

Consumer perception and willingness to buy innovative products based on walnuts and hazelnuts: a consumer research for generations Y and Z, based on the Dutch market



MSc. Health Food Innovation Management

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## **Executive summary**

- There is an average level of overweight and obesity among children, young adults, and adults. 10% of all deaths in the Netherlands accounts on the composition of the diet, and 5% from been overweight.
- These ‘welfare’ diseases are associated with the lack of a healthy lifestyle. A healthy lifestyle is offering an improved overall health.
- Consumers in the Netherlands, and other western countries, have become aware and already exploring healthier food alternatives. Nuts and nut based products seem as good alternatives for that purpose
- What is the difference between generations Y and Z, in the Dutch market, and how they would perceive such products considering factors that could influence their willingness to buy?
- Study with cross-sectional design and creation of quantitative survey for data collection. Age range 20-40 years old with distinction between participants from generation Y and Z, 284 total responses, participants from all nationalities within the Netherlands.
- Consumers were already regularly eating nuts and nut-based products, with the vast majority indicating not consuming every day, and deriving from the guideline for consuming 30gr of nuts daily, while raw nuts were mostly consumed 2 times per week, and regarding nut-based products, consumers tend to use them mostly 2 times per week as well.
- There is a trend for a healthier lifestyle followed by people from generation Y and Z. However, based on their higher expectations in all aspects, participants from generation Y seemed to follow it more strictly. Individuals from both generations have almost identical responses followed by similar characteristics in their lifestyle.
- Consumers from both generations deemed significant to have a nutritious and with health benefits, upcycled nut-based food product. Although, participants from generation Y comment these aspects as of higher importance in comparison to generation Z.
- Consumers from both generations do not worry for the safety of upcycled nut-based food products, but are in need of some information about them. Responders from both generations deemed it important, participants from generation Y indicated a higher significance for the aspect of overall quality.

- Regarding sustainability, the opinions from both generations are in alignment and they suggest a high importance for developing a product that is environmentally friendly with individuals from generation Y been more persistent, while they focus less on the factor of been locally produced or produced by local ingredients.
- Regarding the price sensitivity, both generations offered similar responses by defining the price for a portion of the nut-based upcycled product as of possibly low quality, which was low enough leading them to not buy the product. However, participants from generation Z offered lower prices.
- For a price that is too high but not that much to not buy the product, both generations had slightly different expectations with consumers from generation Y striking higher prices.
- According to consumers from both generations the elements of overall quality, and health benefits of nut based products were positively correlated to the willingness to buy. Overall there is high level of willingness to buy upcycled nut-based foods from both generations.
- It can be suggested that Dutch market is a prosperous environment for such products.
- As a next step, development of a prototype for not investigating a hypothesized price.
- Based on this research, to develop a new upcycled nut-based food product and to define the price further, before introducing it in the Dutch market it has to be of high quality and offer health benefits in comparison to the competition.
- The final result indicated 28% correlation between willingness to buy and to the factors of overall quality, and health benefits.
- This study provided marketing information for the mentioned products regarding the two generations.
- Further qualitative research is needed to determine more accurately the explored factors.
- Concluding, there is a strong indication that consumers prioritize these factors by deeming them of higher importance in order to be willing to buy. However, it has to be pointed out that consumers from generation Y have overall higher expectations.

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## **Abstract**

During recent years, a healthier lifestyle is becoming more important in the Western countries. Consumers in Netherlands are a no exception and they follow this trend. However, Netherlands is no exception for overweight and obese individuals either, with an average number of children, young adults, and adults belonging to both categories. This makes a healthy diet of increasing value to consumers. However, achieving a healthy diet and an overall healthy lifestyle is still a challenge. While the obesity percentage in the Netherlands is below the average in comparison to other countries in the European Union (EU), about 36,8% of consumers aged above 20 were classified as overweight and even 14,2% are obese. In addition, 10% of all deaths in the Netherlands account on the composition of the diet, and 5% from being overweight. Strategies are in place, which aim to support consumers in making healthier choices, and enhancing their lifestyle to become healthier. Healthy food guidelines are one of these strategies, where an increasing important function for nuts has been suggested due to their natural content of nutrients and their health benefits. Therefore, this study investigated how consumers from generation Y and Z, in the Netherlands, would perceive innovative upcycled nut-based products in regards to their quality, healthfulness, sustainability, price sensitivity, and their willingness to buy. It was hypothesized that consumers from both generations will be highly motivated to buy such products based on their needs for healthier, high quality, and sustainable foods. The results supported the hypothesis with participants from both generations indicating strong levels of importance for the mentioned aspects, while participants from generation Y deemed the aspect of nutritious with health benefits, overall quality, and environmentally friendly of higher significance in comparison to participants from generation Z. However, overall both generations had many similarities. Further, the results provided a correlation to the aspects of overall quality, and health benefits in relation to willingness to buy in comparison to other parameters, suggesting that these are consumers' higher priorities. In conclusion, this information is of high value since it can be the foundation for further qualitative research regarding the explored factors, and for any potentially successful attempt of a developing or/and introducing an upcycled nut-based food product in the Dutch market, and eventually aiding consumers to eat healthier.

## **Introduction**

One of the current leading causes of death in the Netherlands among individuals under 75 years, is stroke and ischemic heart disease, with the latter often been related to overweight and having an unfavorable dietary composition (1-3). In alignment with a source in 2019 from CBS, in 2020 Dutch children and young adults between 4-20 years old were moderate overweight by 12,5 % and seriously overweight (obese) by 2,5 %, followed by the adults aged 20 and above who were classified as moderate overweight by 36,8%, and seriously overweight (obese) by 14,2% (4, 5). 10% of all deaths in the Netherlands accounts on the composition of the diet, and 5% from been overweight (3). However, obesity percentage in the Netherlands is below the average in comparison to other countries in the European Union (EU). These ‘welfare’ diseases are associated with the lack of a healthy lifestyle, while people consuming healthy foods and engaging in exercise led to a risk reduction of morbidity and premature mortality (2, 6). A healthy lifestyle is offering an improved overall health and can be accomplished by e.g. being aware of the quality of the consumed food and by maintaining physical fitness (6, 7). Furthermore, more people in the Western countries are following a healthy lifestyle due to a direct association with longevity and hence with a higher sense of life purpose (3, 8). Consumers in the Netherlands, and other western countries, have become aware and already exploring healthier food alternatives while also looking for further information (7, 9). According to a report from the Dutch National Institute for Public Health and the Environment (2016), consumers perception about healthy diet is described as a diet that includes, plenty fruit and vegetables, and controlled amounts of fat, sugars and salt (10).

Based on the decreased food-related time, Dutch consumers shifted towards fast food alternatives in comparison to previous decades. However fast food wasn't healthy, resulting in a higher need for healthier snacking alternatives (11). Interestingly, Witkowska et. al (2019) suggested that nut consumption comes hand in hand with better lifestyle choices as it is a favorable food rich in macro and micronutrients (12). European consumers in western countries prefer healthy snacks in which nuts is an important ingredient, moreover, nuts are usually eaten in desserts, spreads, as oils, in sauces, pastries, ice-creams, baked goods, as part of a meal, and whole either fresh or roasted (13-15).

Diet rich in nuts can be an important contributor to a healthier lifestyle because of their lipid profile, micronutrients, and bioactive substances that they contain, however, is also associated with reduced cholesterol, glucose and serum lipids level modulation, cognitive performance, beneficial influence on body weight, intestinal microbiota, has antioxidant and anti-inflammatory activities which improve markers of inflammation and endothelial dysfunction resulting into having favorable effects against specific chronic diseases such as obesity, cardiovascular diseases (CVD), and diabetes (11, 16-21). The favorable effects of nuts, in relation to CVD, are introduced by several mechanisms for which, the effects probably are mediated by their fatty acid, fiber, antioxidants or by the combination of those (22). Moreover, that is the reason that there are suggestions of consuming 30gr of nuts daily based on the World health organization (23). Although, it has to be highlighted that nuts should be eaten with their skin since, there is located the higher phytochemical content and hence, a major part of their antioxidant activity (18).

**Table 1. Walnut nutrition facts**

<b>Walnuts per 1oz/30gr</b>	
<b>Fats</b>	18g
-Saturated	1.8g (8)
-Polyunsaturated fats (PUFA)	13g
ALA	2.5g
-Monounsaturated fats (MUFA mostly oleic acid)	2.7g (8)
<b>Carbohydrates</b>	4.1g (8)
-Fibers	2g
<b>Protein</b>	4g
<b>Phosphorous</b>	10% of the daily value (100mg) (9)
<b>Magnesium</b>	11% of the daily value (44mg) (9)
<b>Potassium</b>	3% of the daily value (132mg) (9)
<b>Antioxidants:</b> Melatonin, Phenolic acid (ellagic acid), Folate,	Total 3.68mmol

Flavonoids, Selenium, Proanthocyanidins, Gamma tocopherol (Vitamin E), Juglone, Polyphenols (mostly non-flavonoid ellagitannins), Phytosterols	
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An exception to that are walnuts since, they are commonly consumed unpeeled and as a raw food product (17). The antioxidants that walnuts include, as shown in Table 1, are in high content (3.68mmol/oz) and are melatonin, phenolic acid (ellagic acid), folate, flavonoids, selenium, proanthocyanidins, gamma tocopherol (vitamin E), juglone, polyphenols mostly as non-flavonoid ellagitannins which are metabolized to urolithins providing with compounds that have antioxidant, anti-inflammatory, anticancer and prebiotic effects, and phytosterols which are also contributing to the cholesterol-lowering effect (21, 22, 24). Walnuts have also the highest polyphenol content of all nuts and it contains the lowest percentage of SFA and the highest percentage of PUFA (17, 25). While most nuts contain monounsaturated fats, walnuts have a high amount of plant-based omega-3 fatty acid, and mainly contain polyunsaturated fat (13 g of 18 g total fat per 1 oz walnuts), of which the n-3-a-linolenic acid (ALA) amount is 2.5 g and it is the precursor for eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which have anti-inflammatory effects (11, 17, 21, 24, 26). Furthermore, individually walnut fatty acids are palmitic and stearic acid respectively to 69 and 25% of the SFA, and 90% of the MUFA is oleic acid (25). However, possible differences can occur between some varieties in their chemical composition since, it can be influenced by different environmental conditions and the harvesting year, such in the case of “Franquette” which has significantly higher quantities of SFA and MUFA but lower concentration of PUFA (25). Walnuts have an optimal balance of n-6 and n-3 polyunsaturated fatty acids, a ratio of 4 : 1, which can lead to the reduction of the incidence of cardiovascular risk (10). Further, walnuts deliver fiber (2 g/oz), protein (4 g/oz), 10% of the daily value for phosphorus, 11% of the daily value of magnesium and are a good source of manganese (17, 26). From another study conducted from Chauhan A and Chauhan V (2020), a walnut-enriched diet can decrease total and low-density lipoprotein (LDL) cholesterol, increase high-density lipoprotein (HDL) cholesterol, and reduce blood pressure, inflammation, and plaque formation (21, 22, 27). Oxidative stress and inflammation are critical for the aging process, MCI, dementia, and many age-related diseases. Walnuts supports the immune system by reducing oxidative stress by decreasing the free radical levels, and by boosting antioxidant defense,

leading to reduced oxidative damage to lipids and proteins and thus, potentially they can have mental benefits aside from the physical ones leading to the reduction of age-related diseases (21). In addition, non-sodium minerals like potassium and magnesium, that walnut and other nuts contain, have a beneficial effect on cardiometabolic risk (24, 26). Moreover, contrary to expectations because of the high amount of fats, walnut consumption, does not contribute to weight gain and does not suppress weight loss goals as compared to a control diet (21). However regarding the sustainability aspect, walnut by-products are also useful and can be exploited in various ways, the green husk, hard shells, and walnut dregs are the main by-products of the cultivation of walnuts (17, 18). The walnut husk can be used for sugar production, for the walnut husk liqueur, as a natural pesticide, and as an inexpensive high-potential resource of pectin (28-30). Finally, walnut shells and dregs can be used as biomass through pyrolysis (28, 31, 32).

**Table 2. Hazelnuts nutrition facts**

<b>Hazelnuts per 1oz/30gr</b>	
<b>Fats</b>	18g (22)
-Saturated	1.3g (22)
-Polyunsaturated fats (PUFA)	2.4g (22)
-Monounsaturated fats (MUFA mostly oleic acid)	13.7g (22)
<b>Carbohydrates</b>	5g (22)
-Fibers	3g (22)
<b>Protein</b>	4.5g (22)
-L-Arginine	
<b>Copper</b>	
<b>Magnesium</b>	
<b>Potassium</b>	
<b>Antioxidants:</b> Phenolic compounds (p-hydroxy benzoic acid, synaptic acid), Folate, Selenium, Proanthocyanidins, Gamma tocopherol (Vitamin E), A-tocopherol, Polyphenols (caffeic acid, galic acid), Epicatechin, Phytosterols (mainly $\beta$ -sitosterol), Flavonoids (Quercetin)	

Regarding hazelnuts, they have the highest quantity of folate and proanthocyanidins in comparison to all other nuts (20, 23, 27). As shown in the Table 2, they are rich in vitamin E, PUFA, fibre, polyphenols, phytosterols (mainly  $\beta$ -sitosterol), L-arginine,  $\alpha$ -tocopherol, phenolic compounds, folate, magnesium, potassium, copper, selenium, they are the second richest source of monounsaturated fatty acids among nuts and have the highest unsaturated-saturated fatty acids ratio among nuts while the monounsaturated fatty acids are composed mainly by the oleic acid (18:1), and 7.7%–8% are saturated fatty acids (20, 23, 27, 33, 34). The total lipids of hazelnut are the 60% of its dry weight and are mainly represented by triacylglycerols, in which the main fatty acids are the linoleic and the oleic acids (34). Moreover, hazelnut consumption has benefits in regards to the cholesterol-lowering properties, and the reduction of atherogenic/cardiovascular risk and inflammation if consumed as whole, sliced or ground (23, 33). Hazelnuts are rich in various bioactive substances such as tocopherols and phytosterols, L-arginine, selenium, caffeic acid, fibers, gallic acid, p-hydroxy benzoic acid, epicatechin, sinapic acid and quercetin that could have anti-atherogenic effects by means of biological mechanisms acting on various pathways such as lowering blood glucose concentrations, decreasing oxidative stress biomarkers, leading to the reduction of risk for CVD development, however, their biochemical profile is depended with the country of origin and the cultivar (20, 27, 33). A hazelnut-enriched diet decreases low-density lipoprotein cholesterol (LDL-C) in a significant way and shows a trend toward the reduction of total cholesterol, without decreasing high-density lipoprotein cholesterol (HDL-C), while the level of triglycerides and the body mass index (BMI) remained unchanged (27, 34). Additionally regarding the hazelnuts' by-products, in the food industry the addition of hazelnut skin extracts can be useful due to the phenolic compounds that offer antioxidant and antimicrobial properties to the films placed on food packaging, or for plasticizers, antioxidants, and reinforcing fillers (35, 36). Shells are also high in phenolic compounds making them a reliable source of new efficient natural antioxidant (37, 38). Finally, other hazelnut by-products can be used for biomass fuel (39-41). Therefore, walnuts and hazelnuts are not only healthy and nutritious, but they have also the potential to be highly environmental friendly.

Based on their health benefits, walnuts and hazelnuts are used for the creation of several products. The remaining by-products, depending the process, could still retain high nutritious quality, leading to upcycling possibilities which are beneficial for the aspect of sustainability (42-51). Environmentally friendly foods, with nutritious quality, which are containing safe

ingredients that otherwise would not have gone to human consumption, are missing from the market. However, it is significant to distinguish agricultural products that reach the consumers after processing and those which are consumed as a fresh product (52). Upcycled foods are products containing ingredients such as damaged foods, by-products and scraps from food preparation, which usually would not be treated as waste (53). Overall, it is suggested that the acceptance of waste-to-value food products is determined by individual regarding the context and product-related aspects (54). Upcycled food products are based on unconventional ingredients, which can influence consumers' willingness to buy due to concerns about their quality which can also be related to the healthfulness of those foods (53, 55). Although, consumers' perception considering upcycled nut-based food products haven't been investigated yet and the elements they deemed important are unknown. Personal factors are key for the assessment of new foods, and consumers' behavior is rooted in a combination of conscious and unconscious evaluations based on their cognition and emotions (56). Consumers are driven by certain values or a combination of them such as health and safety, honesty, convenience, and the sense of doing something good (57). Consumers' behavior is also influenced positively considering healthier food options based on their health, availability and education (58). Another parameter which has to be taken in consideration is the price sensitivity which also has a critical role to the purchase behavior (59). Further, more factors such as their sensory characteristics, price, availability, and convenience of a product can influence their perception (60). Based on the previous, to explore consumers' perception and willingness to buy such products, in the Dutch market, two generations are viewed. These are Generation Y and Z, since their combined age range stretches from nowadays, 42 years old adults to 7 year old children. Generation Y also known as Millennials, are consumers who were born between 1980 and 1994 and are nowadays wise for their age adults (55, 61). Generation Z are consumers who were born between 1995 and 2015 and it is the newest generation, which represents 32% of the global population and is expected to represent 26% of the world population in 2030 (55, 61, 62). Therefore, by researching these generations a better overview of the Dutch market, for the near future until further, can be provided.

Dutch food sector is fairly described as a technological innovative because of the high prevalence of food patents and process innovation (56). Generally, Dutch consumers are willing to experience innovative and unfamiliar products(56, 63). The Netherlands is also home to many

internationals who characterize the general Dutch consumption behaviour and market, cultural factors that are involved in such cases are the education and migration status. It is suggested that a “typically Dutch” behaviour, which is usually the rejection of conventional type of foods, is related to higher educated citizens and migrants who also do not appreciate conventional type of foods (59).

Considering the sustainability aspect, consumers are seeking to be informed about the environmental impact for the consumption of certain food products (10, 64). Furthermore, there is a lack of information about upcycled foods since there is not a certain market strategy to introduce them to consumers, while these products are made from ingredients that otherwise would be waste, and hence, it is a promising solution for reducing food waste (61, 65). Added to the previous, in the Netherlands, there is an increasing demand for sustainable sourcing and healthy snacking, which are the leading forces driving consumer to better alternatives such nuts. Based on the Dutch Center for the Promotion of Imports (CBI), an increased number of people are following vegan diets, and specific groups such as those who are lactose intolerance, must match their protein needs while dealing with the absence of animal proteins. Evidence suggests that nuts consumption is already growing in the Netherlands, while Dutch traders and consumers demand more ethical and sustainable sources, therefore, it is expected that nuts will have the highest growth in the snack segment (14). In case of walnuts and hazelnuts, they have been proved beneficial for consumption and hence, this is why they are imported in Netherlands and also distributed in all Western Europe (2).

Thus after all the previous, it is critical to explore the aspects of those nuts, since it can be the trigger for initiatives such as growing walnuts and hazelnuts in Netherlands, which is investigated and promoted by KeepFoodSimple in collaboration with the “Nederlandse Noten Vereniging”. The results can be proved significant for the consumers since these nuts are beneficial for health, and it would be essential to know how they can be used in innovative food products and find their way to them, moreover, initiatives such as this promote an environmental friendly approach. For the food industry the benefits are multiple due to reuse of otherwise remaining wastes, normally requiring extra costs for handling them properly, and instead creating products with actual value for the consumers, which can be sold in the market.

Therefore, the upcoming question is evoked: What is the difference between generations Y and

Z, in the Dutch market, and how they would perceive such products considering factors that could influence their willingness to buy?

## **Methods and Materials**

### ***Study Design***

The best approach to the research question was a survey, since there was no background study that could be used as foundation to dive further into a certain characteristic. Therefore, this survey explores several parameters to evaluate the differences between the two generations based on certain categories, and eventually willingness to buy. The current quantitative study followed a cross sectional design and a survey was created based on previous literature. The literature used was from Moshtaghian H, Bolton K, Rousti K (2021), regarding challenges for upcycled foods, from a study conducted by Aschemann-Witzel J and Stangherlin (2021), for the investigation of consumer perspective of upcycled by-product used in agri-food systems (53, 54). Another study was advised regarding how to position upcycled food products to different generations by Zhang J et al. (2021), followed by a marketing research for the different generations from Williams K, and Page R (2011) (55, 61). Added to the previous, a study for the retail potential of upcycled foods conducted by Goodman-Smith F et al. (2021), a study for measuring accurately willingness to pay for consumers goods, followed by a survey from CCB considering consumer behavior research, was also used (65-67). The rest of the literature used will be pointed out later in this **section**. Furthermore, the approach of hypothetical willingness to pay was used, since to measure with any method the real willingness to pay, and therefore price sensitivity, a product has to be developed at least a prototype, and a sellable version is required which for this study did not exist (66). Next, willingness to buy was measured independently from the price sensitivity, and without a certain price in question due to the previous reason. The main objective of this research is to examine how consumers, between two generations, perceive upcycled nut-based food products regarding healthfulness, quality, and sustainability while eventually define which factors are most strongly associated with their willingness to buy.

### ***Participants and recruitment criteria***

The sample size of this study in order to offer reliable results is 385 participants, however, in the study 287 participants were collected from which 17 had to be excluded due to major lack of answers in the questionnaire. The sample size was calculated while considering the total population in the Netherlands between 20-40 years old, 95% (CI), Margin error 5%, and population proportion 50% (68). For this study consumers from the Netherlands were attracted randomly, from both genders, with age ranged between 20-40 years old in order to measure their perception, and willingness to buy upcycled nut-based products. Firstly, this age range was suggested in order to have adults from 20 to 29 years old from the Generation Z, and participants from generation Y between 30 and 40 years old. Finally, the collected data will be compared between age groups, which will be divided in two groups with ten years range, and they will be described as “generation Y” (range) and “generation Z”(range). Finally, to be included in the study, participants had to do their groceries in the Netherlands since the current consumer research was focused at the Dutch market. Participants were excluded if they were younger than 20 and older than 40 years old, if they were allergic to nuts, if they follow medication which restricts their nuts consumption, if they follow any extreme diet, if they were pregnant, and if they had any health issue that do not allow them to consume nuts.

### ***Data Collection Procedure***

This survey was published on the 3<sup>rd</sup> of April 2022 to social media platforms, specifically on “Facebook” and “Instagram”, since the majority of the generations investigated, mostly use these online platforms, and all data were gathered until the 1st of June (69). In addition, it was also published on websites such as “surveycircle.com” and “surveyswap.io”. The survey was provided in both Dutch and English languages to allow more participants completing it, by making it more convenient for either Dutch or internationals living in the Netherlands. This questionnaire was completed by volunteers, and the participants remained anonymous, however, before participants were able to begin with the survey, they had to state that they agree with the conditions that are stated in the beginning. Further, participants had to complete certain personal and demographic information in order to proceed. The participants were asked to take the survey in a moment that they would be relaxed, they had time to read with care the questions, and they were not been distracted by music, interaction with other person, food or TV/series/movies/news.

Before the beginning of the survey there was an introduction section in which the concept of the survey and the presumed time needed to complete it was described. Further, all participants were instructed to answer the questions based on their opinion and habits.

### *Data, Instruments, and Measures*

The survey was composed in stages for which five distinct sections were developed based on an approach that has been employed in previous research exploring the same elements and further studies on consumer perceptions toward novel technology (61, 66, 67, 70-76). To begin with, theory from the study considering the approach for different generations, related to upcycled food products was used (61). Further theoretical background was taken into consideration by two studies regarding consumers' perception of foods, made by innovative technologies, and consumer behavior towards modern food products and trends (73, 75). For the determination of willingness to pay and willingness to buy, the studies conducted by Schmidt J and Bijmolt (2020), and by Chen Y, Wang J, and Yu Y (2019), were explored regarding accurately ways to measure willingness to pay for consumer goods, and for the examination of elements that affect willingness to pay for remanufactured products (66, 70). Moreover, to set up potential elements that may influence consumers' perception of products that this study wants to investigate, aside from the previous study for remanufacturing goods, two other studies were considered. From the research that Verbeke W et.al (2005) conducted, consumers' perception regarding the scientific health benefits and safety risks of fish consumption was inspected, and the other study explored the influencing factors of consumers' purchase intention for nuts (74, 76). To investigate the consumption frequency, a study and its survey were explored in relation to the subject of consumption, characteristics, and perception of fruit and vegetable intakes in Dutch universities by students (72).

In the introduction participants were asked to agree with the concept (0 = yes proceed with this survey). For the first part of the survey, possible cofounders suggested by Hong L et al. (2020), were examined and therefore this section was about general information considering demographics, education level, current employment occupation, and diet (76). Gender was asked (0 = Female, 1 = Male, 2 = Other), the age of birth ranging in a scale from 1982 to 2002, what is

the country of birth, and their marital status (0 = Single, 1 = Married, no child, 2 = Married with child, 3 = Married with children, 4 = Single parent with children, 5 = Other). Further, in the same section the level of education was asked with all possible choices based on the Dutch educational system (0 = No schooling completed, 1 = Adult education, 2 = Primary school, 3 = Elementary school, 4 = High school, 5 = Secondary pre-university education, 6 = Secondary vocational education, 7 = Bachelor diploma (WO), 8 = Bachelor diploma (HBO), 9 = Master diploma (WO), 10 = PhD, 11 = Prefer not to answer). Participants were asked if they had any qualification in the field of food science and/or nutrition (0 = No, 1 = If yes please indicate the degree below), and in addition, their employment status was requested (0 = Student, 1 = Full time employed, 2 = Part time employed, 3 = Self-employed, 4 = Out of work, 5 = Other, 6 = Prefer not to answer). Concluding this section a final question was asked in regards to how they prefer to do their groceries (0 = Online, 1 = Offline).

The followed up second section considers consumers' nutrition habits in relation to nut consumption, and more specifically about walnuts and hazelnuts. Based on a previous literature regarding fruit and vegetables, intake was measured by a food frequency tool, which is also used in the Dutch Health Monitor, and has reasonable high accuracy (source). To measure fruit intake, participants indicated how many days per week they usually consume fruit on an eight-point scale ranging from 0 (Less than once per week) to 7 (Seven days per week) and then the number of portions they used to consume these days on a seven-point scale ranging from 0 (Less than one portion) to 6 (More than five portions) (55). Participants were questioned about how frequently they consume raw nuts during a day (0 = 4 times per day, 1 = 3 times per day, 2 = 2 times per day, 3 = 1 time per day, 4 = I do not consume nuts every day), and during a week (0 = Every day, 1 = 5 times per week, 2 = 4 times per week, 3 = 3 times per week, 4 = 2 times per week or less). Further with the same possible answers, participants were asked the same questions but instead of raw nuts, it was about food products containing nuts. Moreover, their level of agreement for certain statements was measured in a scale from 1 as strongly disagree to 5 as strongly agree, regarding raw walnuts and hazelnuts and for products made with them. Finally two questions concluded this section, and were in relation to consumer preference for consumption of raw nuts (Walnuts/Hazelnuts) and products containing those nuts (0 = As a snack/ In between meal before after breakfast/lunch/dinner, 1 = Breakfast, 2 = Lunch, 3 = Dinner).

The third section explores consumers' opinions on nut-based food products, aiming to investigate consumers' perception and perspective considering the suitability, pricing, and quality of such products. For the purpose of exploring various elements such as sustainability, pricing, and quality which altogether conclude consumers' perception, to finally investigate willingness to buy, extensive literature and survey research have been conducted considering the evaluation of upcycled foods based on different generations (61, 67, 70, 71, 73-76). Participants had to indicate their level of agreement or importance with certain statements in a scale from 1 as strongly disagree to 5 as strongly agree (for example: Generally speaking, the higher the price of a product, the higher the quality), next they had to indicate their motivation in purchasing nut based products such as those described. Then they had to rank based on their priorities, considering the mentioned products, some statements in a scale from 1 as most important to 5 least important (for example: Contains no additives). Following the previous, participants had to indicate their level of agreement for certain statements in a scale ranging from 1 representing never to 5 been always (for example: I read the ingredients on food labels). Further, they were asked to indicate their level of satisfaction regarding the sustainability aspects of nut-based products (0 = Extremely satisfied, 1 = Somewhat satisfied, 2 = Neither satisfied nor dissatisfied, 3 = Somewhat dissatisfied, 4 = Extremely dissatisfied), and they also had to explain the reason behind their answer in a different question. Moreover, participants were asked about the information regarding the food they consume, and if they wish to now more details about the process and ingredients, (0 = No, 1 = Yes). In case that their answer was positive a follow-up question is about where they would like to find this information and a possibility for open answer is also provided (0 = Online, 1 = On the product, 2 = Both online and on product packaging, 4 = Open answer). After, the same questions with the same possible answers were provided but with the specification for nut based products.

For the next section, extensive literature and survey research was performed with a focus on the inspection of price sensitivity and willingness to buy. Since the product does not exist yet, hypothetical willingness to pay has to be measured based on individual preference for a hypothetical price, and therefore willingness to buy was evaluated independently without asking for a price (66). Based on previous research, willingness to pay is defined as the maximum price a consumer is willing to pay for a given quantity of a product. However, at that price, the consumer is indifferent to buying or not buying, because the willingness to pay reflects the

product's inherent value in monetary terms and therefore, the product and the money have the same value. Hence, spending to obtain a product is the same as keeping the money. Although, as the concept was hypothetical and to reveal the real willingness to pay an incentive-compatible method was used, as in a prior empirical study, to measure real willingness to pay. Further, to measure willingness to buy eventually it has to be translated into acceptance of new products, focus on quality, environmental awareness, risk preference, and price sensitivity (66, 70, 75, 76). Therefore, the fourth section is about upcycled products that are made from walnuts and hazelnuts by-products, investigating consumer's perception and perspective in relation to flavour, sustainability, willingness to buy, and quality. Before the beginning of the section, participants are questioned if they knew beforehand about upcycled food products (0 = No, 1 = Yes). Afterwards, the definition of upcycled products is provided and then consumers are asked about their expectation for such products regarding the flavour, for this an open answer is provided as well (0 = Sweet, 1 = Sour, 2 = Bitter, 3 = Salty, 4 = Umami, 5 = Combination/open answer). Next, they were asked about their preference in regards to flavour for such products with a scale ranging from 1 as very intense to 5 as slightly noticeable for all possible answers, in addition, there was an option for an open answer referring as combination. Then participants had to rank from 1 as most important to 5 as least important certain statements in order to define their preferences considering upcycled foods, once again an option for an open answer is also there (for example: Be highly nutritious with health benefits). Next, they have to rank based on the level of importance ranging from 1 as most important to 5 as least important, for specific statements and there is also an optional open answer (for example: High price). Following that, a question regarding their level of agreement, with 1 as strongly disagree to 5 as strongly agree, for statements involving upcycled foods made from walnuts/hazelnuts (for example: If a new product made by walnuts or/and hazelnuts was on the market, I would be willing to buy it.). Afterwards, there were four questions regarding the price with an optional open answer (0= 0-0,05, 1= >0,5- 1, 2= >1-1,5 , 3= >1,5- 2, 4= >2-2,5 , 5= >2,5-3, 6= >3- 3,5 , 7= > 3,5- 4 , 8= >4 -4,5 , 9= >4,5 -5, 10= >5 -5,5, 11= >5,5 -6, 12 = Other as an optional open answer). The questions were, what is the maximum that you are willing to pay for one portion of the described upcycled foods, at what price would you consider a portion of an upcycled product to be so expensive that you would not consider buying it, at what price would you consider that a portion of upcycled products to be priced so low that you would feel the quality couldn't be very good, and at what

price would you consider a portion of an upcycled food product starting to get expensive, so that it is not out of the question, but you would have to give some thought to buying it. Moreover, participants were asked to indicate the feature/properties/characteristic for purchasing such products. Then they were asked about their preference regarding walnut/hazelnut upcycled food products and considering the type that they prefer ( 0 = As alternative dairy product (milk, cheese, yogurt), 1 = As ingredient to use for making food or meal (flour, oil), 2 = As alternative meat products, 3 = As drink products (smoothie, high caloric drink as meal replacer), 4 = As snack (granola, nut-based cereal/energy bar/protein bar, powder for sweet cream or soup). The final question of this section requires from participants to explain in case that they agree, if their willingness to buy or consume the mentioned products depended on the type of the final product (0 = No, 1= if yes/ open answer). Finally, the last section was created to allow participants to share any feedback or question regarding the questionnaire and before the end, they are also thanked for the participation. For the total survey see appendix 1

**Table 3. Questions from the survey that were used as variables for the chosen categories.**

<i>Category</i>	<i>Question</i>	<i>Variable</i>
<b>Healthfulness</b>	<i>How important is it for you that nut based food products are nutritious?</i>	Nutritious
	<i>Do you believe that nut based uncycled food products are barring health benefits?</i>	Health benefits
<b>Quality</b>	<i>Do you worry that upcycled nut-based food products are containing harmful chemicals?</i>	Safe
	<i>Do you consider as a barrier for buying upcycled nut-based food products the lack of awareness?</i>	Awareness
	<i>Do you agree that the described upcycled food products are overall of good quality?</i>	Overall quality
<b>Sustainability</b>	<i>Is it important for you to be informed if a product is local or made by local ingredients?</i>	Locally produced
	<i>Overall, do you consider important if the upcycled nut-based food product is environmentally friendly?</i>	Environmental friendly
<b>Price sensitivity/ Willingness to pay</b>	<i>At what price would you consider that a portion of upcycled products to be priced so low that you would feel the quality couldn't be very good?</i>	Low price indication for low quality
	<i>At what price would you consider a portion of an upcycled food product starting to get</i>	Expensive

	<i>expensive, so that it is not out of the question, but you would have to give some thought to buying it?</i>	price but willing to buy
<b>Willingness to buy</b>	<i>All the same variables from the previous categories with the exception of price sensitivity, for which the maximum price that consumers are willing to pay was only used, and the addition of the age range (not as generations).</i>	

**Data Processing and Analysis**

Overall, after the analysis which consisted of a T-test, comparing the variables between the two groups who represent the two generations, and binary logistic regression analysis for the determination of willingness to buy, the data were deleted. Based on the mentioned theory, the data collected for the t-test and the binary logistic regression analysis were gathered as the variables representing certain categories that were explored. Namely, the categories were healthfulness, quality, sustainability, and price sensitivity. To measure consumers’ willingness to buy, data from the previous categories were used, with the exception of the variables from price sensitivity. In this study, the data were analyzed with a t-test and a binary logistic regression analysis by using the IBM SPSS statistics 28 version. To verify if the data were suitable for the analysis the normality of data was explored to verify if the data follows a normal distribution. The variables were categorized in four sections in which the information gathered was related to demographics, habits, healthfulness, quality, sustainability, willingness to pay/price sensitivity, and willingness to buy. A t-test is used to compare the means of two groups and to observe any possible differences between them. Afterward, a binary logistic regression analysis was used which was made of two blocks. The first one contained the outcome measure which was the willingness to buy, and the other had the background variables from the previous categories. For the category of healthfulness the variables of nutritious and health benefits were used, for the quality the variables for safe, awareness, and overall quality, and for the sustainability the variables for locally produced and overall environmentally friendly. Following the previous, for the binary logistic regression analysis age was also a variable, and the final variable used in this analysis was the maximum price that they are willing to pay for buying. Therefore with these

analyses, consumers' perception considering upcycled food products, with a focus on differences between these generations, and eventually their willingness to buy was explored.

## Results

### *Description of the Sample*

To begin with as Table 4 depicts, the questionnaire was completed by 267 participants. The vast majority of participants were from Generation Z (241, 89.5%), compared to 26 participants from Generation Y (10.5%). Further, the majority of the total participants who took the survey were females 189 (70.8%), followed by males (76, 28.5%), and participants who identify as other gender 2 (0.7%). Dutch participants were the most who completed the questionnaire 155 (54%) followed by respondents from other countries in Europe and UK 89 (31 %), mostly from Greece 28 (9.9%) and Germany 20 (7.1%), then from America 11 (4%), Asia 10(3.6%), Africa 2 (0.7%), Australia 1 (0.4%) and from 2 participants who didn't want to share their origins (0.7%). Additionally, most of the completed surveys were from persons that are single 197 (69.4%) and from people who are in another relation status 53 (18.7%) rather than been married with or without child or children (number and percentage). Finally, the responses were dominated by voluntaries with a bachelor, either HBO 79 (27.8%) or WO 84 (29.6%), and a Master diploma 62 (21.8%), from which a small number had relevance with the fields of Food science and/or nutrition 37 (13.1%).

**Table 4. Sample description and demographics**

<b>Title</b>	<b>N= 267</b>	<b>Percent= 100%</b>
<b>What gender do you identify as?</b>	- Female = 189 - Male = 76 - Other =2	- Female = 70.8 - Male = 28.5 - Other = 0.7
<b>What is your year of birth?</b>	- 1982-1992 = 26 - 1993-2002 = 241	- 1982-1992 = 10.5 - 1993-2002 = 89.5
<b>What is your country of birth?</b>	- The Netherlands = 155 - UK & Europe = 89 - America = 11 - Asia = 10 - Africa = 2 - Australia = 1 - Other = 2	- The Netherlands = 54 - UK & Europe = 31 - America = 4 - Asia = 3.6 - Africa = 0.7 - Australia = 0.4 - Other = 0.7
<b>What is your marital status?</b>	- Single = 197 - Married, no child = 11 - Married with child = 2 - Married with children = 4	- Single =69.4 - Married, no child = 3.9 - Married with child = 0.7 - Married with children = 1.4

	- Other = 53	- Other = 18.7
<b>What is the highest level of education that you have completed?</b>	- No schooling completed = 1 - Adult education = 3 - Primary School = 1 - Elementary school = 1 - High school = 9 - Secondary pre-university education = 17 - Secondary vocational education = 5 - Bachelor diploma (HBO) = 79 - Bachelor diploma (WO) = 84 - Master diploma (WO) = 62 - PhD = 6	- No schooling completed = 0.4 - Adult education = 1.1 - Primary School = 0.4 - Elementary school = 0.4 - High school = 3.2 - Secondary pre-university education = 6.0 - Secondary vocational education = 1.8 - Bachelor diploma (HBO) = 27.8 - Bachelor diploma (WO) = 29.6 - Master diploma (WO) = 21.8 - PhD = 2.1
<b>Are you qualified in the field of food science or/and nutrition?</b>	- No = 230 - Yes = 37	- No = 81 - Yes = 13.1

### *Consuming nut based products*

Consumption frequency was measured, for both generations for days per week, based on consumer's preference for raw nuts and nut-based food products. Raw nuts were mostly consumed 2 times per week 159 (56%), followed by consumers who eat them every day 35 (12.3%). Regarding nut-based products, consumers tend to use them mostly 2 times per week 109 (38.4%), and every day 58 (20.4%). (Table 5)

**Table 5. Frequency for measuring how many days per week do you consume raw nuts or nut-based products**

Raw nuts	Frequency	Percent		Nut-based food products	Frequency	Percent
Every day	35	12.3		Every day	58	20.4
5 times per week	19	6.7		5 times per week	41	14.4
4 times per week	22	7.7		4 times per week	26	9.2
3 times per week	29	10.2		3 times per week	30	10.6
2 times per week or less	159	56.0		2 times per week or less	109	38.4

Table 6 contains information regarding the daily consumption of either raw nuts or nut-based food products, the vast majority did not consume nuts or nut-based food products every day (Raw nuts = 183 (64.4%), Nut-based food products = 116 (40.8%)). Of the 28.6% of consumers that ate nuts every day, only 9.2% ate raw nuts 2 or more times per day, and 19.4% of them ate nuts 1 time per day. Similarly, 52.2% of the consumers ate nut-based products every day, with

23.3% consuming them 2 times per day or more, and 28.9% that ate nut-based foods once per day.

**Table 6. Frequency of how many times per day do you consume raw nuts or nut-based food products**

Raw nuts	Frequency	Percent		Nut-based food products	Frequency	Percent
4 times per day	5	1.8		4 times per day	8	2.8
3 times per day	4	1.4		3 times per day	7	2.5
2 times per day	17	6.0		2 times per day	51	18.0
1 time per day	55	19.4		1 time per day	82	28.9
I do not consume nuts every day	183	64.4		I do not consume nuts every day	116	40.8

Further, as depicted in the Table 7, the majority of the consumers prefers to eat raw nuts as a snack 177 (62.3%), the majority of consumers who use nut-based food products preferred to consume them in their breakfast 127 (44.7%).

**Table 7. Frequency regarding the preference for consuming either raw nuts or nut-based food products**

Raw nuts	Frequency	Percent		Nut-based food products	Frequency	Percent
As a snack / In between meal (before/after breakfast-lunch-dinner)	177	62.3		As a snack / In between meal (before/after breakfast-lunch-dinner)	118	41.5
Breakfast	61	21.5		Breakfast	127	44.7
Lunch	18	6.3		Lunch	18	6.3
Dinner	8	2.8		Dinner	1	.4

***Healthfulness, regarding the nutritious aspect***

According to Table 8, there was significant difference between the generations regarding the nutritious aspect which is of high importance for both of them, while consumers from generation Y consider it slightly more important (mean Gen. Z = 1.93, mean Gen. Y = 1.50 with  $t(253) = 2.618$  and  $p = .005$ ). Regarding the health benefits there was no a significance difference between the generations, both consider that the health benefits are of high importance, with consumers from generation Y deemed it of higher significance in comparison to consumers from generation Z (mean Gen. Z = 1.87, mean Gen. Y = 1.48 with  $t(238) = 2.171$  and  $p = .015$ ).

**Table 8. Healthfulness**

Healthfulness, for the nutrition aspect									
Nutritious	Generations	Mean	Std. Deviation		F	Sig.	t	df	One-Sided p (sig.)
	Gen. Z	1.93	.788		.116	.734	2.618	253	.005
	Gen. Y	1.50	.511						

Healthfulness, for the aspect of health benefits									
Health benefits	Generations	Mean	Std. Deviation		F	Sig.	t	df	One-Sided p (sig.)
	Gen. Z	1.87	.820		1.298	.256	2.171	238	.015
	Gen. Y	1.48	.512						

### *Quality (safe – trustworthy – overall quality)*

Based on Table 9, it was suggested that there is no significant difference between the two generations for the aspects of safeness and awareness. For safeness, both generations indicated that it is important (mean Gen. Z = 2.37, mean Gen. Y = 2.229 with  $t(238) = 0.338$  and  $p = .368$ ) and for awareness individuals from both generations were neutral (mean Gen. Z = 3.36, mean Gen. Y = 2.95 with  $t(237) = 0.843$  and  $p = .200$ ). For the overall quality, there is a significance difference with individuals from generation Y suggesting that overall quality is important in comparison to generation Z who considered it slightly less important (mean Gen. Z = 3.59, mean Gen. Y = 3.95 with  $t(238) = -2.059$   $p = .014$ ).

Table 9. Quality

Quality, for the aspect of safety									
Safe	Generations	Mean	Std. Deviation		F	Sig	t	df	One-Sided p (sig.)
	Gen. Z	2.37	1.077		1.067	.303	.338	238	.368
	Gen. Y	2.29	1.231						
Quality, for the aspect of trust									
Awareness	Generations	Mean	Std. Deviation		F	Sig	t	df	One-Sided p (sig.)
	Gen. Z	3.36	2.090		.878	.350	.843	237	.200
	Gen. Y	2.95	2.269						
Overall quality perception									
Overall quality	Generations	Mean	Std. Deviation		F	Sig	t	df	One-Sided p (sig.)
	Gen. Z	3.59	.781		4.346	0.38	-2.340	25.530	.014
	Gen. Y	3.95	.669						

### *Sustainability*

As regards to the aspect of local production, information is provided by Table 10, which indicated no a significant difference between the two groups when they were asked to evaluate the importance of consuming an upcycled nut-based food product which was local or was made

by local ingredients. Both generations suggested that it is of medium importance, with consumers from generation Z supporting less the importance of this issue in comparison to consumers from generation Y (mean Gen. Z, mean Gen. Y with  $t(236) = 1.895$  and  $p = .030$ ). Participants from both groups also suggested that overall, it is important for them the upcycled nut-based food products to be environmentally friendly with the consumers from generation Y indicating slightly higher level of importance when compared to generation Z (mean Gen. Z = 2.37, mean Gen. Y = 1.86 with  $t(238) = 2.443$  and  $p = .008$ ).

**Table 10. Sustainability**

Sustainability, for the aspect of local production									
Local produced	Generations	Mean	Std. Deviation		F	Sig	t	df	One-Sided p (sig.)
	Gen. Z	3.07	1.036		.206	.650	1.895	236	.030
	Gen. Y	2.62	1.071						
Sustainability, for been overall environmentally friendly									
Overall environmentally friendly	Generations	Mean	Std. Deviation		F	Sig	t	df	One-Sided p (sig.)
	Gen. Z	2.37	.921		2.344	.127	2.443	238	.008
	Gen. Y	1.86	.793						

**Price sensitivity**

In Table 11, the aspect of a price that indicates low quality is measured, and the results suggested no significant difference between the groups which suggested a price ranging from 0.5 euro to 1.50 euro with Gen Z considering a lower an overall lower price in comparison to Gen Y (mean Gen. Z = 2.45, mean Gen Y = 3.1 with  $t(238) = - 1.154$  and  $p = .125$ ). Both generations have no significant difference when they had to suggest a price that it is so high but eventually after some thought they would buy a portion of an upcycled nut-based food product. Both generations suggested a price ranging between 2.5 and 3.5 euro with Gen Y indicating a higher price in comparison to Gen Z with an almost significant difference (mean Gen. Z = 6.68, mean Gen. Y = 7.52 with  $t(238) = - 1.443$  and  $p = .075$ ).

**Table 11. Price sensitivity**

Price sensitivity, for the aspect of low quality									
Low price indication for low quality	Generations	Mean	Std. Deviation		F	Sig	t	df	One-Sided p (sig.)
	Gen. Z	2.45	2.383		1.746	.188	-1.154	238	.125
	Gen. Y	3.10	2.982						

Price sensitivity, for the aspect of the price getting expensive but you are willing to buy.									
Expensive price but willing to buy	Generations	Mean	Std. Deviation		F	Sig	t	df	One-Sided p (sig.)
	Gen. Z	6.68	2.577		.013	.908	-1.443	238	.075
	Gen. Y	7.52	2.522						

### *Factors associated with willingness to buy*

Finally, in this part the correlation of willingness to buy with the healthfulness, quality, sustainability, and age was measured. According to the first part of the Table 12 the explained correlation with the willingness to buy was 28% (Nagelkerke R Square = 0.280). Both groups were willing to buy upcycled nut-based food products, and the last part depicts that there is significant change based on the variables of overall quality ( $p < 0.001$ ) and the health benefits ( $p = 0.002$ ) which are correlating to determine the willingness to buy for both generations. Finally, the parameter of age seems to have a slight influence in the willingness to buy without being significant ( $p = 0.75$ ). The variables that influenced mostly consumers' willingness to buy are stated by the level of significance and are the overall quality, and the health benefits respectively, while overall age wasn't so important.

**Table 12. Correlation between willingness to buy, in a certain price range, and with healthfulness, quality, sustainability, and generation**

Nagelkerke R Square			
.280			
Step 1 <sup>a</sup>		B	Sig.
Nutritious		0.12	.953
Health benefits		-.667	.002
Safe		-.100	.486
Awareness		-.017	.827
Overall quality		.890	<.001
Local produced		-.197	.239
Overall environmentally friendly		.047	.803
Age		-.093	.075
Max. price for willing to buy		.110	.117

## **Discussion & Conclusions**

### ***Overall findings and previous literature comparison***

The current study focused at defining comparisons and differences between consumers from generation Y and Z, concerning their perception regarding the quality, healthfulness, sustainability, willingness to pay, and willingness to buy of upcycled nut-based food products in the Dutch market. Next factors associated with consumers' willing to buy upcycled nut-based products was studied. Overall, the results from this study concluded that participants from both generations indicated high levels of importance for all the explored aspects, with the exception of locally produced upcycled foods for which participants responded with moderately significance. However, while both generations seemed very much aligned regarding the mentioned aspects and their willingness to buy nut based upcycled products, we learned that healthfulness, overall quality, and sustainability were of some greater importance for the older generation compared to the younger age group. These findings comes in contradiction with a previous study conducted by Peng et al. (2016), suggesting that age does not make a difference in regards to consumers' behavior when they assess information (77). Furthermore, based on the results there is a trend for both generations showing a relatively high demand and expectation for upcycled nut-based food innovations that have health benefits, are nutritious, with high overall quality, and they are overall environmentally friendly. A subject that will be analyzed further in the discussion is that consumers did not seem to worry about the safety of upcycled products, while they need some information about them, and they did not persist much in consuming locally produced or made from local ingredients upcycled foods. The trend of a healthier lifestyle, which was suggested by previous research, was supported by the outcomes of this study by associating the elements of healthfulness, and overall quality to eventually consumers' willingness to buy (3, 5, 7, 8).

Consumer perception from both generations regarding the aspect of healthfulness is of high significance, with people suggesting that these products are expected to be nutritious and offer health benefits. Supported by the results of this study are the findings from Bumbac et. Al (2020), which suggested that generation Z expect to be in control of what they eat, and they are willing to adopt a healthy diet (62). Moreover based on the literature and the results, the same can be stated for individuals from generation Y (61). Therefore, the nut-based upcycled food

products proposed in this research can be proved beneficial to support consumers and their needs.

Based on the previous literature it is supported that consumers in the Netherlands have become more aware and they seek further information, they are driven by the value of safety, and they have deemed the overall quality as very important parameter for upcycled food products (9, 14, 53, 57, 61). This statement is supported by this study, since participants from both generations suggested that the overall quality of a product is of high significance, while generation Y illustrated higher levels of importance in comparison to people from generation Z. For the same category, they deemed of neutral importance to be more aware, indicating that they probably know what they need to assess a food purchase, whilst both generations perceives upcycled products as potentially safe. Thus, it would be favorable to communicate further information regarding upcycled food products by using a convenient approach for the consumers, which do not need to be related to the safetiness aspect as long the overall quality is high.

For the aspect of sustainability, consumers from both generations were slightly interested in products that are locally produced or are made by local ingredients though, for a product that is overall environmentally friendly both deemed it more important in comparison to the previous aspect of sustainability, while participants from generation Y showed higher level of importance in comparison to these from generation Z. Once again, the results are correlating with the literature except for the stated high importance for locally produced products, which was almost of neutral interest for both generations in the current research. According to previous research, individuals from generation Z should have a greater appreciation for locally produced food. However, that wasn't the outcome of this research, it can be explained as a general concern that volunteers from both generations have while they want to be more aware of moral and ethical considerations, and therefore, that is why they deemed it important to have a product that is overall environmentally friendly (50). It can be further argued how the aspect of sustainability is interpreted by the consumers and how much is related to the local production since consumers are seeking to be informed about the environmental impact of certain food products (64).

Regarding the price sensitivity, both generations offered similar responses by defining the price for a portion of the nut-based upcycled product as of possibly low quality, which was low enough leading them to not buy the product. Individuals from generation Z want to be more

aware of moral and ethical considerations, and are price-conscious while are triggered more by higher quality than the lowest price (66). Therefore, it was reasonable that the lowest prices were given by individuals from generation Z due to their focus towards the aspect of quality.

Similarly, for a price that is too high but not that much to not buy the product, both generations had slightly different expectations with consumers from generation Y striking higher prices.

Once more, the results were expected because individuals from generation Z while triggered by the quality are also price-conscious (66). Although, contradictory to the explored literature was that consumers belonging to this generation provided lower prices for the highest amount that they are willing to pay for buying the described products in comparison to volunteers from generation Y, who provided higher prices (55, 59, 61). Following the previous and based on the results, it can be argued that generation Y relates the price with higher expectation for quality in comparison to consumers from generation Z.

Furthermore, regarding the overall willingness to buy from both generations, there is a correlation between the health benefits that such products provide along with the aspect of the overall quality. Therefore, both generations are willing to buy if the nut-based upcycled food products bare health benefits and are of high quality. These evidence are supported by previous literature suggesting that due to concerns about their quality which can also be related to the healthfulness of those foods, consumers' willingness to buy can be influenced since, upcycled food products are based on unconventional ingredients (53, 61, 70). Based on the trend of a healthier lifestyle, the final results are also in alignment with other previous literature which suggested that consumers in the Western countries are getting gradually more aware and seek healthier alternatives with good quality that will result in an improved overall health leading to longevity (3-7).

Moreover, of high interest is also the fact that the majority of the responders were from the Netherlands. According to Sobol, Cleveland, and Laroche (2018), most Dutch follow the current trends, high technology, and luxuries, they belong to one of the most modern, liberal, and diverse societies in which they embrace the promoted global lifestyle through multinational marketing activities and global mass media (78). While upcycled food products are not renounced yet, Dutch consumers from both generations would perceive them in a good way, and it seems that overall they are willing to buy them. Therefore, the Dutch market seems as a friendly

environment for an innovative endeavor such as for upcycled nut-based products which are environmentally friendly, nutritious with health benefits, and with a good overall quality. Finally, for this study another significant point was the final result relating by 28% the willingness to buy to the factors of overall quality, and health benefits. This association is of high value for any successful attempt of promoting such products to the Dutch market. Further, since other parameters were considered as categories and as subcategories, it is a strong indication that consumers prioritize these factors by deeming them of higher importance for upcycled nut-based products in order to buy them.

### ***Strengths and Limitations of the research***

In this study other parameters that may affect the outcome of the research were considered except for the aspect of individual income. According to Hong L et al. (2020), the consumption of food products can be affected by sex, education, profession, family size, and income, with the latter being able to influence the willingness to buy (76). This study has the benefit of taking in consideration all the covariates, with the exception of income, that may affect the final results. Added to the previous, this study provides valuable information since it explores the consumers' perception of healthfulness, quality, and sustainability which were further inspected by exploring certain aspects of each category. That has been done with the purpose of evaluating with higher accuracy, eventually consumers' willingness to buy.

On the other hand, it is critical to mention that the power of this study was reduced due to the limited time for gathering the appropriate number of participants, and for gathering an equal amount of volunteers from each generation. In this study consumers from generation Z were the predominant responders in comparison to individuals from generation Y. For this research, the aging groups for the two generations were close to the cut point right at the beginning of generation Z, and the age range was also limited to 20 years overall which was separated to 10 years for each generation. Although, the study provided a number of responders that were more than efficient to offer a high power, and hence, reliable results.

Though, to improve this research it would be appropriate to dedicate more time for gathering a larger amount of volunteers for a greater age span, which will be equally distributed through groups. By following the previous, it would be ideal if volunteers do not have a too small age

gap, even if they belong to a different generation. To counter this issue, based on the available time and on the potential power of the study, a realistic and appropriate range of 20 years in total was examined. However, it has to be pointed out that for this study the vast majority of the respondents were well educated and as a previous research highlighted, educated consumers tend to behave positively considering healthier food options (55).

Another limitation of this study was the necessity to use hypothetical price to measure price sensitivity, and to eventually evaluate consumers' willingness to buy independently from the price. Since, no specific product with a defined price was developed, the product representation was based on a description which was provided. This description offered various options of products and thus, suggesting that the overall willingness to buy, and the price sensitivity/willingness to pay may vary from individual to individual based on their preferences for certain categories of products. However to counter the latter, in the study information was gathered for the category of foods that consumers expect these products to belong to, and it was suggested to position such products as snacks or for breakfast.

#### ***Application to future research and practice***

This study, as a quantitative research was the first to approach this subject, and has provided an overview which resulted in an association with consumers' willingness to buy. Based on that, a fruitful academic approach could be further qualitative research with a cross sectional design to dive more into the interpretation of the mentioned factors for defining certain consumers' needs, and the potential differences between generations. For future research, it would be interesting to explore the interpretation that consumers have for the overall quality of an upcycled food product. Based on previous research which supported the findings of this study, it is crucial to consider the quality aspect of upcycled food products since, they are based on unconventional ingredients and eventually that can influence consumers' willingness to buy, due to potentially quality concerns (53, 61). Further, the aspect of sustainability should be explored to define more what consumers associated, deemed important, and how they interpreted it, and it is also needed to determine further what consumers expect and how they interpret the health benefits.

Afterward, for the investigation of a food innovation a more realistic approach is essential. Hence for exploring consumers' willingness to buy more accurately, a prototype food product

from a certain category such as snacks should be developed with a price outside of the hypothetical spectrum.

As a conclusion and suggestion for Keep Food Simple and other companies related to this field, while upcycled nut-based food products seems to be highly acceptable by individuals from both investigated generations in the Dutch market, the main focus is on the high overall quality, and healthfulness of these products. Therefore, health and quality aspects along with their improvement should be investigated along with marketising approach of these characteristics. This can be proved profitable since consumers from both generations have several similarities regarding their lifestyle and their priorities. Additionally, after qualitative research and a prototype development, to further increase the chance of success, the identification of competitors should be a step for an even more appropriate approach for the price. Based on the competitor identification, and comparison of the price and food properties, a reliable first assessment can be made for launching a new product. Finally, the price will be defined, based on the previous, to examine the price sensitivity and willingness to buy outside the hypothetical spectrum.

## **Valorization**

The added value of this study is based on the promotion of upcycled food products. Firstly, from a consumer perspective these products are a potential ally for their long term-goals, and their attempt to have and follow a healthier lifestyle. As it was suggested, nuts, their products, and by-products are of high nutritious value and they can be incorporated into many categories of foods to enhance the quality of consumers' nutrition. The by-products from processes can be used again as food innovations and get sold in the market leading to an increase of revenue to the company when it would otherwise been only extra costs. Moreover, in case that the wastes have to be treated before they got into the environment, the business do not have to spend money to treat the wastes in any way since they used them for a new product. Another benefit of this research is that since there are no wastes, or the wastes are highly reduced, the environment is not polluted, the company becomes more sustainable and gets an improved prestige, and consumers are kept satisfied for using products that are environmental friendly. Moreover, while the modern trend is promoting longevity and been healthier, certain hustles are taking form for the consumers and it gets difficult for them to follow through. To counter this hurdle, upcycled-nut based food products, as snacks, are a promising supporting solution for consumers who want to have a healthy lifestyle but they need something fast, convenient, healthy, and tasteful to eat between their meals. Furthermore, aside from the increasing healthy lifestyle trend, there is an increase to consumers who want meat alternatives and/or becoming vegetarian/vegan in order to promote a sustainable lifestyle as well, for whom upcycled nut-based products would probably be highly attractive addition.

Based on the nutrition habits that people in Netherlands have, it was expected that this study will have the suggested outcome. These products are created in the notion of been sustainable, nutritious, and pleasant. Hence, Dutch consumers that are characterized by their curiosity, they have a drive for finding healthier alternatives, and most importantly care about the sustainably aspects, and are expected to support such initiatives. Therefore, an innovation such as the described one will be welcome by the majority of the people assembling the Dutch market, and it could be successful if the outcomes of this study are taken into consideration. Further, these alternatives can offer the macronutrients needed to specific groups such as vegan, vegetarian, lactose intolerance, pregnant, or people that need high caloric meals. Based on this study, food

industry can determine the creation of products with these characteristics in order to support consumers need, while gain knowledge for finding an optimal technology to process nuts and gain highly nutritious products and by-products. In addition, based on the evidence from this study, which supported the growing need of such products, consumers, industry, and the environment can potentially benefit from growing walnuts and hazelnuts at certain locations in the Netherlands instead of importing them.

Finally, these findings contained several parameters associating willingness to buy, which were also evaluated independently in comparison to the two generations, resulting in is a strong indication that consumers prioritized these factors by deeming them of high importance for upcycled nut-based products in order to buy them. Due to the obtained knowledge from this study, entrepreneurs can purposeful developed products with these characteristics that they should promote conveniently towards consumers to motivate them buying such innovations for truly supporting them to their long-term ambitions regarding longevity.

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## Appendix 1

### English version

*Hello and thank you for taking time to proceed with this survey. My name is Mike Xanthakis and I am a master's student from Maastricht University. In collaboration with KeepFoodSimple, a research is conducted on the Dutch market considering the consumers perception and perspective for nut based (walnuts and/or hazelnuts) innovative products. Those products are upcycled, meaning that the by-products of the raw materials that are used for the production are not wasted, as they usually do, but instead are used for the creation of nutritious food products. Moreover, the aim for those otherwise wasted parts, is to be incorporated to food products with an optimal process which will allow the highest possible retention of nutrients. In this 15min survey, you are asked to offer your opinion and point of view for this concept. Please answer the questions with honesty and based on your current nutrition habits. This survey is completely voluntary, your data will remain anonymous and will be deleted when the research comes to an end. Take your time, and complete the survey while you are in a place without distractions and you feel calm. If you have any further questions regarding the survey, please contact Mike Xanthakis at [m.xanthakis@student.maastrichtuniversity.nl](mailto:m.xanthakis@student.maastrichtuniversity.nl). Kindly reminder, in case that you are pregnant, you have nut allergies, you follow medication and/or you have a health condition that do not allow you to consume nuts or restricts their consumption , and if you follow an extreme diet which restricts or excludes nuts from your diet, then please do not proceed.*

**By selecting the box below you agree to participate in this survey and the survey will start**

*\* Yes, proceed with the survey.*

**SECTION I: General information considering demographics, education level, current employment occupation, and diet.**

**1. What gender do you identify as?**

- 1) Female
- 2) Male
- 3) Other

**2. What is your year of birth?**

“Scale beginning from 1982 until 2002”

**3. What is your country of birth?**

**4. What is your marital status?**

- 1) Single
- 2) Married, no child
- 3) Married with child

- 4) Married with children
- 5) Single parent with child
- 6) Single parent with children
- 7) Other

**5. What is the highest level of education that you have completed? If currently enrolled, then highest certification completed.**

- 1) No schooling completed
- 2) Adult education
- 3) Primary school
- 4) Elementary school
- 5) High school
- 6) Secondary pre-university education
- 7) Bachelor diploma (HBO)
- 8) Bachelor degree (WO)
- 9) Master degree (WO)
- 10) PhD
- 11) Prefer not to answer

**6. Are you qualified in the field of food science or/and nutrition? If yes please indicate the degree/title below.**

- 1) No
- 2) If yes please indicate the degree/title below

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**7. What is your employment status?**

- 1) Student
- 2) Full time employed
- 3) Part time employed
- 4) Self-employed

- 5) Out of work
- 6) Other
- 7) Prefer not to answer

**8. How do you prefer to do your groceries?**

- 1) Online
- 2) Offline

*SECTION II: Nutrition habits in relation to nut consumption, and more specifically about walnuts and hazelnuts.*

**9. How many times per day do you consume raw nuts?**

- 1) 4 times per day
- 2) 3 times per day
- 3) 2 times per day
- 4) 1 time per day
- 5) I do not consume nuts every day

**10. How many days a week do you usually eat raw nuts?**

- 1) Every day
- 2) 5 times per week
- 3) 4 times per week
- 4) 3 times per week
- 5) 2 times per week or less

**11. How many times in a day do you usually consume food products containing nuts? (Granola, protein/energy/nut-cereal bar, milk alternative drinks such as almond milk, nut oil, nut flour, spreads etc.)**

- 1) 4 times per day
- 2) 3 times per day
- 3) 2 times per day
- 4) 1 time per day
- 5) I do not consume nuts every day

**12. How many days a week do you usually consume food products containing nuts? (Granola, protein/energy/nut-cereal bar, milk alternative drinks such as almond milk, nut oil, nut flour, spreads etc.)**

- 1) Every day
- 2) 5 times per week
- 3) 4 times per week
- 4) 3 times per week
- 5) 2 times per week or less

**13. Please indicate the level of agreement for the following statements regarding walnuts, and walnuts products.**

	1	2	3	4	5
	Strongly disagree	Disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Walnuts are nutritious and healthy food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walnuts are safe for me to consume them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food products made by walnuts are nutritious and safe.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**14. Please indicate the level of agreement for the following statements in regards to hazelnuts, and hazelnut products.**

	1	2	3	4	5
	Strongly disagree	Disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Hazelnuts are nutritious and healthy food.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Hazelnuts are safe for me to consume them.

Food products made by hazelnuts are nutritious and safe.

**15. When would you prefer to consume walnuts or/and hazelnuts?**

- 1) As a snack / In between meal (before/after breakfast-lunch-dinner)
- 2) Breakfast
- 3) Lunch
- 4) Dinner

**16. When would you prefer to consume food products made of walnuts or/and hazelnuts such as granola, protein/energy/nut-cereal bar, milk alternative drinks such as almond milk, nut oil, nut flour, spreads etc.**

- 1) As a snack / In between meal (before/after breakfast-lunch-dinner)
- 2) Breakfast
- 3) Lunch
- 4) Dinner

*SECTION III: In this section you are expected to offer your opinion for nut based food products to investigate your perception and perspective considering the suitability, pricing, and quality for such products. Examples of such are granola, protein/energy/nut-cereal bar, milk alternative drinks such as almond milk, nut oil, nut flour, spreads etc.*

**17. Please indicate your level of agreement with the following:**

	1	2	3	4	5
	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neither agree nor disagree</b>	<b>Somewhat agree</b>	<b>Strongly agree</b>
Generally speaking, the higher the price of a product,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

the higher the quality.					
I consider nut based products expensive.	<input type="radio"/>				
I believe that nut based products are worth buying because they are nutritious and have health benefits.	<input type="radio"/>				
I would buy nut based products, even if they are expensive because they are nutritious and have health benefits.	<input type="radio"/>				

18. What motivates you the most to purchase nut based products as those described in the SECTION III?

19. Please rank the following statements from most important (1) to least important (5) based on your priorities, considering the food that you eat in a typical day:

	1	2	3	4	5
	Most important	Important	Neutral	Less important	Least important
Is nutritious.	<input type="radio"/>				
Is easy to prepare.	<input type="radio"/>				

Is easily available in shops and supermarkets.	<input type="radio"/>				
Contains no additives.	<input type="radio"/>				
Contains natural ingredients.	<input type="radio"/>				
Comes from countries I approve of.	<input type="radio"/>				
Is locally produced.	<input type="radio"/>				
The country of origin clearly indicated.	<input type="radio"/>				
Is environmentally friendly.	<input type="radio"/>				
I worry that there are harmful chemicals in my foods.	<input type="radio"/>				
Has information about the food.	<input type="radio"/>				
Other // Please indicate what other or others attributes are important for you.	<input type="radio"/>				

If you choose the last option, please indicate what other or others attributes are important for you.

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20. Please indicate your level of agreement for the following statements with (1) as Never and (5) Always:

	1	2	3	4	5
	Never	Rarely	Sometimes	Often	Always
I seek out information regarding the new types of food products.	<input type="radio"/>				
I read the ingredients on food labels	<input type="radio"/>				
I check the origin of packaged products (country of origin)	<input type="radio"/>				

21. Overall, how satisfied or dissatisfied are you with the nut based food products that already exist, concerning sustainability issues?

- 1) Extremely satisfied
- 2) Somewhat satisfied
- 3) Neither satisfied nor dissatisfied
- 4) Somewhat dissatisfied
- 5) Extremely dissatisfied

21a. Please feel free to explain the reason behind your response in the space provided here.

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**22. Would you ideally like to be provided with more information about the methods of the food produced, along with more details about the ingredients that have been used?**

- 1) No
- 2) Yes

**22a. (If yes), I would want this additional information to be provided:**

- 1) Online
- 2) On product packaging
- 3) Both online and on product packaging
- 4) Other

If your answer was other, please indicate in the space below the way that you would prefer to get informed. It can also be a combination of options.

**23. In case of nut based products, would you ideally like to be provided with more information about the methods of the food produced, along with more details about the ingredients that have been used?**

- 1) No
- 2) Yes

**23a. (If yes), I would want this additional information to be provided:**

- 1) Online
- 2) On product packaging
- 3) Both online and on product packaging
- 4) Other

If your answer was other, please indicate in the space below the way that you would prefer to get informed. It can also be a combination of options.

***SECTION IV: In this case, upcycled products are made from walnuts and hazelnuts. Consumers' perception and perspective is investigated, considering upcycled food products in relation to flavor, sustainability, willingness to buy, and quality.***

***Examples of such are granola, protein/energy/nut-cereal bar, sweet cream or soup, spreads etc.***

24. Have you heard about upcycled food products before taking this survey?

- 1) No
- 2) Yes

**Definition:** *Upcycled products are made from the by-products of raw food that has been processed for the creation of the main food product (oil, butter, flour, milk-cheese alternatives etc.), and instead of wasting them are incorporated into food products. For this purpose the aim is to retain the nutrients of those “wastes” and offer another highly nutritious final product.*

25. What kind of flavour you would expect, before you try for the first time, from upcycled nut based products as those described previously?

- 1) Sweet
- 2) Sour
- 3) Bitter
- 4) Salty
- 5) Umami
- 6) Combination

If you choose the combination, please indicate what combination/combinations you would expect, before you have tried an upcycled product, and put the dominant flavor first in your statement. (For example sweet/bitter)

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26. What type of flavour would you prefer for such walnut/hazelnut-based food products? Please indicate the level of the flavour that you would like with (1) being very intense to (5) slightly noticeable.

	1	2	3	4	5
	Very intense	Intense	Neutral	Mild intensity	Slightly noticeable
Sweet	<input type="radio"/>				

Sour	<input type="radio"/>				
Bitter	<input type="radio"/>				
Salty	<input type="radio"/>				
Umami	<input type="radio"/>				
Combination	<input type="radio"/>				

If you choose the combination, please indicate what combination/combinations you would prefer and put the dominant flavor first in your statement. (For example sweet/bitter)

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**27. Please rank the following from the most important (1) to least important (5), in relation to what would you prefer in a upcycled food that you would consume or use:**

	1	2	3	4	5
	Most important	Important	Neutral	Unimportant	Least important
Not having preservative in it	<input type="radio"/>				
Be highly nutritious with health benefits	<input type="radio"/>				

Inform me if a product is local or made by local ingredients.	<input type="radio"/>				
Is environmental friendly	<input type="radio"/>				
Has a long self-life	<input type="radio"/>				
Other	<input type="radio"/>				

If you choose the last option, please indicate what and how much is it important for you. Additionally, if there are more than one characteristic, feel free to include them.

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**28. Please rank the importance of these potential barriers for not purchasing upcycled food products as those described. Please rank the following from the most important constraint (1) to least important constraint (5).**

	1	2	3	4	5
	Most important	Important	Neutral	Unimportant	Least important
Lack of awareness	<input type="radio"/>				
Not easily available	<input type="radio"/>				

High price	<input type="radio"/>				
It is not convenient	<input type="radio"/>				
Not made in the Netherlands	<input type="radio"/>				
Other	<input type="radio"/>				

If you choose the last option, please indicate what and how much is it important for you. Additionally, if there are more than one characteristic, feel free to include them.

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**29. Please indicate your level of agreement with the following:**

	1	2	3	4	5
	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neither agree nor disagree</b>	<b>Somewhat agree</b>	<b>Strongly agree</b>
If a new product made by walnuts or/and hazelnuts was on the market, I would be willing to buy it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If this product made from walnuts/hazelnuts was upcycled food, I would be interest to buy it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I feel that the described upcycled foods appears to be of good quality

There is a high likelihood that I would try upcycled food as the one described for the first time.

I wouldn't buy nut-based upcycled products because I am afraid of what they may contain (chemicals, preservatives etc.)

**30. What is the maximum that you are willing to pay for one portion of the described upcycled foods? Examples of such are spreads (sweet or savoury), granola, protein/energy bar, and powder for sweet cream or soup.**

- 1) 0 - 0,5 euro
- 2) > 0,5 - 1 euro
- 3) > 1 - 1,5 euro
- 4) > 2 - 2,5 euro
- 5) > 2,5 - 3 euro
- 6) > 3 - 3,5 euro
- 7) > 3,5 - 4 euro
- 8) > 4 - 4,5 euro
- 9) > 4,5 - 5 euro
- 10) > 5 - 5,5 euro
- 11) > 5,5 - 6 euro
- 12) Other

If your answer was other, please indicate below the amount that you are referring to.

**31. At what price would you consider a portion of an upcycled product to be so expensive that you would not consider buying it?**

- 1) 0 - 0,5 euro
- 2) > 0,5 - 1 euro
- 3) > 1 - 1,5 euro
- 4) > 2 - 2,5 euro
- 5) > 2,5 - 3 euro
- 6) > 3 - 3,5 euro
- 7) > 3,5 - 4 euro
- 8) > 4 - 4,5 euro
- 9) > 4,5 - 5 euro
- 10) > 5 - 5,5 euro
- 11) > 5,5 - 6 euro
- 12) Other

If you choose the last option, please indicate the amount of money that you are referring to, below:

**32. At what price would you consider that a portion of upcycled products to be priced so low that you would feel the quality couldn't be very good?**

- 1) 0 - 0,5 euro
- 2) > 0,5 - 1 euro
- 3) > 1 - 1,5 euro
- 4) > 2 - 2,5 euro
- 5) > 2,5 - 3 euro
- 6) > 3 - 3,5 euro
- 7) > 3,5 - 4 euro
- 8) > 4 - 4,5 euro
- 9) > 4,5 - 5 euro
- 10) > 5 - 5,5 euro
- 11) > 5,5 - 6 euro

12) Other

Please indicate the amount of money below, in case that your answer was other.

**33. At what price would you consider a portion of an upcycled food product starting to get expensive, so that it is not out of the question, but you would have to give some thought to buying it?**

1) 0 - 0,5 euro

2) > 0,5 - 1 euro

3) > 1 - 1,5 euro

4) > 2 - 2,5 euro

5) > 2,5 - 3 euro

6) > 3 - 3,5 euro

7) > 3,5 - 4 euro

8) > 4 - 4,5 euro

9) > 4,5 - 5 euro

10) > 5 - 5,5 euro

11) > 5,5 - 6 euro

12) Other

Please indicate the amount of money below, in case that your answer was other.

**34. What feature/properties/characteristic of the upcycled food would made you purchasing at the price that you indicate in the previous question. Please elaborate in the space below:**

**35. I would accept/prefer walnut/hazelnut upcycled food products (*Check all that apply to you*).**

1) As alternative dairy products (milk, cheese, yogurt)

2) As ingredient to use for making food or meal ( flour, oil)

3) As alternative meat products

- 4) As a drink products (smoothie, high caloric drink as a meal replacer)
- 5) As snack (granola, nut-based cereal/energy/protein bar, powder for sweet cream or soup)

**36. Does your willingness to buy or consume upcycled products made by walnuts/hazelnuts depend on the type of the final product?**

- 1) No
- 2) Yes

a. *(If yes)*, please explain in the space provided here.

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*SECTION V: Further feedback or observations in relation to the survey*

**37. Please, if you have something to add in relation to the upcycled food products (a characteristic/properties/flavour etc.) and in your opinion was not cover by this survey, feel free to indicate it in the space below. It will be appreciated!**

*From the researcher, Maastricht University and Keep Food Simple, thank you for taking the time to complete this survey, your information and contribution for this analysis is really valuable and appreciated!*

*Kind regards, Michalis Xanthakis*

## Dutch version

Hallo en bedankt dat u de tijd neemt om deze enquête in te vullen. Mijn naam is Mike Xanthakis en ik ben een masterstudent aan de Maastricht Universiteit. Dit onderzoek is in samenwerking met KeepFoodSimple en gaat over de perceptie en het perspectief van de consument op noten gebaseerde (walnoten en/of hazelnoten) innovatieve producten op de Nederlandse markt. Deze innovatieve producten worden ge-upcycled, wat betekent dat de bijproducten van de grondstoffen die voor de productie worden gebruikt, niet worden verspild, zoals gewoonlijk, maar worden gebruikt voor het maken van voedzame voedingsproducten. Bovendien is het doel om de normaliter verspilde delen in voedselproducten te verwerken met een zo optimaal mogelijk productieproces en met een zo hoog mogelijke rendement van voedingsstoffen mogelijk maakt. In deze enquête van 15 minuten wordt u gevraagd uw mening en standpunt over dit concept te geven. Beantwoord de vragen alstublieft eerlijk en gebaseerd op uw huidige voedingsgewoontes. Deze enquête is volledig vrijwillig, uw gegevens blijven anoniem en worden verwijderd wanneer het onderzoek wordt beëindigd. Neem de tijd om de enquête in te vullen terwijl u zich op een plaats zonder afleiding bevindt en u zich rustig voelt. Als u nog vragen heeft over het onderzoek, neem dan gerust contact op met Mike Xanthakis via [m.xanthakis@student.maastrichtuniversity.nl](mailto:m.xanthakis@student.maastrichtuniversity.nl). Houd er rekening mee dat als u zwanger bent, een notenallergie heeft, medicijnen gebruikt en/of een gezondheidstoestand heeft waardoor u geen noten mag consumeren of de consumptie ervan beperkt, en als u een extreem dieet volgt zonder noten, ga dan niet verder.

**Door het onderstaande vakje te selecteren, gaat u akkoord met deelname aan deze enquête en zal de enquête starten**

\* Ja, ga verder met de enquête.

**DEEL I: Algemene informatie met betrekking tot demografie, opleidingsniveau, huidig beroep en dieet.**

**1. Met welk geslacht identificeer u zich?**

- 1) Vrouw
- 2) Man
- 3) Overig

**2. Wat is uw geboortejahr?**

Tik op menu

**3. Wat is uw geboorteland?**

**4. Wat is uw burgerlijke staat?**

- 1) Single
- 2) Getrouwd, geen kind
- 3) Getrouwd met kind

- 4) Getrouwd met kinderen
- 5) Alleenstaande ouder met kind
- 6) Alleenstaande ouder met kinderen
- 7) Anders

**5. Wat is uw hoogst afgerond opleiding? Indien momenteel ingeschreven als student, de hoogst behaalde certificering.**

- 1) Geen opleiding afgerond
- 2) Volwassenenonderwijs
- 3) Basisschool
- 4) middelbaar VMBO
- 5) middelbaar Havo
- 6) middelbaar VWO
- 4) Middelbaar beroepsonderwijs (mbo)
- 5) Bachelor diploma (HBO)
- 5) Bachelor diploma (WO)
- 6) Master diploma (WO)
- 7) PhD
- 8) Liever niet antwoorden

**6. Ben je gekwalificeerd op het gebied van voedingswetenschap en/en voeding? Zo ja, geef dan hieronder de graad/titel aan.**

- 1) Nee
- 2) Zo ja, geef dan hieronder de graad/titel aan.

**7. Wat is uw arbeidsstatus?**

- 1) Student
- 2) Voltijds in dienst
- 3) Parttime werkzaam
- 4) Zelfstandigen

- 5) Zonder werk
- 6) Overig
- 7) Liever niet antwoorden

**8. Hoe doet u boodschappen het liefst?**

- 1) Online
- 2) Offline

**DEEL II: Voedingsgewoonten in relatie tot notenconsumptie, en meer specifiek over walnoten en hazelnoten.**

**9. Hoe vaak per dag consumeert u rauwe noten?**

- 1) 4 keer per dag
- 2) 3 keer per dag
- 3) 2 keer per dag
- 4) 1 keer per dag
- 5) Ik eet niet elke dag noten

**10. Hoeveel dagen per week eet u gewoonlijk rauwe noten?**

- 1) Elke dag
- 2) 5 keer per week
- 3) 4 keer per week
- 4) 3 keer per week
- 5) 2 keer per week of minder

**11. Hoe vaak per dag consumeert u gewoonlijk voedingsmiddelen die noten bevatten? (Granola, eiwit/energie/noten-graanreep, alternatieve melkdranken zoals amandelmelk, notenolie, notenmeel, spreads etc.)**

- 1) 4 keer per dag
- 2) 3 keer per dag
- 3) 2 keer per dag
- 4) 1 keer per dag
- 5) Ik eet niet elke dag noten

**12. Hoeveel dagen per week consumeert u gewoonlijk voedingsmiddelen die noten bevatten? (Granola, eiwit/energie/noten-graanreep, alternatieve melkdranken zoals amandelmelk, notenolie, notenmeel, spreads etc.)**

- 1) Elke dag
- 2) 5 keer per week
- 3) 4 keer per week
- 4) 3 keer per week
- 5) 2 keer per week of minder

**13. Geef de mate van overeenstemming aan voor de volgende stellingen over walnoten en walnotenproducten.**

	1	2	3	4	5
	<b>Sterk oneens</b>	<b>oneens</b>	<b>Niet eens, niet oneens</b>	<b>eens</b>	<b>Sterk mee eens</b>
Walnoten zijn voedzaam en gezond.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Walnoten zijn veilig voor om te consumeren.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Voedingsproducten gemaakt met walnoten zijn voedzaam en veilig.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**14. Geef de mate van overeenstemming aan voor de volgende uitspraken met betrekking tot hazelnoten en hazelnootproducten.**

	1	2	3	4	5
	<b>Sterk oneens</b>	<b>Oneens</b>	<b>Niet eens, niet oneens</b>	<b>Eens</b>	<b>Sterk mee eens</b>
Hazelnoten zijn voedzaam en gezond voedsel.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Hazelnoten zijn veilig om te consumeren.

Voedingsproducten gemaakt met hazelnoten zijn voedzaam en veilig.

**15. Wanneer eet u het liefst walnoten en/of hazelnoten?**

- 1) Als tussendoortje / Tussenmaaltijd (voor/na ontbijt-lunch-diner)
- 2) Ontbijt
- 3) Lunch
- 4) Diner

**16. Wanneer zou u liever voedingsmiddelen consumeren die gemaakt zijn van walnoten en/en hazelnoten zoals granola, eiwit/energie/noten-graanreep, alternatieve melkdranken zoals amandelmelk, notenolie, notenmeel, spreads hier gebleven.**

- 1) Als tussendoortje / Tussenmaaltijd (voor/na ontbijt-lunch-diner)
- 2) Ontbijt
- 3) Lunch
- 4) Diner

*DEEL III: In deze sectie wordt van u verwacht dat u uw mening geeft over op noten gebaseerde voedingsproducten om uw perceptie en perspectief te onderzoeken, rekening houdend met de geschiktheid, prijsstelling en kwaliteit van dergelijke producten. Voorbeelden hiervan zijn granola, eiwit/energie/noten-granenreep, alternatieve melkdranken zoals amandelmelk, notenolie, notenmeel, spreads etc.*

**17. Geef aan in hoeverre u het eens bent met het volgende:**

	1	2	3	4	5
	Sterk oneens	Oneens	Niet eens, niet oneens	Eens	Sterk mee eens

Over het algemeen geldt: hoe hoger de prijs van een product, hoe hoger de kwaliteit.	<input type="radio"/>				
Ik beschouw producten op basis van noten als duur.	<input type="radio"/>				
Ik geloof dat producten op basis van noten de moeite waard zijn om te kopen omdat ze voedzaam zijn en gezondheidsvoordelen hebben.	<input type="radio"/>				
Ik zou producten op basis van noten kopen, omdat ze voedzaam zijn en gezondheidsvoordelen hebben, ondanks dat ze duur zijn.	<input type="radio"/>				

18. Wat motiveert u het meest om producten op basis van noten te kopen, zoals beschreven in hoofdstuk III?

19. Rangschik de volgende uitspraken van meest belangrijk (1) tot minst belangrijk (5) op basis van uw prioriteiten, rekening houdend met het op noten gebaseerde voedsel dat u op een normale dag eet::

	1	2	3	4	5
	Meest belangrijk	Belangrijk	Neutrale	Minder belangrijk	Minst belangrijk
Is voedzaam.	<input type="radio"/>				

Is gemakkelijk te bereiden.	<input type="radio"/>				
Is gemakkelijk verkrijgbaar in winkels en supermarkten.	<input type="radio"/>				
Bevat geen toevoegingen.	<input type="radio"/>				
Bevat natuurlijke ingrediënten.	<input type="radio"/>				
Komt uit landen die ik goedkeur.	<input type="radio"/>				
Wordt lokaal geproduceerd.	<input type="radio"/>				
Het land van herkomst duidelijk aangegeven.	<input type="radio"/>				
Is milieuvriendelijk.	<input type="radio"/>				
Ik maak me zorgen dat er schadelijke chemicaliën in mijn voedsel zitten.	<input type="radio"/>				
Heeft informatie over het eten.	<input type="radio"/>				
Ander	<input type="radio"/>				

Kiest u voor de laatste optie, geef dan aan welke (andere) kenmerken voor u van belang zijn. \_\_\_\_\_

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**20. Geef aan in hoeverre u het eens bent met de volgende uitspraken met (1) als Nooit en (5) Altijd:**

	1	2	3	4	5
	Nooit	Zelden	Soms	Vaak	Altijd
Ik zoek informatie over de nieuwe soorten voedingsproducten.	<input type="radio"/>				
Ik lees de ingrediënten op voedsletiketten	<input type="radio"/>				
Ik controleer de herkomst van verpakte producten (land van herkomst)	<input type="radio"/>				

**21. Hoe tevreden of ontevreden bent u in het algemeen over de al bestaande voedingsproducten op basis van noten met betrekking tot duurzaamheidskwesties?**

- 1) Uiterst tevreden
- 2) Enigszins tevreden
- 3) Noch tevreden, noch ontevreden
- 4) Enigszins ontevreden
- 5) Uiterst ontevreden

**21a. Aarzel niet om de redenen achter uw reactie uit te leggen in de ruimte die hier wordt geboden.**

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**22. Wilt u graag meer informatie over de methoden van het geproduceerde voedsel en meer details over de gebruikte ingrediënten?**

1) Nee

2) Ja

**22a. (Zo ja), Hoe zou u willen dat deze aanvullende informatie wordt verstrekt:**

1) Online

2) Op productverpakking

3) Zowel online als op productverpakking

4) Overig

Als uw antwoord anders was, geef dan in de ruimte hieronder aan op welke manier u graag geïnformeerd wilt worden. Het kan ook een combinatie van opties zijn.

**23. In het geval van producten op basis van noten, zou u idealiter meer informatie willen ontvangen over de methoden van het geproduceerde voedsel, samen met meer details over de gebruikte ingrediënten?**

1) Nee

2) Ja

**23a. (Zo ja), hoe zou u willen dat deze aanvullende informatie wordt verstrekt:**

1) Online

2) Op productverpakking

3) Zowel online als op productverpakking

4) Overig

Als je antwoord anders was, geef dan in de ruimte hieronder aan op welke manier u graag geïnformeerd wilt worden. Het kan ook een combinatie van opties zijn.

*DEEL IV: In dit geval worden upcycled producten gemaakt van walnoten en hazelnoten en wordt de perceptie en het perspectief van de consument onderzocht, rekening houdend met upcycled voedingsproducten in relatie tot smaak, duurzaamheid, koopbereidheid en kwaliteit. Voorbeelden hiervan zijn granola, eiwit/energie/noten-granenreep, zoete room of soep, spreads etc.*

**24. Heeft u voor het invullen van deze enquête gehoord van upcycled voedingsproducten?**

- 1) Nee
- 2) Ja

**Definitie:** Upcycled producten worden gemaakt van de bijproducten van rauw voedsel dat is verwerkt voor de creatie van het belangrijkste voedselproduct (olie, boter, meel, melk-kaasalternatieven enz.), en in plaats van ze te verspillen, worden ze verwerkt in voedsel producten. Voor dit doel is het doel om de voedingsstoffen van die "afvalstoffen" vast te houden en een ander zeer voedzaam eindproduct aan te bieden.

**25. Wat voor smaak zou u verwachten, voordat u het voor de eerste keer probeert, van upcycled op noten gebaseerde producten zoals eerder beschreven?**

- 1) Zoet
- 2) Zuur
- 3) Bitter
- 4) Zout
- 5) Umami
- 6) Combinatie

Als u de combinatie kiest, geef dan aan welke combinatie/combinaties u zou verwachten, voordat u een upcycled product hebt geprobeerd, en zet de dominante smaak voorop in uw statement. (Bijvoorbeeld zoet/bitter)

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**26. Wat voor soort smaak zou u verkiezen voor dergelijke voedingsproducten op basis van walnoot/hazelnoot? Geef a.u.b. het niveau van de smaak aan dat u wenst met (1) zeer intens tot (5) licht merkbaar.**

	1	2	3	4	5

	<b>Zeer intens</b>	<b>Intens</b>	<b>Neutrale</b>	<b>Milde intensiteit</b>	<b>Licht merkbaar</b>
Zoet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Zuur	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bitter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Zout	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Umami	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Combinatie	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Als u de combinatie kiest, geef dan aan welke combinatie/combinaties uw voorkeur heeft en zet de dominante smaak vooraan.  
(Bijvoorbeeld zoet/bitter)

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**27. Rangschik het volgende van het belangrijkste (1) tot het minst belangrijke (5), in relatie tot wat u liever zou hebben in een upcycled voedsel dat u zou consumeren of gebruiken:**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
	<b>Meest belangrijk</b>	<b>Belangrijk</b>	<b>Neutrale</b>	<b>Minder belangrijk</b>	<b>Minst belangrijk</b>
Er zit geen conserveermiddel in	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Wees zeer voedzaam met gezondheidsvoordelen	<input type="radio"/>				
Laat het me weten als een product lokaal is of gemaakt is met lokale ingrediënten.	<input type="radio"/>				
Is milieuvriendelijk	<input type="radio"/>				
Heeft een lang zelfleven	<input type="radio"/>				
Ander	<input type="radio"/>				

Kiest u voor de laatste optie, geef dan aan wat en hoeveel dit voor u van belang is. Bovendien, als er meer dan één kenmerk is, aarzel dan niet om ze op te nemen.

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**28. Geef een rangorde van het belang van deze potentiële barrières om geen upcycled voedingsproducten te kopen zoals beschreven. Rangschik het volgende van de belangrijkste beperking (1) tot de minst belangrijke beperking (5).**

	1	2	3	4	5
	Meest belangrijk	Belangrijk	Neutrale	Minder belangrijk	Minst belangrijk
Tekort aan oplettendheid	<input type="radio"/>				

Niet gemakkelijk verkrijgbaar	<input type="radio"/>				
Hoge prijs	<input type="radio"/>				
Het is niet handig	<input type="radio"/>				
Niet gemaakt in Nederland	<input type="radio"/>				
Ander	<input type="radio"/>				

Kiest u voor de laatste optie, geef dan aan wat en hoeveel dit voor u van belang is. Bovendien, als er meer dan één kenmerk is, aarzel dan niet om ze op te nemen.

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**29. Geef aan in hoeverre u het eens bent met het volgende:**

	1	2	3	4	5
	<b>Sterk oneens</b>	<b>Oneens</b>	<b>Niet eens, niet oneens</b>	<b>Eens</b>	<b>Sterk mee eens</b>
Als er een nieuw product van walnoten en/of hazelnoten op de markt zou zijn, zou ik het graag willen kopen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Als dit product gemaakt van walnoten/hazelnoten upcycled voedsel was, zou ik het graag willen kopen.

Ik heb het gevoel dat het beschreven upcycled voedsel van goede kwaliteit lijkt te zijn

De kans is groot dat ik geüpicycled voedsel zou proberen, zoals het voedsel dat voor het eerst wordt beschreven.

Ik zou geen upcycled-producten op basis van noten kopen omdat ik bang ben voor wat ze kunnen bevatten (chemicaliën, conserveermiddelen enz.)

**30. Wat is het maximum dat u bereid bent te betalen voor één portie van de beschreven upcycled voedingsmiddelen? Voorbeelden hiervan zijn spreads (zoet of hartig), granola, eiwit/energiereep en poeder voor zoete room of soep.**

- 1) 0 - 0,5 euro
- 2) >0,5 - 1 euro
- 3) >1 - 1,5 euro
- 4) >2 - 2,5 euro
- 5) >2,5 - 3 euro
- 6) >3 - 3,5 euro
- 7) >3,5 - 4 euro
- 8) >4 - 4,5 euro
- 9) >4,5 - 5 euro

10) >5 - 5,5 euro

11) >5,5 - 6 euro

12) Andere

Indien uw antwoord anders was, gelieve dan hieronder het bedrag aan te duiden waarnaar u verwijst.

**31. Tegen welke prijs zou u een deel van een upcycled product zo duur vinden dat u niet zou overwegen om het te kopen?**

1) 0 - 0,5 euro

2) >0,5 - 1 euro

3) >1 - 1,5 euro

4) >2 - 2,5 euro

5) >2,5 - 3 euro

6) >3 - 3,5 euro

7) >3,5 - 4 euro

8) >4 - 4,5 euro

9) >4,5 - 5 euro

10) >5 - 5,5 euro

11) >5,5 - 6 euro

12) Andere

Kiest u voor de laatste optie, geef dan hieronder aan om welk bedrag het gaat:

**32. Tegen welke prijs zou u denken dat een deel van de upcycled producten zo laag geprijsd zou zijn dat je zou denken dat de kwaliteit niet erg goed zou kunnen zijn?**

1) 0 - 0,5 euro

2) >0,5 - 1 euro

3) >1 - 1,5 euro

4) >2 - 2,5 euro

- 5) >2,5 - 3 euro
- 6) >3 - 3,5 euro
- 7) >3,5 - 4 euro
- 8) >4 - 4,5 euro
- 9) >4,5 - 5 euro
- 10) >5 - 5,5 euro
- 11) >5,5 - 6 euro
- 12) Andere

Geef hieronder het bedrag aan, voor het geval uw antwoord anders was.

**33. Tegen welke prijs zou u denken dat een deel van een upcycled voedingsproduct duur begint te worden, zodat het niet uitgesloten is, maar u zou moeten nadenken om het te kopen?**

- 1) 0 - 0,5 euro
- 2) >0,5 - 1 euro
- 3) >1 - 1,5 euro
- 4) >2 - 2,5 euro
- 5) >2,5 - 3 euro
- 6) >3 - 3,5 euro
- 7) >3,5 - 4 euro
- 8) >4 - 4,5 euro
- 9) >4,5 - 5 euro
- 10) >5 - 5,5 euro
- 11) >5,5 - 6 euro
- 12) Andere

Geef hieronder het bedrag aan, voor het geval uw antwoord anders was.

**34. Welke eigenschap/eigenschappen/eigenschap van het upcycled voedsel zou ervoor zorgen dat u zou kopen tegen de prijs die u in de vorige vraag hebt aangegeven. Gelieve hieronder nader toe te lichten:**

**35. Ik accepteer/geef de voorkeur aan upcycled voedingsproducten van walnoot/hazelnoot (vink alles aan wat op uw van toepassing is)**

- 1) Als alternatieve zuivelproducten (melk, kaas, yoghurt)
- 2) Als ingrediënt te gebruiken voor het maken van voedsel of maaltijd (meel, olie)
- 3) Als alternatieve vleesproducten
- 4) Als drankproducten (smoothie, hoogcalorische drank als maaltijdvervanger)
- 5) Als tussendoortje (granola, mueslireep/energie/eiwitreep, poeder voor zoete room of soep)

**36. Hangt uw bereidheid om upcycled producten van walnoten/hazelnoten te kopen of te consumeren af van het type eindproduct?**

- 1) Nee
- 2) Zo ja, licht dit toe in de daarvoor bestemde ruimte

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*DEEL V: Verdere feedback of opmerkingen met betrekking tot de enquête.*

**37. Als u iets toe te voegen heeft met betrekking tot de upcycled voedselproducten (een kenmerk/eigenschappen/smaak etc.) en naar uw mening niet in dit onderzoek is behandeld, kunt u dit in de ruimte hieronder aangeven. Het zal gewaardeerd worden!**

**Namens de onderzoeker, Universiteit Maastricht en Keep Food Simple, bedankt dat u de tijd heeft genomen om deze enquête in te vullen, uw informatie en bijdrage voor deze analyse is echt waardevol en wordt gewaardeerd!**

Vriendelijke groeten, *Michalis Xanthakis*