie heute erreicht, heute schon.

Weil viele Menschen bei meiner Umfrage das Bedenken geäußert haben, dass sie zwar Insekten essen würden, aber nicht die Möglichkeit dazu haben momentan: Was müsste hier verändert werden?

T: Genau das ist ja das Ding mit Angebot und Nachfrage. Das heißt heut gibt's zwar noch sehr wenig Angebot – da sprechen wir von ganz Europa. Sehr wenig Angebot was die Zucht betrifft, das heißt was Insekten als Lebensmittel betrifft. Die werden ja heute wirklich in Europa gezüchtet. Da gibt's noch sehr wenig. Deswegen ist hier das Angebot eben noch sehr gering. Das wird sich in naher Zukunft noch ändern. Die Leute sind interessiert, wollen Insekten essen, fragen nach und daher gibt's dann Leute wie uns, die versuchen, diese Nachfrage zu stillen und dieses Thema größer zu machen.

Gibt es gesundheitsvorschriftlich Probleme in Europa momentan?

T: Gesundheitsvorschriftlich das Hauptding ist sicher, dass man die Insekten einfach für den Menschen [Telefon läutet]. Gesundheitsbezogen würde ich von keinen Problemen sprechen, sondern da... Jetzt hab ich die Frage... Was war die Frage?

Also wie ist die gesundheitsvorschriftliche Lage in Europa momentan?

T: Genau, also da geht's im Großen und Ganzen darum, dass wir Insekten heute wirklich für den menschlichen Verzehr züchten, das heißt, wie vorhin schon gesagt, „best-case“-Modelle ausarbeiten. Wir halten uns hier an dieselben gesetzlichen Regulierungen und Gegebenheiten, wie sie für andere Lebensmittel auch gelten. Da gibt's ganz klare Gesetze, an die sich der Züchter heute auch von Insekten halten muss. Ansonsten zu den Gesundheitsvorschriften: Wir reden hier natürlich von strengen Hygienerichtlinien, die bei Lebensmitteln allgemein gelten. Das heißt gerade wenn wir von der Kühlkette zum Beispiel sprechen. Du hast die Futtermittel schon angesprochen: Wenn wir von den Futtermitteln sprechen. Das heißt, hier einfach einerseits die Standards die schon für andere Lebensmittel da sind, auf die wird sich bezogen, und auf der anderen Seite werden hier einfach neu jetzt nach bestem Wissen und Gewissen ausgearbeitet.

Ist die Produktion bzw. die Züchtung von Insekten wirtschaftlich gesehen sinnvoll?

T: Wirtschaftlich gesehen sinnvoll? Das ist heute auch eine sehr schwierig zu beantwortenden Frage, weil wir den Markt nicht wirklich vorherdenken können. Es ist heute eben noch sehr teuer, das haben wir schon gesagt, weil es eben sehr wenig Angebot gibt und weil die Zucht heute sehr hohen Arbeitsaufwand betrifft [Anmerkung: gemeint ist „benötigt“]. Weil wir heute natürlich auch von Energiekosten sprechen, die wir in Europa brauchen. Weil wir die Insekten ich sag einmal relativ erhitzen, also es muss relativ heiß sein dazu. Das heißt, hier haben wir natürlich Energiekosten mit denen wir rechnen müssen. Summa summarum am Ende des Tages, wenn wir uns die Statistiken und die Zahlen anschauen, ist es am Ende des Tages immer ökologischer als die Nahrungsmittelproduktion die wir heute kennen in einer Massenproduktion. Das heißt am Ende des Tages, wenn wir Module entwickeln, skalierbare Zuchtmodule entwickeln, wenn sich die Nachfrage erhöht, dann wird das sicher auch wirtschaftlich zu machen sein. Am Ende des Tages sprechen wir

von Insekten und wir haben schon gesagt, dass die wenig brauchen im Vergleich zu anderen Sachen und dass die sehr einfach zu züchten sind. Das heißt, es wird früher oder später auch in Europa sicher ein wirtschaftliches Thema sein.

Damit Insekten auch angenommen werden von der Bevölkerung sind noch einige Hürden momentan vorhanden, die zu überwinden sind. Welche Reaktionen zeigen die Menschen gegenüber Insekten als Nahrungsmittel, wenn sie diese so verkaufen, und welche Bedenken haben diese Menschen?

T: Also das Interesse ist da. Das ist einmal das wichtigste. Das heißt, wenn wir Insekten irgendwo anbieten, kommen die Leute zu uns und wollen sich das auf jeden Fall anschauen. Das heißt, die Neugierde ist sehr groß. Das Interesse grundsätzlich nach neuen Sachen, spür ich hier, ist groß. Das ist aber jetzt ganz egal, ob du Insekten anbrätst oder einen guten Fisch machst. Das heißt, hier einfach weg von dem was man bisher kennt, aber um jetzt konkret zu den Insekten wieder zurückzukommen ist es natürlich am Anfang eine große Überwindung, eine große Überraschung, dass es hier jetzt Insekten gibt. Der Ekel ist natürlich ein großes Thema hier in Europa. Zur jetzigen Zeit grad bei uns in unserer Generation, wo wir mit Insekten noch keine Berührung im Prinzip hatten, ist hier natürlich ein Ekelgefühl vorhanden. Ich versuche dann meistens, dieses schnell die Leute überwinden zu lassen und wenn man das einfach probiert, sich eine eigene Meinung bildet, selber herausfindet, wie das schmeckt, das tun meistens die Leute auch, ein Großteil zumindest. Ich würde sagen 80% die bei mir am Stand stehen, die probieren das dann am Ende des Tages auch und von diesen 80% sind 100% überzeugt am Ende, dass es dann auch wirklich schmeckt und sie sind dann doch stolz drauf, dass sie's probiert haben, das heißt es ist immer auch eine Mutprobe, immer auch der Spaß heute noch dabei, der Gagfaktor, es werden Fotos geschossen, es wird gelacht und das ist auch gut. Essen bringt die Leute zum. Es wird über das Thema viel gesprochen und, wie gesagt, es ist sicher noch viel zu tun. Generation Zukunft muss hier aufgeklärt werden. Der Ekel sollte nicht entstehen. Wir essen nicht, was uns schmeckt, sondern uns schmeckt, was wir essen.

Ist das nur eine einmalige Überwindung der Hemmschwelle, wenn die Menschen das bei ihnen kosten oder bedeutet das, dass man dann bereit ist, öfter Insekten zu essen, tatsächlich in den Supermarkt zu gehen und Insekten zum Beispiel für das Mittagessen zu kaufen?

T: Nachdem es das heute noch nicht gibt, nachdem das Angebot heute noch nicht da ist, kann man da nur mutmaßen. Jetzt konkret zu unseren Events: Da ist es dann oft schon so, dass sie, wenn sie zwei Insekten am Spieß probiert haben, dass sie dann gerne noch eine Portion dazu nehmen, weil es ihnen einfach geschmeckt hat. Also das passiert schon und die Frage kommt oft: „Wo kann ich das jetzt besorgen und in welches Lokal kann ich gehen?“ Das heißt hier ist auf jeden Fall ein Interesse da und ich bin mir sicher: Wenn das Angebot hier größer wird, wird das auch vermehrt angenommen.

Sie haben vorher den Ekel angesprochen, der den Österreichern und auch den Europäern inne liegt. Woher kommt denn dieses Ekelgefühl Insekten über?

T: Dieses Ekelgefühl ist eine reine Kopfsache. Das ist ein hausgemachtes Ding. Das sind Ängste mit denen wir konfrontiert sind, weil uns eingebläut wird, dass Insekten unhygienisch sind, dass die am Boden krabbeln, Ungeziefer sind, alles sind, nur nicht mit dem Essen in Verbindung gebracht werden in unseren Breitengraden. Wenn ich mich konkret anspreche, war bei mir am Anfang auch ein Ekel da. Das liegt einfach daran, dass die Mama gesagt hat, was am Boden kriecht, isst man nicht. Das ist der einzige Grund, das heißt, wie ich schon gesagt hab, einfach probieren, sich eine eigene Meinung bilden, über den eigenen Schatten springen, Vorurteilen versuchen wegzutun und den Kopf ausschalten und dann, glaub ich, kann man diesem Ekel auch in weiterer Folge entgegentreten.

Wie wird sich, denken Sie, dieser jetzt aufkommende Trend in den nächsten Jahren entwickeln, in Österreich und auch in Europa?

T: Ich glaube, dass die Nachfrage weiter wachsen wird. Ich glaube, dass noch viel zu tun ist, vor allem in Richtung Forschung. Das heißt, hier muss einfach noch viel Forschungsarbeit geleistet werden, geschaut werden, wie Insekten richtig gezüchtet werden können, wie sie gefüttert werden müssen, wo wir sie züchten, welche Arten wir züchten, was man damit weiterhin tun kann, also der weiterverarbeitende Prozess, die Entwicklung von Produkten und dann in weiterer Folge die Vermarktung und hier die Zielgruppen definieren und mehr Leute auf diese Thema bringen, ganz viel Aufklärungsarbeit leisten, dann wird sich dieser Trend entwickeln und dann wird's glaub ich auch nicht nur ein Trend bleiben sondern ich bin eh recht positiv eigentlich gestimmt und, wenn ich mir die Entwicklungen in ganz Europa anschau, kann ich mir schon vorstellen, dass das in ein paar Jahren was Normales werden kann und Insekten einfach als Zutat, als Nahrungsmittel, so wie jedes andere, hier sich etablieren können. Vergleiche ich dann auch gerne oft mit Sushi, was vor einigen Jahren auch kein Thema war und mittlerweile nichtmehr wegzudenken ist.

Das heißt ganz konkret: Es könnte sein, dass wir in fünf Jahren in den Supermarkt gehen, um Insekten zu kaufen für das Mittagessen? Das könnte sich etabliert haben?

T: Ich kann mir vorstellen, dass es in fünf Jahren im Supermarkt Insekten zum Essen geben wird. Welche das sein werden, in welchem Supermarkt und in wie vielen Supermärkten ist dann die andere Frage, aber ich bin überzeugt, dass das vielleicht nicht in fünf, aber mit Sicherheit wird's in fünf die ersten geben die hier dranbleiben und sich diesem Thema angenommen haben.

Was spricht denn gegen den Verzehr von Insekten, wenn's da Punkte gibt, die genannt werden sollten oder welche Probleme gibt's bei der Herstellung?

T: Also Problem bei der Herstellung ist, wie schon gesagt, heute der Preisung und der hohe Arbeitsaufwand und die Tatsache, dass man einfach viel sich selber erarbeiten muss und hier keine Erfahrungswerte hergenommen werden können, wie Insekten in Europa eben als sicheres Lebensmittel gezüchtet werden können, das heißt da ist sicher vom hohem Arbeitsaufwand zu sprechen. Von hohem Arbeitsaufwand genauso die Leute zu überzeugen, hier Aufklärungsarbeit zu machen, das Bewusstsein zu fördern, die Bildung zu fördern von allen Schichten und Gruppen. Das fängt beim kleinen Kind an und hört aber beim Erwachsenen nicht auf. Das heißt, im Prinzip jeden hier zu überzeugen und jedem dieses Thema einmal nahe zu bringen. Ansonsten Probleme in der Zucht sehe ich keine wirklichen. Wie gesagt, die Frage ist, wenn man sich das klimatisch anschaut, wo wir das in Europa züchten werden, ob das in wärmeren Gefilden, vielleicht in der Nähe von Griechenland oder eben eher im Süden züchtet. Also es sind natürlich sehr viele Fragen offen. Gegen den Verzehr spricht grundsätzlich gar nichts – probieren sollte das jeder unbedingt. Es schmeckt wirklich hervorragend. Das heißt, ich sehe nichts was gegen den Verzehr, gegen das Probieren von Insekten spricht. In weiterer Folge kann ich heute auch keine klare Antwort darüber geben, ob es gescheit ist, in dieser Anzahl tierische Proteine zu verzehren, wie wir es in Europa tun. Wenn wir da von 70kg Fleisch reden ist das unseres Erachtens einfach zu viel, das sagt auch die Wissenschaft und die Ernährungsexperten sind sich hier einig aber die Ernährungsexperten sind sich eben auch einig, dass alle Argumente dafür sprechen, Insekten zu essen. Das heißt, ich sehe hier tatsächlich nichts. Man muss natürlich noch sehr viel Forschungsarbeit leisten und die Menschen überzeugen.

Denken Sie, könnten Insekten Allergien auslösen?

T: Das habe ich jetzt bewusst nicht angesprochen, weil man da sehr ins Detail geht. Bei Insektenallergien würde ich auch genauso sagen, so wie bei allen anderen Lebensmitteln auch, besteht hier durchaus auch die Möglichkeit, dass man zu Allergien neigt. Wir wissen in Europa sind viele Allergien hausgemacht, entstehen durch falsches Essen, durch falsche Ernährung, durch zu viel von wenig. Ich brech das hier runter, das heißt einfach die Ernährungsformen in Europa sind schlecht.

Gerade in Österreich haben wir sehr viel Aufholbedarf und sehen sehr viele Probleme. Um jetzt konkret zu den Allergien auf Insekten zurückzukommen, wissen wir heute, dass Allergien bestehen können bei Menschen, die Allergien auf Eiweiß haben, also gegen Schrimps zum Beispiel allergisch sind, oder Allergien auf Krusten- oder Schalentiere haben. Genauso die Hausstauballergie könnte ein Problem darstellen. Bis jetzt aber muss man sagen habe ich schon sehr sehr viele tausende Leute Insekten essen lassen und es ist hier noch nichts passiert. Aber natürlich, noch werden sehr wenige Insekten gegessen, das heißt noch haben wir hier eine sehr geringe Datenlage in Europa. Aber was ich vorher jetzt gesagt habe: Diese paar Möglichkeiten kennen wir heute bereits und die geben wir auch an dann als Allergiehinweis, was hier passieren kann, worauf man achten muss und dann muss man das am Ende des Tages auch selber herausfinden.

Sie haben vorhin den großen Arbeitsaufwand bei der Zucht angesprochen. Könnten Sie das kurz konkret erklären, was da bei der Insektenzucht besonders Probleme bereitet, was da die große Schwierigkeit ist?

T: Noch ganz kurz zu den Allergien zurück, bevor ich die Frage zur Zucht näher zu beantworten versuchen werde. Es ist halt ganz wichtig, dass man sich an die richtigen, die's heute in Europa schon gibt, das sind nicht viele aber doch ein paar, versucht zu halten, weil sehr oft die Frage auch vom Konsumenten kommt, ob man das auf Wald und Wiese fangen kann und wo die Insekten herkommen und wie man die richtig zubereitet. Wir reden momentan in Europa davon, dass wir vier Insektenarten züchten und vier Insektenarten auch verzehren dürfen: Das sind die Mehlwürmer, die Buffalowürmer, die Heuschrecken und die Grillen. Das heißt in diesem Fall werden die wirklich für den menschlichen Verzehr unter sterilen hygienischen Bedingungen gezüchtet. Das heißt ich kann heute niemandem empfehlen, in die Wiese zu gehen und Insekten sich zu sammeln und die dann abzubraten. Das heißt hier haben wir gar keine Datenlage und können überhaupt keine Empfehlungen abgeben außer eben, dass wir hier dann sehr wohl in der freien Natur wissen, dass Insekten Krankheitsüberträger sein können, dass die kontaminiert sein können, dass wir nicht wissen, wo die unterwegs waren, bevor wir die dann gefunden haben. Das heißt davon müssen wir abraten, auch vom Verzehr von Insekten als Futtermittel müssen wir abraten. Das heißt hier einfach wirklich darauf achten, dass die Insekten, die wir jetzt verzehren, auch wenn das vielleicht am Anfang nur selten ist, aber es sollte ja dann doch öfter passieren, dass die aus sicheren Gefilden und sicheren Zuchtbetrieben kommen.

Die Frage auf die Zucht, wo kommt der hohe Arbeitsaufwand her – da kann man sich vorstellen, dass da eben heute nicht sehr viele Menschen drinnen arbeiten, wenn wir uns einen Bauernhof vorstellen, sind da zehn, zwanzig Kühe. In Form der Heuschreckenzucht in Vorarlberg zum Beispiel haben wir 100.000 Tiere und die müssen alle gefüttert werden. Das passiert händisch und nicht maschinell oder industriell, sondern händisch und das ist einmal das Hauptding. Diese Boxen müssen alle regelmäßig gereinigt werden und dann gibt's da noch das ganze Bürokratische zusätzlich. Also wir reden hier schon von großen Aufgaben, die uns in der Insektenzucht gerade jetzt am Anfang hier begleiten.

Und denken Sie, dass sich in so großer Masseninsektenhaltung Krankheiten ausbreiten könnten, die dann wiederum mit Antibiotika oder anderen Medikamenten behandelt werden müssten, die für den Konsumenten schädlich sind?

T: Das glaube ich zum heutigen Zeitpunkt nicht und zwar glaube ich das deswegen nicht, weil heute bereits auch Insekten im großen Maßstab gezüchtet werden. Jetzt vielleicht wird's in den nächsten Jahren noch einmal mehr werden und die Zahlen auch in der Zucht werden sich erhöhen, aber im Großen und Ganzen ändert sich dann nichts und deswegen glaube ich dann auch nicht, dass sich hier Krankheiten übertragen werden und schon gar nicht glaube ich, dass wir das versuchen werden, mit Antibiotika zu heilen, weil genau das ist ein großes Problem. Das heißt ich sage zu dieser Frage ganz klar nein, weil ich davon ausgehe, dass es hier andere Möglichkeiten gibt und die kennen wir auch

heute, aber es ist schon, wie wir die Insekten im großen Maßstab züchten und welche Probleme da auftreten können und wie wir diese Probleme dann bewältigen können, aber sicherlich nicht mit Medikamenten, die werden heute nach meinem Wissen in ganz Europa nirgends eingesetzt.

Ist das Einfrieren von Insekten tierfreundlich? Weil oft wird ja gemeint, Kühe werden grausam erschossen oder mit Elektronik getötet, aber bei Insekten wäre das Einfrieren eine Art natürliche Winterstarre, die herbeigeführt, ohne Schmerz.

T: Genauso ist es - ohne Schmerz, das ist richtig. Insekten sind „niedrige Tiere“ ohne ein ausgebildetes Nervensystem. Das heißt nach heutigem Wissensstand kein Schmerzempfinden, kein Stressempfinden. Der natürliche Tötungsprozess ist einfach das Abkühlen, das Einfrieren, Insekten sind wechselwarme Tiere und passen sich der Außentemperatur an. Das heißt im Winter, wenn es kalt wird, sterben 90% der Insekten auch ab. Wir kennen den Maikäfer: Der kann sich im Boden eingraben und so überwintern. Heuschrecken, Grillen, Würmer können das nicht. Das heißt die sterben im Winter wenn es kalt wird. Bei uns werden die Insekten eingefroren und circa nach ein bis zwei Stunden schlafen die dann einfach friedlich ein.

Als letzte Fragen noch zusammenfassend im Bezug auf den Titel meiner Arbeit: Ist die Wiener Bevölkerung nun bereit, Insekten zu essen?

T: Ich glaube ich habe die Frage heute schon ein paar Mal versucht, richtig zu beantworten. Natürlich ist es eine ganz schwere Frage. Die Leute, die heute zu mir kommen, sind bereit. Wir hatten gestern einen Kochkurs hier in dem Studio in Wien, wo die Leute natürlich bereit waren, das zu probieren. Da waren ein paar natürlich auch sehr sehr erfreut, dass sie sich getraut haben, dass sie mutig waren. Die Wiener Bevölkerung allgemein ist insofern bereit, indem sie probieren kommt, wenn das Angebot da ist, dass es sicherlich auch von uns jetzt abhängt, was wir in weiterer Zukunft tun. Das heißt die Gastronomie ist hier ein großes Thema. Wir werden die Insekten an verschiedene Restaurants beliefern, da ist heute schon Anfrage da. Das heißt in weiterer Folge wenn sich das Angebot erhöht, wenn das Bewusstsein da ist, wenn die Stimmung sozusagen passt, dann wird die Wiener Bevölkerung Insekten bestimmt in weiterer Folge langfristig auch annehmen.

Vielen Dank für das Interview!

Appendix D: Two Extra Charts

During the survey, each participant was asked how insects optically appealed to them and what their general attitude towards entomophagy was. Due to the imposed limit of characters, two charts dealing with the answers to those two questions could not be integrated into the main paper, but will be briefly discussed here.

According to *Chart 21*, women and people with limited knowledge (A to C - increase of knowledge) of the ecological benefits of insects as food for humans find insects scarier than their reference group. This also applies to interviewees under the age of 20 or over the age of 70. Apart from that, the older the people surveyed were the less often they characterised insects as optically 'disgusting'.

While the percentage of people describing the optical impression of insects as 'disgusting' does not substantially vary within the comparison groups of different knowledge, women find insects considerably more 'disgusting' than men.

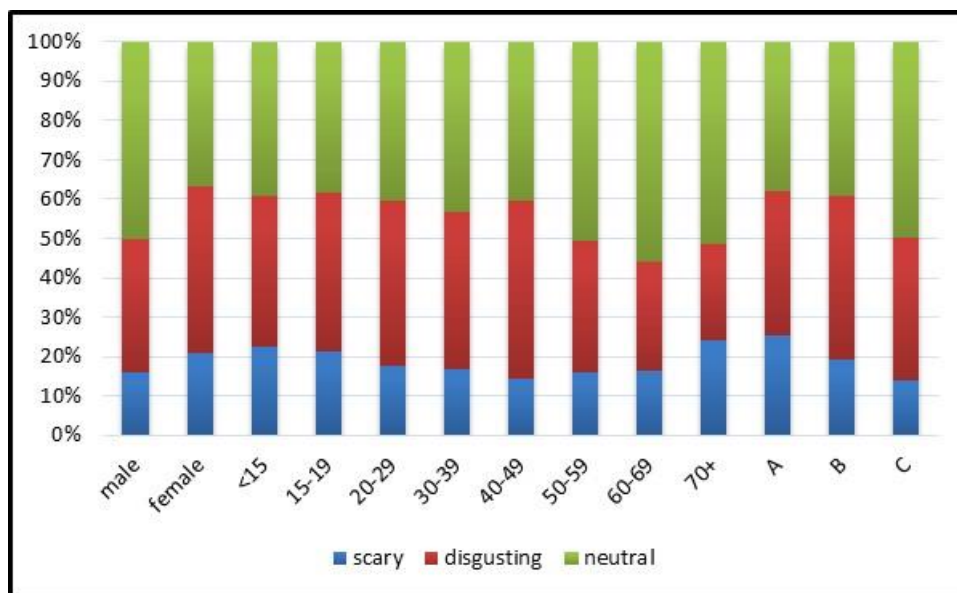


Chart 21: The Visual Impression of Insects (Viennese)
(created by Leo Stöger (2016))

Chart 22 depicts the Viennese' attitude towards entomophagy in dependency of the same variables: gender, age and ecological knowledge. Again, women and people who lack the education about the ecological advantages of insects find entomophagy more disgusting than their reference groups. However, the previously discussed correlation

regarding age is not that clearly visible: people aged between 40 and 49 seem to be most disgusted by the idea of entomophagy while their ten-year-younger or older peers are the least disgusted age groups.

Although quite obvious, the more knowledge people have regarding the ecological benefits of insects, the more likely they are to consider entomophagy 'reasonable', which might explain why people from 'C' display such a significantly higher willingness to eat insects in the future in comparison to the people assembled in 'A' and 'B' (cf. *Chart 17*) despite the similarly disgusting optical impression of insects (cf. *Chart 21*).

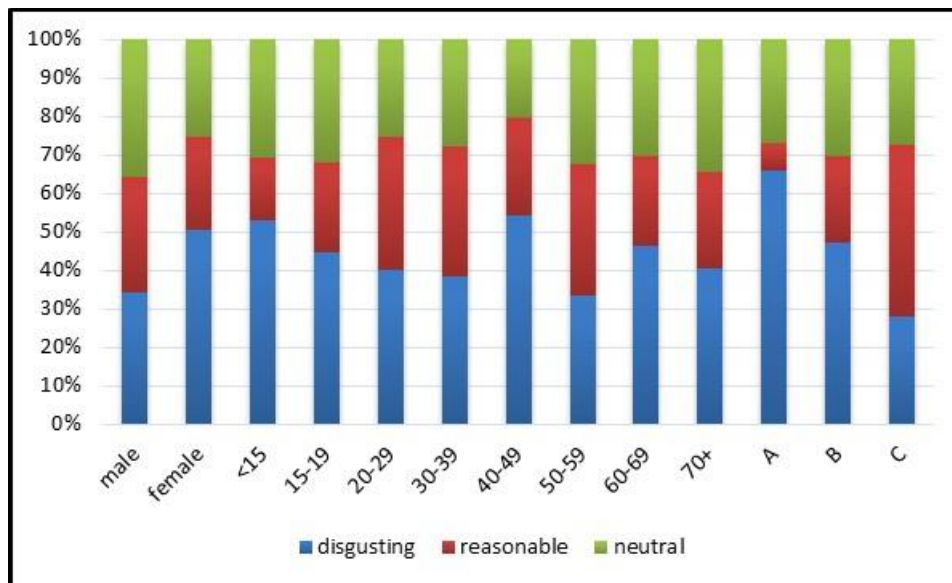


Chart 22: The Viennese' Attitude towards Entomophagy
(created by Leo Stöger (2016))

Eigenständigkeitserklärung

Ich, Leo Stöger, erkläre hiermit eidesstattlich, dass ich diese vorwissenschaftliche Arbeit selbstständig und ohne Hilfe Dritter verfasst habe. Insbesondere versichere ich, dass ich alle wörtlichen und sinngemäßen Übernahmen aus anderen Werken als Zitate kenntlich gemacht und alle verwendeten Quellen angegeben habe.

Wien, 11.02.2017



Leo Stöger