The determinants of the adoption intention of eco-friendly functional food in different market segments

The determinants of the adoption intention of eco-friendly functional food in different market segments

Ingrid Moons, University of Antwerp

Camilla Barbarossa, Toulouse Business School

Patrick De Pelsmacker, University of Antwerp

Conflict of interest: none

Highlights

- Sporters, vegetarians and foodies are early adopters of eco-friendly Spirulina-enhanced food.
- Health consciousness and the willingness to compromise on taste are motivators to adopt this food.
- Neophobia only has a negative effect on this adoption intention for the foodies.
- Neither food involvement nor environmental concern is a driver to adopt Spirulina-enhanced food.

The determinants of the adoption intention of eco-friendly functional food in different market segments

Abstract

Microalgae-based food is a source of proteins that, in comparison to meat, offers significant environmental and health-related benefits. A successful market introduction largely depends on consumer acceptance of this food. The current study investigates the motivational drivers and barriers of the adoption of Spirulina (a specific type of micro-alga)-enhanced food. By means of two qualitative studies and a quantitative survey with 1,325 Belgian participants, early adopter consumer segments of Spirulina-enhanced food are identified (sporting individuals, vegetarians and foodies), and compared with a contrast group (life enjoyers). The motivational drivers and barriers to the adoption of eco-friendly Spirulina-enhanced food across the identified consumer segments is assessed. The results show that health consciousness and the willingness to compromise on taste are major motivational drivers of the adoption intention for sporting individuals, vegetarians and foodies. Neophobia only has a negative effect on this adoption intention for the foodies, while it does not play a role for sporting individuals and vegetarians. Neither food involvement nor environmental concern is a significant driver of Spirulina-enhanced food adoption intention. Implications for marketers and for policy makers are proposed.

Keywords: eco-friendly functional food, Spirulina-enhanced food, motivational drivers and barriers of adoption, early adoption target markets

1. Introduction: Context and Research Objectives

Nowadays, industrial livestock production is responsible for a considerable amount of the ecological footprint of humans, both in terms of resource utilization (e.g., land area and freshwater use, deforestation, biodiversity loss, inefficient feed conversion ratio) and pollution (e.g., use of pesticides, high greenhouse gas emissions, climate change) (de Boer et al., 2006; 2017). Furthermore, Western meat overconsumption is increasingly associated with food-related diseases (e.g., obesity, diabetes, cardiovascular diseases, certain types of cancers) (WHO, 2015). For instance, Appleby et al. (2002) report that non-meat eaters have a lower prevalence of hypertension and lower systolic and diastolic blood pressures than meat eaters. Most meat products contain a significant fat percentage, which makes them less suitable for extensive consumption. The WHO advises to reduce meat consumption to a level below 500 g per week and to avoid fat red meat or prepared meat (max. 300 g per week) and replace it by non-fat or white meat or plant-based alternatives. Increased ratios of polyunsaturated fatty acids (PUFAs) exert suppressive effects on the pathogenesis of many diseases. PUFAs are present in large quantities in plant products, but not so much in animal products (Asgar et al., 2010). Hence, both from an environmental and a health perspective, substitute delivery of proteins and alternative food consumption patterns are needed (de Boer and Aiking, 2017; van Dooren et al., 2017).

Microalgae have been identified as plant-based sources of proteins that, in comparison to meat, offer significant environmental and health-related benefits (de Boer and Aiking, 2011; Hoek et al., 2004). Among different microalgae species, Spirulina seems to be very promising. It is considered an eco-friendly meat substitute because it is produced in large outdoor ponds under controlled conditions, it only demands a limited production surface, and has low emission effects (Draaisma et al., 2013). Additionally, it has significant health-related

benefits (e.g., antiviral, anti-inflammatory and anti-tumoral effects, blood lipid profile, blood sugar and body weight reduction), because it contains high-antioxidant components, abundant amino acids, high-quality proteins, minerals, unsaturated fatty acids and vitamins (Belay, 2008; Khan et al., 2005; Merchant et al., 2001). Spirulina contains 60 to 70% essential proteins whereas meat contains 27% (Spirulina, 2018).

Since 2000, the microalgae production for food and feed showed a five-fold increase. Today, Spirulina is produced in more than 22 countries with a production value of about 40 million dollars (Vigani et al., 2015) and is consumed in over 77 countries. Europe accounted for 32% of global consumption in 2016, and the Asia-Pacific region is expected to be the fastest growing market (compound annual growth rate of 14.48%) (Coherent Market Insights, 2018).

Spirulina is available in two different product types. The first is dried algae, which are sold as dietary supplements and sources of proteins and carbohydrates. This type of product is already available in several markets (for a list of Spirulina-dried algae supplements see Coherent Market Insights, 2018). The second type is specialty products isolated and extracted from the microalgae that can be added to food to improve its nutritional value (hereafter defined as Spirulina-enhanced food) (for a list of Spirulina-enhanced food items see Borowitzka, 2008). The latter can be considered novel functional food for two reasons. First, European Regulation 258/97 of the European Parliament and of the Council of 27 January 1997 stipulates that foods and food ingredients consisting of or isolated from micro-organisms, fungi, or algae are qualified as “novel” (eur-lex.europa, 1997). Second, from a consumer’s point of view, it does not have a significant history of consumption and its market penetration is still very limited (Lähteenmäki-Uutela, 2007; Loizou, 2013).

Functional foods are considered as those foods which are intended to be consumed as part of the normal diet and that contain active components which offer the potential of

enhanced health or reduced risk of disease (Eufic, 2018). Functional foods have not as yet been defined by legislation in Europe. A number of scientific studies have shown the health benefits and disease risk reduction of Spirulina (Ajeesh et al., 2009; Chen, 2011; Belay, 2008; Khan et al., 2005; Merchant et al., 2001; Nuhu, 2013). Based on this evidence, several authors conclude that Spirulina can be considered as an ingredient of functional food. For instance, Molnar and Kiss (2013) and Buono et al. (2014) conclude that Spirulina may bring several health benefits, including prevention of diseases and, as a consequence it can be suggested for involvement in functional food developments. Park et al. (2008) demonstrate that Spirulina has favorable effects on lipid profiles, immune variables, and antioxidant capacity, and that it can therefore be considered as a component of functional food.

Both from an environmental and a health point of view, substituting meat-based products by Spirulina-enhanced food would be an attractive option. However, would that also be attractive to consumers? Many consumers give little thought to the relationship between their food consumption habits and the environmental impact of food production (de Boer et al., 2009; Vlaeminck et al., 2014). The notion of sustainability often does not resonate well with how people experience their everyday life. A recent study indicates that only 10% of the Belgians respect the advice to consume less than 400 grams of meat per week, although 60% wants to eat less meat in the future, both for health and environmental reasons (Brussels Times, 2018). A crucial decisive factor for the success of a new food category is to gain insight into its potential consumers and the motivational drivers and barriers to consumer acceptance (Annunziata and Vecchio, 2013; Chen, 2011; Verbeke, 2005, 2006). The current work fits into the literature on consumer adoption of eco-friendly novel functional food (Annunziata and Vecchio, 2013; Chen, 2011; Verbeke, 2005, 2006), and – in the context of Spirulina-enhanced food – aims to identify early adopter consumer segments of Spirulina-enhanced food, and investigate the motivational drivers and barriers of adopting this food.

According to Rogers' (1995) adoption-diffusion model, a new product should first and foremost appeal to innovators and early adopters, because these individuals serve as opinion leaders for consumers who might adopt the product in a later stage. Hence, if a new product does not appeal to early adopter groups, it will not be adopted by other groups either. It is thus very important to identify potential early adopters of Spirulina-enhanced food. To the best of our knowledge, no previous study has identified these consumer behavioural/lifestyle segments in the context of Spirulina-enhanced food adoption.

Second, previous research has extensively analysed factors that are related to the adoption of functional food, such as socio-demographic characteristics (Tobler et al., 2011; Urala and Lähteemäki, 2007; Verbeke, 2006), values, attitudes and lifestyles (Chen, 2011; Szakály et al., 2012), health issues (Di Pasquale et al., 2011; Urala and Lähteemäki, 2004), food involvement (Bell and Marshall, 2003), food neophobia (Barrena and Sanchez, 2013; Hoek et al., 2004; Verbeke, 2015), taste perceptions (Urala and Lähteemäki, 2007) and environmental concern (Apostolidis and McLeay, 2016; Verbeke, 2015). In general, few previous food-related studies have investigated the relative importance of a number of motivational factors for the adoption of food products simultaneously. Some studies developed and tested extensions of the Theory of Planned Behaviour (TPB). For instance, Ricci et al. (2018) predicted the intention to adopt eco-friendly convenience food by extending the TPB with food shopping habits, agricultural practice concerns and consumer trust. Menozzi et al. (2017) explored the adoption of insect-based novel products, and extended the TPB with variables such as positive effects on health and the environment, taste perceptions, availability in supermarkets, compatibility with local food products, and disgust. To the best of our knowledge, no previous study has simultaneously explored the importance of different motivational factors for the adoption intention of eco-friendly Spirulina-enhanced food.

Finally, motivations to adopt eco-friendly novel functional food may vary between different early adopter consumer segments (Urala and Lähteenmäki, 2004). Effective promotion and awareness building campaigns to convince people to adopt eco-friendly functional food will be more effective when they are tapping into persuasive motivations that are customized to different market segments (Ruiz de Maya et al., 2011). This, in turn, increases the likelihood of prompting behaviour that is more likely to be maintained over time (De Boer and Aiking, 2011). To the best of our knowledge, no previous studies have provided actionable guidelines toward reaching this goal.

The present study tries to partly fill these knowledge gaps by answering the following research questions:

– What are promising early adopter consumer behavioural/lifestyle segments for the introduction of Spirulina-enhanced food?
– What is the relative importance of different motivational drivers and barriers to the adoption intention of Spirulina-enhanced food?
– Are these motivational drivers and barriers different across different consumer segments?

The study was conducted in Flanders, the Dutch-speaking part of Belgium. First, it identifies potential early adopter behavioural/lifestyle consumer segments by means of a two-step qualitative study. Next, in a quantitative study with 1,325 participants, it tests the relative importance of potential motivational drivers and barriers to Spirulina-enhanced food adoption intention, and assesses the differences in the motivational structure across the identified consumer segments.

The study offers practical contributions for marketers and policy makers. Marketers of Spirulina-enhanced food can use the results to better position their products toward different

segments of potential adopters. Similarly, policy makers can use the study's insights to promote sustainable and healthy food consumption habits more effectively.

2. Literature Review and Conceptual Model

2.1. Motivational Drivers and Barriers of the Adoption Intention of Spirulina-enhanced Food

Previous studies have identified a number of important motivational drivers and barriers to adopt functional food. The current study presents a conceptual model (Figure 1) that considers five potential antecedents of eco-friendly novel functional food adoption, and assesses how these they affect the adoption intention of Spirulina-enhanced food.

(Figure 1)

2.1.1. Health Consciousness

Health consciousness is the extent to which individuals are aware of and concerned about their wellness, and are motivated to improve or maintain their health as well as to prevent its deterioration (Mai and Hoffmann, 2015; Oude Ophuis, 1989). Health-consciousness significantly influences consumers' decisions to purchase (un)healthy food (Chen, 2011; Goetzke and Spiller, 2014). Previous research shows that a higher degree of health consciousness is related to a more positive attitude and a higher willingness to buy functional food (Chen, 2011; Urala and Lähteemäki, 2004). Verbeke (2005) found that Belgian consumers' beliefs about the health-related benefits of functional food are the main determinant of functional food acceptance. Annunziata and Vecchio (2013) found similar

results with Italian consumers. Finally, in their Italian study, Di Pasquale et al. (2011) concluded that the more consumers are health conscious, the more they are willing to pay for functional food.

H1: Health consciousness has a positive effect on the adoption intention of Spirulina-enhanced food.

2.1.2. Food Involvement

Food involvement is the level of engagement a person feels about food (Bell and Marshall, 2003). Food is mostly categorized as a low involvement product. However, for some people, food is more highly involving because of the cultural meanings and the social aspects of consuming food (e.g., individuals interested in going to fancy restaurants, or devoted hobby cooks), and/or because of the health risks associated with food intake (e.g., individuals with food aversions or food allergies) (Bell and Marshall, 2003).

Previous research shows that individuals with a high level of food involvement tend to make informed food choices based on active and open-minded information processing (Juhl and Poulsen, 2000; Rozin et al., 1999). High food involvement may also lead to more elaboration of the characteristics of food and its ingredients. Consequently, health claims that are typical for functional food may be processed more profoundly by highly involved individuals, they may have a greater impact on their food choices, and could ultimately be related to their intake of functional food (Bell and Marshall, 2003). In this regard, Marshall and Bell (2004) and Barker et al. (2008) found that highly food-involved individuals choose (less) more (un)healthy food alternatives. Bell and Marshall (2003) claim that highly food involved individuals may be more inclined to try novel food, and Foxall and Bhate (1993)

report that highly food-involved people are more likely to buy innovative, healthy food products.

H2. Food involvement has a positive effect on the adoption intention of Spirulina-enhanced food.

2.1.3. Food Neophobia

Novel food is a type of food that does not have a significant history of consumption, is produced by a method that has not previously been used for food, or is prepared in a different way by adding unknown, new, foreign or unusual ingredients (Loizou, 2013). *Food neophobia* is a reluctance to eat and/or avoidance of novel food (Pliner and Hobden, 1992). Food neophobia predicts responses to novel food products (Barrena and Sanchez, 2013). Studies in the U.K. and The Netherlands found neophobia to be the most important factor that prevents consumers from adopting insects as a meat substitute (Hoek et al., 2011; Verbeke, 2015). Food neophobia has also been shown to have a negative impact on consumers' adoption intention of functional food products containing novel, unknown or unusual ingredients (Urala and Lahteenmaki, 2004, 2007).

H3. Food neophobia has a negative effect on the adoption intention of Spirulina-enhanced food.

2.1.4. Willingness to compromise on taste

Food choice is strongly driven by sensory liking, which often overrules the influence of other motivations. The desire to eat tasty food often contradicts the desire to eat healthily, owing to the widespread assumption that unhealthy food tastes better than healthy food (Mai and Hoffmann, 2015). Urala and Lähteemäki (2007) identified taste as a critical factor for

accepting functional food. Rational arguments are not always convincing in the adoption process of functional foods, if the taste of the food is not expected to be good (Verbeke, 2006). Consumers may be hardly willing to compromise on the taste of food for eventual health or environmental benefits. In this regard, Spirulina suffers from the disadvantage of its strong taste and colour which is not always disguisable in the food product it is added to. Sautier and Tremolieres (1975) tested the acceptability of various culinary products containing Spirulina, and found that they were little appreciated due to offensive color, smell and taste. Becker (2007) conducted a series of experiments to combine Spirulina with widely consumed food, and found that only small amounts of Spirulina could be added before the appearance, consistency and taste changed into unattractive food.

H4. The willingness to compromise on taste has a positive effect on the adoption intention of Spirulina-enhanced food.

2.1.5. Environmental Concern

Environmental concern is the extent to which individuals are concerned about the negative effects of their consumption actions on the natural environment (Barbarossa et al., 2017). Environmental concern is a relevant predictor of consumers' intentions to switch to alternative food consumption habits with a reduced negative impact on the environment, such as reducing or removing meat consumption in favour of plant-based diets (Hoek et al., 2011; Tobler et al., 2011; Vermeir and Verbeke, 2008). Functional food as a category is not eco-friendly *per se*. However, Spirulina production processes only demand a limited production surface and have reduced emission effects (Draaisma et al., 2013). It thus represents a plant-based source of proteins that, in comparison to meat, offers significant environmental-related benefits, which may therefore appeal to environmentally concerned consumers.

H5. Environmental concern has a positive effect on the adoption intention of Spirulina-enhanced food.

2.2. Early Adopter Target Segments for Spirulina-Enhanced Food and their Motivational Drivers and Barriers

Previous studies have tried to profile consumers that would make interesting early adopter target segments for eco-friendly novel functional food. A number of studies explored socio-demographic characteristics of potential functional food adopters. However, they produced rather inconsistent results. While some studies identified women as the main functional food users (Tobler et al., 2011), others found that gender does not affect attitudes toward functional food (Urala and Lähteemäki, 2007), or that gender differences are fading away (Verbeke, 2006). Similarly, while early studies found that older people are more likely to adopt functional food (IFIC, 2002), more recent ones found the opposite (Apostolidis and McLeay, 2016).

A number of studies have considered attitudes, lifestyles and behavioural variables to profile functional food adopters. Szaláky et al. (2012) identified three primary targets for the functional food market in Hungary: “rational” consumers because of their high health consciousness, “adventurous” consumers because of their search for novelty, and “conservative” consumers because of their predisposition to adopt a healthier lifestyle. Similarly, Di Pasquale et al. (2011) identified two primary consumer target groups in Italy: “health-concerned” consumers because of their awareness about the food–health relationship, their familiarity with functional food and their regular functional food purchase behaviour, and “conscious” consumers because of their beliefs about functional food health-related benefits, although they only occasionally buy functional food. Finally, Goetzke and Spiller

(2014) analysed German functional food adopters' lifestyles characteristics, and found that these consumers mostly buy functional food for beauty reasons and passive disease prevention.

However, none of these studies provided actionable information to allow marketers of functional food products and policy makers to build effective promotional campaigns. The empirical research presented in the next sections aims to *i*) identify specific behavioural/lifestyle target groups that are promising early adopter consumer segments of Spirulina-enhanced food, and that can be efficiently reached by marketers and policy makers, and *ii*) investigate differences across the identified behaviour/lifestyle segments in terms of the importance they attach to different motivational drivers and barriers to adopt Spirulina-enhanced food.

3. Method

3.1. Qualitative Study

From March 2015 to May 2015, a multi-stakeholder qualitative study was conducted to provide insights into promising early adopter market segments for Spirulina-enhanced food, and to corroborate the motivational factors underlying this adoption process that emerged from the literature review. The study was conducted in two steps: *i*) a workshop with experts, and *ii*) semi-structured in-depth interviews with members of the different target groups that came out from the workshop.

3.1.1. Workshop with Experts

A three-hour workshop was organized with 10 Belgian experts in novel food markets and special diets, owners and marketing managers of food companies, and health consultants. These experts were selected based on either their knowledge on creating new food, health-related food benefits, nutrogenetics, or the chemical composition of food. The workshop aimed to develop lifestyle/behavioural profiles of potential early adopter consumer segments of Spirulina-enhanced food and to identify their motivations to adopt this food. To this end, the "persona canvas" method was used (Pruitt and Grudin , 2003). Personas are hypothetical archetypes of potential customers that display the key attributes of the group they represent. They provide a rich description of a potential user of a product in terms of hypothetical demographics, attitudes, behaviours, aspirations, needs, expectations, culture, personality, motivations to use the product and touch points. The workshop led to the identification of three potential early adopter target segments: "sporting individuals", "vegetarians" and "foodies".

Sporting individuals are interested in the positive effects of food consumption on their health, physical performances and body shape. These individuals are willing to try out novel food if it is beneficial for their body, even if it is not sensory attractive. They are well-informed about appropriate diets and the effects of nutritional supplements on body weight, muscles and energy levels. Sporting individuals may therefore be interested in Spirulina-enhanced food because of its high level of proteins and health-related benefits.

Vegetarians abstain from the consumption of meat, and eventually from by-products of animal slaughter. They are oriented toward healthier eating and a higher quality of life, and they are willing to try out new food that provides more variation in their diets. Moreover, they are also environmentally concerned. They may therefore be interested in Spirulina-enhanced

food because of both environmental-related (i.e., Spirulina is more eco-friendly than animal-based sources of proteins) and health-related reasons (i.e., Spirulina-enhanced food may provide an additional source of proteins, vitamins and antioxidants, that lack in a vegetarian diet).

Foodies follow the latest food trends, and visit trendy restaurants and specialty shops. They are interested in new food ingredients or combinations, new recipes or cooking methods, and food-related media, programs and places to be. They like to try out, share and show new food experiences. A healthy lifestyle and ecological concerns related to food are relevant for them, provided they are novel and trendy. These individuals may be interested in Spirulina-enhanced food because they are highly involved in novel food and interested in its health- and/or environmental-related benefits.

Finally, *life enjoyers* were selected as a contrast consumer group. These individuals prioritize taste and hedonic aspects above functional or social characteristics in food. They appreciate traditional food and adhere to well-known flavours. They are not well informed about (and are less interested in) the effects of food production and consumption on the natural environmental and the human health. Consequently, they may be less willing to adopt Spirulina-enhanced food.

3.1.2. In-Depth Interviews

Next, in-depth interviews were conducted with respondents belonging to the different segments that emerged from the workshop (15-20 per segment) and with food experts with respect to each consumer segment (two per segment). The interviews aimed to corroborate the persona canvas descriptions and the relevance of the previously identified motivational drivers and barriers to the adoption of Spirulina-enhanced food.

Respondents were approached in vegetarian restaurants and food shops (vegetarians), sport clubs (sporting individuals), fancy restaurants, specialty food shops and food market festivals (foodies) and in traditional restaurants and bars (life enjoyers). They were invited to participate in an interview (40–60 minutes). The laddering technique was used to get a better understanding of their motivations. This technique provides a rich understanding of consumers' perceptions of products and of the bases of their purchase decisions (Reynolds and Gutman, 1988). The findings largely confirmed both the relevance of the previously identified consumer segments and the of the motivational drivers and barriers to Spirulina-enhanced food adoption intention that were identified in both the literature and the workshop.

3.2. Quantitative Study

3.2.1. Procedure, Measures and Sample

We conducted a survey in Belgium (Flemish speaking region) to corroborate the findings of the qualitative study and to answer our three research questions. In March 2016, an online survey was sent out to snowball samples of sporting individuals, vegetarians, foodies and life enjoyers. Participants were asked to fill out the questionnaire and forward it to people they knew and that had specific characteristics: how frequently they exercise, or being vegetarian, or knowing a lot about the latest food trends, or liking to eat. They were all asked to participate in a study about novel food, assuring their anonymity. The first section of the questionnaire explained the aim of the study. The second section included the measurement scales for the model constructs (Appendix A shows the constructs, their source, and their items measured on 7-point Likert scales). Respondents first expressed their health consciousness, food involvement, food neophobia, willingness to compromise on taste, and environmental concern. Next, after a description of Spirulina-enhanced food (Appendix B),

they expressed their adoption intention toward it. The last section included socio-demographic characteristics and the lifestyle screening question: "Considering the following lifestyles, [i.e., sporting, vegetarian, foodie or life enjoyer], which lifestyle represents you the most?". A total of 1,325 respondents fully completed the questionnaire. The composition of the sample is shown in Table 1. Lifestyle/behaviour groups resulted from respondents' self- reported lifestyle/behaviour.

(Table 1)

4. Data Analysis and Results

4.1. Adoption Intention of Different Market Segments

The four lifestyle/behaviour consumer segments differ significantly in their intention to adopt Spirulina-enhanced food ($F(3,1321)=26.46$, $p<.01$). Bonferroni-corrected post-hoc tests show that, compared to the other three consumer segments, life enjoyers have the significantly lowest adoption intention ($p<.05$). Foodies' adoption intention is significantly higher than that of the other three consumer segments ($p<.05$), while sporting individuals' and vegetarians' adoption intentions do not differ significantly ($p=.88$) (Appendix A).

We used structural equation modelling to test the model reported in Figure 1 (Anderson and Gerbing, 1988). First, we assessed the measurement model by carrying out confirmatory factor analysis (CFA) on each sample. Second, we analysed the full structural model on each sample. Finally, we performed multi-group analysis to assess significant differences across consumer groups.

4.2. Confirmatory Factor Analysis

We validated the six-factor measurement model by means of CFA using LISREL 8.80 (Jöreskog and Sörbom, 2006). Appendix A shows that global fit indices meet standard requirements in all samples: RMSEA<.08, SRMR <.08, and NFI, NNFI and CFI >.95. Also local fit criteria are good. All standardized item loadings (λCFA) significantly (p<.01) load on their constructs, and factor loadings are substantially greater than .50. Cronbach's alphas (α) for all constructs are greater than .70. The composite reliability (CR) threshold of .60 is met for every factor, and the average variance extracted (AVE) is always greater than .50. Appendix A also reports means and standard deviations of the constructs for each sample. Bivariate correlations (φ) between the components for each sample range as follows: .01< φ<.36 (sporting individuals), .02< φ<.43 (vegetarians), .02< φ<.41 (foodies), and .02< φ<.34 (life enjoyers). Discriminant validity is confirmed in each sample because the shared variance between pairs of factors is always less than the corresponding AVE (Appendix A) (Fornell and Larcker, 1981).

4.3. Structural model

Second, we analysed the full structural model for each sample. We included age and gender as covariates in the model. Results are reported in Table 2. Global fit indices are appropriate. Results show that health consciousness (HC) is a significant and positive antecedent of Spirulina-enhanced food adoption intention (AI) in all samples. H1 is fully supported. The effect of food involvement (FI) on AI is not significant in any sample, except for the *life enjoyers*, for which FI→AI is significant and positive. H2 is not supported. The effect of food neophobia (FN) on AI is significantly negative for the *foodies* and the *enjoyers*.

The FN→AI path is not significant for *sporting individuals* and the *vegetarians*. H3 is partly confirmed. The effect of willingness to compromise on taste (CT) on AI is strongly significant and positive in all samples. H4 is fully confirmed. The effect of environmental concern (EC) on AI is not significant in any sample. H5 is not supported.

Neither gender nor age significantly impact AI, with the exception of a significant positive effect of gender in the *vegetarian* sample ($F(1, 246)=6.86$, $p=.01$; male: $M=3.41$, $SD=1.33$; female: $M=3.95$, $SD=1.31$).

(Table 2)

4.4. Multi-group analysis

Finally, we performed multi-group analysis to assess significant differences in the motivational structure of adopting Spirulina-enhanced food across the consumer groups. To test the equivalence of the factorial measurement and the structural model across consumer samples, configural, metric and structural invariance was tested. C*onfigural* invariance, that is, whether the pattern of fixed and free parameters is the same for the four groups, is met (SRMR<.06, GFI>.90; $\chi^2(484)=991.39$, RMSEA=.05, CFI=.97). *Metric* invariance, that is, whether the factor structure is statistically invariant among the four groups, is also observed (SRMR<.06, GFI>.90; $\chi^2(520)=1{,}030.02$, RMSEA=.05, CFI=.97, $\Delta\chi^2(36)=41.63$, $p=.24$). Based on these results, the hypothesized model could be meaningfully compared across the four consumer samples.

Structural invariance, that is, whether regression weights for each of the structural paths are statistically invariant across consumer groups, was tested. Paths that are significantly different across groups are reported in bold in Table 3. Results show that the effect of health consciousness on Spirulina-enhanced food adoption intention (HC→AI) is

positive and significant across the four consumer segments (Table 2). Furthermore, this effect is significantly stronger for *vegetarians* and *foodies* than for *life enjoyers* (Table 3). The effect of food involvement on Spirulina-enhanced food adoption intention (FI→AI) is not significant for – and invariant across – *sporting individuals*, *vegetarians* and *foodies* (Tables 2 and 3). Conversely, the effect FI→AI is significant and positive for *life enjoyers* (Table 2), and significantly stronger than in the other consumer segments (Table 3). The effects of food neophobia on Spirulina-enhanced food adoption intention (FN→AI) is not significant for – and invariant between – *sporting individuals* and *vegetarians*. Conversely, FN→AI is significantly negative for – and invariant between – *foodies* and *life enjoyers*. The effect of consumer willingness to compromise on taste on Spirulina-enhanced food adoption intention (CT→AI) is positive and significant (Table 2) and statistically invariant across the four consumer segments (Table 3). Finally, the effect of environmental concern on Spirulina-enhanced food adoption intention (EC→AI) is not significant (Table 2) and statistically invariant across the four consumer segments (Table 3).

(Table 3)

5. Discussion

The current study identifies three potential early adopter consumer segments of Spirulina-enhanced food: *sporting individuals*, *vegetarians* and *foodies*, and a contrast consumer segment of *life enjoyers*, who are less likely to adopt Spirulina-enhanced food. Results show that the intention to adopt Spirulina-enhanced food is significantly higher for sporting individuals, vegetarians and foodies than for life enjoyers. Additionally, adoption intention is significantly higher for foodies than for sporting individuals and vegetarians. The latter result can be explained as follows. Sporting individuals are not just into food. Despite

the fact that they are highly motivated to improve their health, they may pursue this goal through other behaviours than just food intake. Vegetarian consumers, rather surprisingly, do not seem to take the eco-argument (an important motivation for vegetarians' food choices) into account when considering the adoption of Spirulina-enhanced food. This factor may explain why their intention to adopt Spirulina-enhanced food is not so outspoken (see below for a more detailed discussion of this issue).

In line with previous research, across all consumer segments, highly health-conscious consumers are more willing to adopt Spirulina-enhanced food (Barrena and Sanchez, 2013; Chen, 2011; Di Pasquale et al., 2011; Urala and Lähteemäki, 2004; Verbeke, 2006). Furthermore, the effect of health consciousness is significantly stronger for vegetarians and foodies than for life enjoyers and sporting individuals. This result is consistent with previous research demonstrating that health consciousness is one of the major motivators of being a vegetarian (Hoek et al., 2004) and of consuming less meat in general (Brussels Times, 2018). However, the fact that health motives are equally important for vegetarians and foodies is somewhat surprising. Indeed, despite Bell and Marshall's (2003) claim that health concerns are important motivators for people who are a lot into food, foodies are supposed to be interested in food for more reasons than just health-related concerns. The result of health consciousness being significantly stronger for vegetarians and foodies than for life enjoyers and sporting individuals can be explained as follows. Life enjoyers' food choices are generally less driven by health-related motivations, but rather by hedonic ones. Similarly, sporting individuals' food consumption is only partly driven by health motives (Parviainen et al., 2017). Indeed, these individuals are also motivated to take in nutrients that help them to compete in their sports or to shape their body. This motivation is not health-related, nor does it necessarily lead to healthy food intake.

Food involvement only affects life enjoyers' Spirulina-enhanced food adoption intention. Conversely, food involvement does not seem to play a significant role for the other segments. This result does not confirm previous studies that found that food involvement is related to healthy choices (Bell and Marshall, 2003; Jarman et al., 2012) and the willingness to try novel food (Foxall and Bhate, 1993).

One of the core characteristics of early adopters is that they are, in general, less neophobe (Rogers, 1995). However, even in early adopter consumer groups, there can still be a substantial variation in food neophobia. The effect of food neophobia on adoption the adoption intention of Spirulina-enhanced food is equally and significantly negative for life enjoyers and foodies, confirming previous research (Barrena and Sanchez, 2013; Urala and Lähteenmäki, 2007; Verbeke, 2015). Life enjoyers are indeed inclined to make conservative food choices. As to foodies, this result is more surprising, because interest in food is traditionally associated with the inclination to try stimulating, novel food. Differently, food neophobia does not affect either vegetarians' or sporting individuals' intention to adopt Spirulina-enhanced food. Vegetarians have a general interest in replacing meat with alternative sources of proteins, and therefore they are less afraid of letting their neophobia get in the way of trying new options. Sporting people are often used to taking food supplements, including protein-rich ones. In fact, Spirulina supplements are already sold in, for instance, fitness clubs. This explains why neophobia may not play a role in their motivation to try novel protein-rich food items.

The willingness to compromise on taste is a significant, and equally important, positive driver of Spirulina-enhanced food adoption intention across the four segments. This result confirms the importance of taste as a critical factor for food choices (Urala and Lähteemäki, 2007; Verbeke, 2005, 2006).

Contrary to previous findings (Apostolidis and McLeay, 2016; Hoek et al., 2011; Tobler et al., 2011; Verbeke, 2015), our results show that environmental concern is not a motivator to try Spirulina-enhanced food in any consumer segment, although participants were informed about the positive environmental effect of Spirulina production. Many consumers may give little thought to (or may be sceptical about) the relationship between their everyday food consumption habits and the environmental impact of food production (de Boer et al., 2009). A number of previous studies have indeed reported a low to moderate association between environmental concern and actual eco-friendly consumption behaviours (Barbarossa and De Pelsmacker, 2016). Nevertheless, this result is surprising for the vegetarian segment. The ecological motivation is one of the key reasons for being a vegetarian (Hoek et al., 2004; Swinder and Trocchia, 2001). Fox and Ward (2008) made a distinction between "health vegetarians", who choose to avoid meat for health reasons, and "ethical vegetarians", who consider meat avoidance as a moral imperative in terms of animals and environmental protection. A possible explanation for our results could be a prevalence of health vegetarians among our vegetarian respondents.

Finally, gender and age do not impact Spirulina-enhanced food adoption intention in any of the consumer segments, except for the fact that vegetarian women have a higher intention to adopt Spirulina-enhanced food than vegetarian men. Overall, this result confirms previous findings that demographics only play a minor role in the acceptance of functional food (Apostolidis and McLeay, 2016; Szakaly et al., 2012; Verbeke, 2006).

6. Implications for Marketers and Policy Makers

Functional food seems to be here to stay. Bimbo et al. (2017) estimate the market value for food with health claims at $168 billion in 2013, with an annual average growth rate of 8.5%,

and it is forecasted to exceed $300 billion by 2020. Nearly 90% of American adults acknowledge the benefits of functional food. Food companies attracted by this potential have been investing in the development of new nutrition-modified and functional products (Khan et al., 2014). In this regard, marketers can use the insights of the current study to promote the diffusion of a novel type of eco-friendly functional food such as Spirulina-enhanced food. Specifically, based on our findings, marketers can better target Spirulina-enhanced food products to different potential early adopter consumer segments. The success of marketing campaigns depends on, amongst others, the extent to which target groups can be easily reached, and on the effectiveness of positioning Spirulina-enhanced food products in the mind of different consumer segments by using appealing arguments for each target group. This is certainly the case for the early adopter consumer segments identified in the current study. Sporting individuals can be reached at sport events, in sport clubs and stores selling sports gear, via sport media and websites. Spirulina-enhanced food can be offered and promoted in cafeteria or snack bars in these sport clubs, sport stores, or in their vicinity. Vegetarians can be approached through promoting Spirulina-enhanced food in vegetarian restaurants, or restaurants that offer vegetarian dishes. The food items can be promoted via vegetarian clubs, specialized media and websites, or events. Our research team is also conducting follow –up co-creative research to develop appropriate Spirulina-enhanced products, such as soup and veggie burgers for vegetarians, energy bars and smoothies for sporting individuals, a cook book for foodies.

Marketers should primarily focus on the health argument and the willingness to compromise on taste for both sporting individuals and vegetarians. Specifically, when targeting sporting individuals, messages should focus on promoting Spirulina-enhanced food as a healthy means to get a better body shape and improved physical performance. When targeting vegetarian consumers, messages should focus on communicating Spirulina-

enhanced food as a meat- and dairy-free protein source that has specific, beneficial health effects. Foodies are easily reached by means of promoting Spirulina-enhanced food in specialized magazines and websites, in cooking programs on television, at food fairs and exhibitions, or in innovative restaurants. Companies may also reach this target group by using celebrities as Spirulina ambassadors to make these products more fashionable. When targeting foodies, marketers should consider communicating Spirulina-enhanced food as a means for consumers to stay healthy and, therefore, as a prerequisite of being happy and having a meaningful, pleasant life. Marketers should also avoid the "novelty" argument of Spirulina-enhanced food, since it could trigger neophobic responses that prevent foodies from adopting this food. Similarly, emphasizing the willingness to compromise on taste might also be a risky strategy: the good taste of food is a prime motivator for foodies to eat food, and emphasizing the sacrifice argument for trying Spirulina-enhanced food may scare these consumers off. Finally, in general, marketers should refrain from using the "ecological concern" argument, since it seems not to appeal to any target group.

Policy makers can also use the insights of the current study to promote more sustainable and healthy food consumption habits. Standardized awareness campaigns directed to the public at large may not be an effective strategy to accomplish this goal. Instead, identifying promising early adopter consumer segments and approach them with the right persuasive messages may represent a better alternative. For policy makers, these target groups are the same as for the marketers of Spirulina-enhanced food, and so is the way to get in touch with them. Additionally, by means of public awareness campaigns, policy makers could promote the positive determinants of Spirulina-enhanced food adoption, such as more health consciousness and environmental concern, and reduce the negative ones, such as food neophobia. For example, in order to improve public health and cut greenhouse gas emissions, the Chinese health ministry has recently recommended that the nation's 1.3 billion population

should dramatically reduce its per capita meat consumption to a maximum of 75g per day. In this regard, Hollywood celebrities where involved in a series of new public information adverts to emphasize the positive effects of reducing meat consumption also on the natural environment (The Guardian, 2016). Similarly, the beneficial effect on the environment of meat-free sources of proteins such as Spirulina could be more explicitly communicated, as for many consumers the environmental benefits of consuming and producing Spirulina may still not be well known. Governments could also support investments in technologies that improve the quality of Spirulina-enhanced food products, especially with respect to its sensory characteristics. An effective strategy would be to develop Spirulina-enhanced food that does no longer have the typical negatively perceived smell and taste. Having said this, a recent study in four countries found only a weak unhealthy-tasty intuition (Cooremans et al., 2017), indicating that the motivation to compromise with taste could become less important in the future. Finally, public policy could develop legislation and tax schemes that favour healthy and eco-friendly alternatives to meat consumption.

Besides Spirulina algae, also other micro-algae, such as Chlorella, are often used in food or as a food supplement. Spirulina and Chlorella are very similar in that they are both among the richest nutrient sources on the planet (Merchant et al., 2001). Our results and insights could therefore be generalized and applied to other types of algae-enhanced food.

7. Further research

When consumers make choices between conventional and eco-friendly functional food products, their reasons behind eco-friendly, functional food choices can be different across different food categories (Urala and Lähteemäki 2007). Adding Spirulina may make food products more or less attractive depending on the type of products or on the perceived fit

between Spirulina and the food category at hand (e.g., desserts versus salads). Future research is invited to analyse consumer intentions to adopt Spirulina-enhanced food across different food product categories.

Second, the health-taste conflict and the relative importance of health and taste perceptions on consumer willingness to adopt Spirulina-enhanced food represents an interesting avenue for further research. For instance, Mai and Hoffman (2015) found that increasing health consciousness has only a limited effect on healthy food choices: health consciousness only operates at a rational cognitive level and implicitly induced taste perceptions have a far larger impact on food decisions than healthiness expectations. Conversely, other studies have indicated that some products may have such a strong health claim that consumers are ready to compromise on taste (Annunziata and Vecchio, 2013; Urala and Lähteenmäki, 2004). The mechanism behind the taste-health perceptions warrants further investigation.

In the current study, purposive snowball sampling was used to obtain sufficiently large samples for each consumer segment. The conceptual model proposed in this study should be tested in samples which are more representative of a nation's population, to enhance the external validity of our findings.

Results of the current study show that environmental concern does not motivate consumers to adopt Spirulina-enhanced food, even after pointing out to them that Spirulina production is eco-friendly. Future research is invited to explore the ecological motivations to adopt eco-friendly functional food, more particularly among different subgroups of vegetarian individuals (e.g., health-concerned and ethical vegetarians; Fox and Ward, 2008). This may shed light on other factors possibly responsible for the green gap observed in the current study among vegetarian participants.

The present work mainly focused on the relative importance of a number of motivational drivers and barriers to Spirulina-enhanced food adoption intention in early adopter segments. Future research should explore these motivations in early and late majority consumer groups.

Finally, other motivational drivers and barriers could be explored, such as the role of the supply chain, public policy actions and public awareness, and the role of the credibility of health- and eco-related claims to promote Spirulina-enhanced food.

References

Ajeesh, M., Bohra, C.P.N., Gupta, N., Chandrasekaran, R., 2009. Spirulina as 'functional food.' New Biotechnol., 25.

Anderson, J.C., Gerbing, D.W., 1988. Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach. Psychol. Bull., 103(3), 411-423.

Annunziata, A., Vecchio, R., 2013. Consumer Perception of Functional Foods: A Conjoint Analysis with Probiotics. Food Qual. Prefer., 28(1), 348-355.

Apostolidis, C., McLeay, F., 2016. Should We Stop Meating Like This? Reducing Meat Consumption Through Substitution. Food Policy, 65, 74-89.

Appleby, P.N., Davey, G.K., Key, T.J., 2002. Hypertension and blood pressure among meat eaters, fish eaters, vegetarians and vegans in EPIC–Oxford. Public Health Nutr., 5(5), 645-654.

Asgar, M.A., Fazilah, A., Huda, N., Bhat, R., Karim, A.A., 2010. Nonmeat protein alternatives as meat extenders and meat analogs. Compr. Rev. Food Sci.F., 9(5), 513-529.

Barbarossa, C., De Pelsmacker, P., Moons, I., 2017. Personal values, green self-identity and electric car adoption. Ecol. Econ., 140, 190-200.

Barbarossa, C., De Pelsmacker, P. 2016. Positive and negative antecedents of purchasing eco-friendly products: A comparison between green and non-green consumers. J. Bus. Ethics, 134(2), 229-247.

Barker, M., Lawrence, W.T., Skinner, T.C., Haslam, C.O., Robinson, S.M., Inskip, H.M., Margetts, B.M, Jackson, A., Barker, D., Cooper, C., 2008. Constraints on food choices of women in the UK with lower educational attainment. Public Health Nutr., 11(12), 1229-1237.

Barrena, R., Sánchez, M., 2013. Neophobia, personal consumer values and novel food acceptance. Food Qual. Pref., 27(1), 72-84.

Becker, E. W., 2007. Micro-algae as a source of protein. Biotechnology Advances, 25(2), 207-210.

Belay, A. (2008). Spirulina (Arthrospira): production and quality assurance. Spirulina in Human Nutrition and Health, 1-25.

Bell, R., Marshall, D.W., 2003. The construct of food involvement in behavioral research: scale development and validation. Appetite, 40(3), 235-244.

Bimbo, F., Bonanno, A., Nocella, G., Viscecchia, R., Nardone, G., De Devitiis, B., Carlucci, D., 2017. Consumers' acceptance and preferences for nutrition-modified and functional dairy products: A systematic review. Appetite, 113, 141-154.

Borowitzka, M.A., 2013. High-value products from microalgae—their development and commercialisation. J. Appl. Phycol., 25(3), 743-756.

Borowitzka, M.A., 2008. Spirulina in human nutrition and health. In Gershwin, M.E., Belay, A. (eds). J. Appl. Phycol., 21(6), 747-748.

Buono, S., Langellotti, A.L., Martello, A., Rinna, F., Fogliano, V., 2014. Functional ingredients from microalgae. Food & Function, 5(8), 1669-1685.

Chen, M.F., 2011. The joint moderating effect of health consciousness and healthy lifestyle on consumers' willingness to use functional foods in Taiwan. Appetite, 57(1), 253-262.

Cooremans, K., Geuens, M., Pandelaere, M., 2017. Cross-national investigation of the drivers of obesity: Re-assessment of past findings and avenues for the future. Appetite, 114, 360-367.

de Boer, J., Aiking, H., 2017. Pursuing a low meat diet to improve both health and sustainability: How can we use the frames that shape our meals? Ecol. Econ., 142, 238-248.

de Boer, J., Aiking, H., 2011. On the merits of plant-based proteins for global food security: Marrying macro and micro perspectives. Ecol. Econ., 70(7), 1259-1265.

de Boer, J., Boersema, J.J., Aiking, H., 2009. Consumers' motivational associations favoring free-range meat or less meat. Ecol. Econ., 68(3), 850-860.

de Boer, J., Helms, M., Aiking, H., 2006. Protein consumption and sustainability: diet diversity in EU-15. Ecol. Econ., 59(3), 267-274.

Di Pasquale, J., Adinolfi, F., Capitanio, F., 2011. Analysis of consumer attitudes and consumers' willingness to pay for functional foods. International Journal on Food System Dynamics, 2(2), 181-93.

Draaisma, R.B., Wijffels, R.H., Slegers, P.E., Brentner, L.B., Roy, A., Barbosa, M.J., 2013. Food commodities from microalgae. Curr. Opin. Biotechn., 24(2), 169-177.

Dunlap, R.E., 2008. The new environmental paradigm scale: From marginality to worldwide use. J. Environ. Educ., 40(1), 3-18.

Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. J. Marketing Res., 18(1), 39-50.

Fox, N., Ward, K., 2008. Health, ethics and environment: a qualitative study of vegetarian motivations. Appetite, 50(2-3), 422-429.

Foxall, G.R., Bhate, S., 1993. Cognitive Style and Personal Involvement as Explicators of Innovative Purchasing of ″Healthy″ Food Brands. Eur. J. Marketing, 27(2), 5-16.

Goetzke, B., Spiller, A., 2014. Health-improving lifestyles of organic and functional food consumers. Brit. Food J., 116(3), 510-526.

Hoek, A.C., Luning, P.A., Stafleu, A., de Graaf, C., 2004. Food-related lifestyle and health attitudes of Dutch vegetarians, non-vegetarian consumers of meat substitutes, and meat consumers. Appetite, 42(3), 265-272.

Hoek, A.C., Luning, P.A., Weijzen, P., Engels, W., Kok, F.J., de Graaf, C., 2011. Replacement of meat by meat substitutes. A survey on person-and product-related factors in consumer acceptance. Appetite, 56(3), 662-673.

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31997R0258.

IFIC (2002), IFIC Annual Report 2002. Available at: https://www.ific.ca/wp-content/uploads/2013/09/2002-Annual-Report-to-Members-November-5-2002.pdf/4583/.

Janda, S., Trocchia, P.J., 2001. Vegetarianism: Toward a greater understanding. Psychol. Market., 18(12), 1205-1240.

Jarman, M., Lawrence, W., Ntani, G., Tinati, T., Pease, A., Black, C., Bird, J., Barker, M., 2012. Low levels of food involvement and negative affect reduce the quality of diet in women of lower educational attainment. J. Hum. Nutr. Diet., 25(5), 444-452.

Jöreskog, K. G., Sörbom, D., 2006. LISREL 8.80 for Windows [Computer software]. Lincolnwood, Scientific Software International.

Juhl, H.J., Poulsen, C.S., 2000. Antecedents and effects of consumer involvement in fish as a product group. Appetite, 34(3), 261-267.

Khan, R.S., Grigor, J.V., Win, A.G., Boland, M., 2014. Differentiating aspects of product innovation processes in the food industry: An exploratory study on New Zealand. Brit. Food J., 116(8), 1346-1368.

Khan, Z., Bhadouria, P., Bisen, P.S., 2005. Nutritional and therapeutic potential of Spirulina. Curr. Pharm. Biotechno., 6(5), 373-379.

Mai, R., Hoffmann, S., 2015. How to combat the unhealthy= tasty intuition: The influencing role of health consciousness. J. Public Policy Mark., 34(1), 63-83.

Marshall, D., Bell, R., 2004. Relating the food involvement scale to demographic variables, food choice and other constructs. Food Qual. Pref., 15(7-8), 871-879.

Marshall, D., Bell, R., 2003. Meal construction: exploring the relationship between eating occasion and location. Food Qual. Pref., 14(1), 53-64.

Menozzi, D., Sogari, G., Veneziani, M. Simoni, E., Mora, C., 2017. Eating novel foods : an application of the theory of planned behaviour to predict the consumption of an insect-based product. Food Qual. Pref., 59, 27-3.

Merchant, R.E., Andre, C.A., Wise, C.M., 2001. Nutritional supplementation with Chlorella pyrenoidosa for fibromyalgia syndrome: a double-blind, placebo-controlled, crossover study. J. Musculoskelet. Pain, 9(4), 37-54.

Molnar, S., Kiss, A., 2013. Comparative Studies on Accumulation of Selected Microelements by Spirulina Platensis and Chlorella Vulgaris with the Prospects of Functional Food Development. Journal of Chemical Engineering & Process Technology. DOI: 10.4172/2157-7048.10001722008.

Moons, I., De Pelsmacker, P., 2012. Emotions as determinants of electric car usage intention. Journal of Marketing Management, 28(3-4), 195-237.

Nuhu, A.A., 2013 Spirulina (Arthrospira): An important source of nutritional and medicinal compounds. Journal of Marine Biology, http://dx.doi.org/10.1155/2013/325636.

Oude Ophuis, P. A., 1989. Measuring health orientation and health consciousness as determinants of food choice behavior: Development and implementation of various attitudinal scales. Available at: http://agris.fao.org/agris-search/search.do?recordID=NL2012067364.

Park, H.J., Lee, Y.J., Ryu, H.K., Kim, M.H., Chung, H.W., Kim, W.Y. (2008). A randomized double-blind, placebo-controlled study to establish the effects of spirulina in elderly Koreans.Ann. Nutr. Metab., 52 (4), 322-8.

Parviainen, H., Elorinne, A.L., Väisänen, P., Rimpelä, A., 2017. Consumption of special diets among adolescents from 1999 to 2013: A population-based study in Finland. Int. J. Consum. Stud., 41(2), 216-224.

Pliner, P., Hobden, K., 1992. Development of a scale to measure the trait of food neophobia in humans. Appetite, 19(2), 105-120.

Pruitt, J., Grudin, J., 2003. Personas: practice and theory. Proceedings of the 2003 conference on Designing for user experiences ACM, 1-15.

Reynolds, T. J., Gutman, J., 1988. Laddering theory, method, analysis, and interpretation. J. Advertising Res., 28(1), 11-31.

Ricci, E.C., Banterle, A., Stranieri, S., 2018. Trust to go green: An exploration of consumer intentions for eco-friendly convenience food. Ecol. Econ., 148, 54-65.

Rogers, E.M. (1995), Diffusion of Innovations, fourth ed. The Free Press, New York.

Rozin, P., Fischler, C., Imada, S., Sarubin, A., Wrzesniewski, A., 1999. Attitudes to food and the role of food in life in the USA, Japan, Flemish Belgium and France: Possible implications for the diet-health debate. Appetite, 33(2), 163-180.

Ruiz de Maya, S., López-López, I., Munuera, J.L., 2011. Organic food consumption in Europe: International segmentation based on value system differences. Ecol. Econ., 70(10), 1767-1775.

Sautier, C., Tremolieres, J., 1975. Food value of the Spiruline algae to man. Ann. Nutr. Aliment., 29(6), 517-534.

Tobler, C., Visschers, V.H., Siegrist, M., 2011. Eating green. Consumers' willingness to adopt ecological food consumption behaviors. Appetite, 57(3), 674-682.

Urala, N., Lähteenmäki, L., 2007. Consumers' changing attitudes towards functional foods. Food Qual. Pref., 18(1), 1-12.

Urala, N., Lähteenmäki, L., 2004. Attitudes behind consumers' willingness to use functional foods. Food Qual. Pref., 15(7-8), 793-803.

van Dooren, C., Douma, A., Aiking, H., Vellinga, P., 2017. Proposing a novel index reflecting both climate impact and nutritional impact of food products. Ecol. Econ., 131, 389-398.

Verbeke, W., 2015. Profiling consumers who are ready to adopt insects as a meat substitute in a Western society. Food Qual. Pref., 39, 147-155.

Verbeke, W., 2006. Functional foods: Consumer willingness to compromise on taste for health? Food Qual. Pref., 17(1-2), 126-131.

Verbeke, W., 2005. Agriculture and the food industry in the information age. Eur. Rev. Agric. Econ., 32(3), 347-368.

Vermeir, I., Verbeke, W., 2008. Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values. Ecol. Econ., 64(3), 542-553.

Vigani, M., Parisi, C., Rodríguez-Cerezo, E., Barbosa, M.J., Sijtsma, L., Ploeg, M., Enzing, C., 2015. Food and feed products from micro-algae: market opportunities and challenges for the EU. Trends Food Sci. Tech., 42(1), 81-92.

World Health Organization (2015). Carcinogenicity of consumption of red and processed meat. International Agency for Research on Cancer Monographs.

www.brusselstimes.com/belgium/10514/greenpeace-says-belgium-continues-to-eat-too-much-meat

www.coherentmarketinsights.com/market-insight/spirulina-market-972.

www.eufic.org/en/food-production/article/functional-foods

www.spirulina.nu/spirulina.xhtml.

www.theguardian.com/world/2016/jun/20/chinas-meat-consumption-climate-change.

Table 1. Samples composition

		Sporting	Vegetarian	Foodie	Enjoyer
N		207	248	251	619
Gender					
	Male	59.0	39.1	31.5	45.4
	Female	41.0	60.8	68.5	54.6
Age:					
	18-29	49.3	48.4	31.1	22.0
	30-45	17.5	25.8	21.9	9.2
	46-55	16.9	14.1	23.1	22.6
	56+	16.3	11.7	23.9	46.2
Education					
	High school	26.8	23.3	26.8	37.6
	Higher	73.2	76.7	73.2	62.4

Notes: cells are percentages.

Table 2. Standardized structural Paths and global fit indices

Hypotheses	*Direct effects*	*Sporting*	*Vegetarian*	*Foodie*	*Enjoyer*
H1	HC→AI	.26**	.30**	.33**	.17**
H2	FI→AI	.03(ns)	-.07(ns)	-.02(ns)	.07*
H3	FN→AI	-.09(ns)	-.12(ns)	-.19*	-.14*
H4	CT→AI	.20*	.14*	.20**	.25**
H5	EC→AI	-.19(ns)	-.10(ns)	.01(ns)	-.04(ns)
Controls					
	Age→AI	.02(ns)	.15*	.05(ns)	.03(ns)
	Gender→AI	-.07(ns)	-.07(ns)	.05(ns)	.05(ns)
Global fit indices					
		$\chi^2(121)$=217.27 RMSEA=.05	$\chi^2(121)$=208.82 RMSEA=.05	$\chi^2(121)$=209.82 RMSEA=.05	$\chi^2(121)$=355.49 RMSEA=.05
		SRMR=.06	SRMR=.05	SRMR=.05	SRMR=.05
		NFI=.91	NFI=.93	NFI=.93	NFI=.95
		NNFI=.95	NNFI=.97	NNFI=.97	NNFI=.96
		CFI=.96	CFI=.98	CFI=.97	CFI=.97

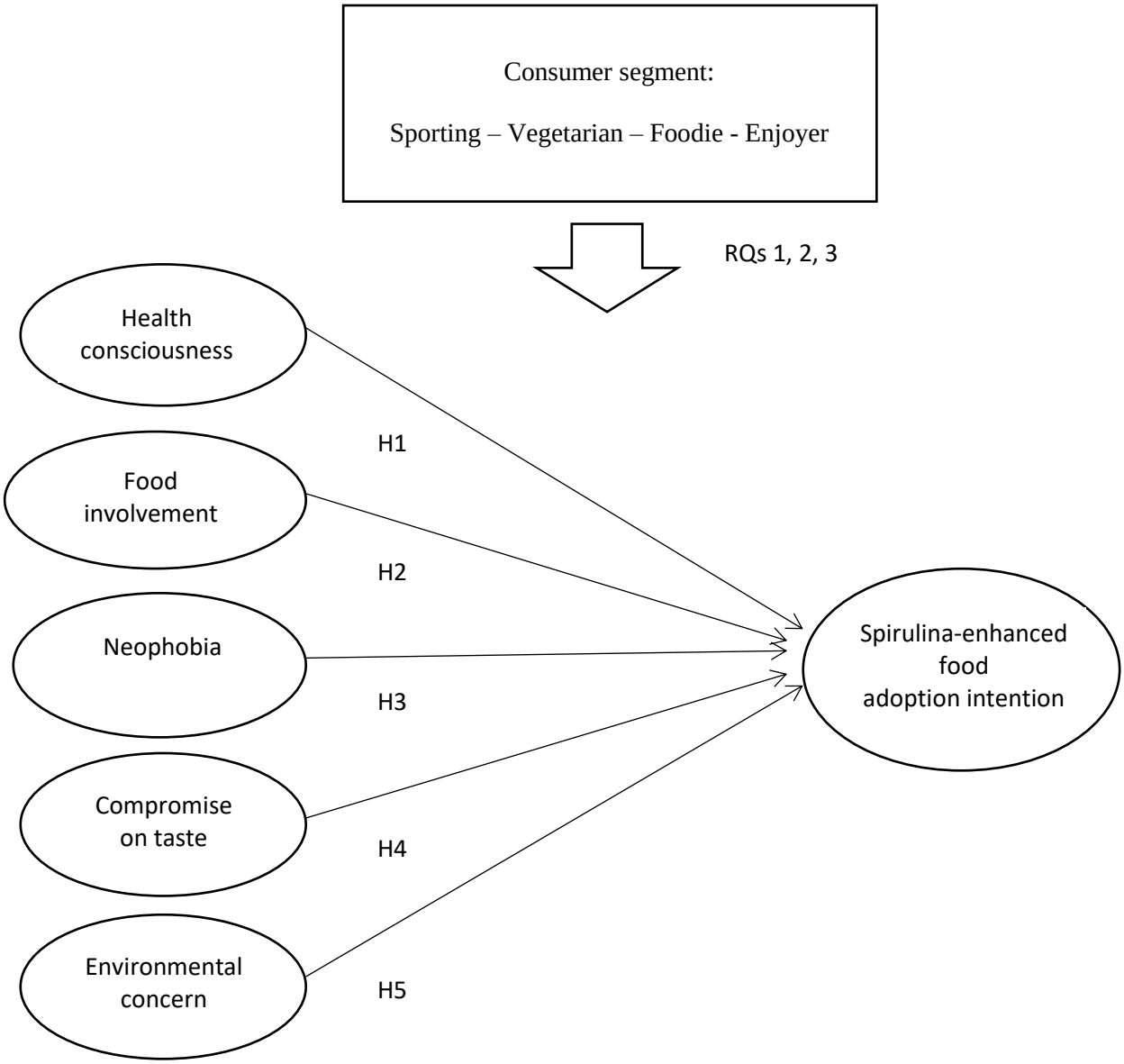
Notes: HC= Health consciousness; EC= Environmental concern; FI= Food involvement; FN= Food neophobia; CT= Compromise with taste; AI= Functional food adoption intention; **=p <.01, *=p<.05, (ns)= not significant because p>.05; Gender: 1=male; 2=female; Age: 1=18-45; 2=over 46.

Table 3. Multi-group Analysis and Structural Invariance

		1. Sporting vs. Vegetarian		*2. Sporting vs. Foodie*		*3. Sporting vs. Enjoyer*		*4. Vegetarian vs. Foodie*		*5.Vegetarian vs. Enjoyer*		*6. Foodie vs. Enjoyer*	
Hypotheses	*Direct effects*	$\Delta\chi^2(1)$	*p*	$\Delta\chi^2(1)$	*p*	$\Delta\chi^2(1)$	*p*	$\Delta\chi^2(1)$	*p*	$\Delta\chi^2(1)$	*p*	$\Delta\chi^2(1)$	*p*
H1	HC→AI	-.41	> .05	-.22	> .05	.87	> .05	.06	> .05	**4.26**	**< .05**	**4.46**	**< .05**
H2	EC→AI	.46	> .05	1.75	> .05	1.36	> .05	.17	> .05	.06	> .05	.07	> .05
H3	FI→AI	1.29	> .05	.18	> .05	**4.34**	**< .05**	.19	> .05	**3.90**	**< .05**	**3.85**	**< .05**
H4	FN→AI	1.86	> .05	**4.59**	**< .05**	**5.06**	**< .05**	**4.05**	**< .05**	**4.67**	**< .05**	.21	> .05
H5	CT→AI	.18	> .05	.02	> .05	1.77	> .05	.98	> .05	3.20	> .05	3.07	> .05

Notes: HC= Health consciousness; EC= Environmental concern; FI= Food involvement; FN= Food neophobia; CT= Compromise with taste; AI= Functional food adoption intention. Bolded results indicate that structural paths are significantly different between the two groups ($\Delta\chi^2(1) \rightarrow p < .05$).

Figure 1. Conceptual model



Note: Consumer gender and age are introduced in the model as covariates.

Appendix A. Item List per Construct , Measure Source and Measurement Model Assessment

Constructs and items	Construct s source	*Sporty (n=207)*					*Vegetarian (n=248)*					*Foody (n=251)*					*Enjoyer (n=619)*				
		M SD	λCFA	α	CR	AVE	M SD	λCFA	α	CR	AVE	M SD	λCFA	α	CR	AVE	M SD	λCFA	α	CR	AVE
Health consciousness (HC)		5.24		.85	.87	.64	5.14		.87	.89	.66	5.40		.88	.90	.69	4.50		.84	.85	.60
I have the impression that I sacrifice a lot for my health (HC1)	Oude Ophuis (1989)	1.13	.82				1.12	.83				1.14	.82				1.15	.74			
I consider myself very health conscious (HC2)			.93					.84					.88					.77			
I think that I take health into account a lot in my life (HC3)			.61					.68					.71					.67			
I have the impression that other people pay more attention to their health than I do (HC4- R)			.79					.88					.88					.89			
Environmental concern (EC)		4.74		.76	.80	.50	4.95		.78	.80	.50	4.88		.78	.80	.51	4.62		.77	.80	.50
When humans interfere with nature it often produces disastrous consequences (EC1)	Dunlap et al. (2008)	1.09	.60				1.08	.63				1.18	.69				1.09	.67			
The Earth is like a spaceship with very limited room and resources (EC2)			.70					.75					.80					.68			
The so-called “ecological crisis” facing humankind has been greatly exaggerated (EC3 - R)			.72					.59					.73					.58			
Humans are seriously abusing the environment (EC4)			.56					.58					.54					.57			
Food involvement (FI)		5.08		.80	.82	.70	5.31		.87	.88	.78	5.64		.74	.76	.61	5.14		.84	.86	.76
I don’t think about food every day (FI1 - R)	Bell and Marshall, 2003	1.26	.94				1.24	.93				1.12	.68				1.26	.77			
I don’t really enjoy cooking (FI2 - R)			.71					.84					.87					.95			
Food neophobia (FN)		2.98		.78	.80	.50	2.79		.76	.80	.51	2.55		.75	.80	.50	3.00		.80	.80	.51
Exotic food seems strange to me (FN1)		1.19	.72				1.13	.70				1.18	.62				1.35	.67			

At dinner parties, I will try new food (FN2 - R)	Pliner and Hobden (1992)	.65				.58				.67				.72					
I am afraid to try food that I do not know (FR3)		.64				.69				.65				.70					
I like trying out restaurants where they serve food from everywhere (FR4 - R)		.71				.70				.69				.75					
Compromise with taste (CT)		3.12 1.54		NA	NA	NA	3.27 1.61		NA	NA	NA	3.56 1.77		NA	NA	NA	2.83 1.47		NA	NA	NA
I accept functional foods even if they taste worse than conventional substitute foods	Verbeke (2005)	.98				.98				.98				.98					
Adoption intention (AI)		3.64 1.36		.90	.91	.77	3.74 1.59		.94	.95	.85	4.11 1.50	.94	.95	.85	3.18 1.46		.94	.94	.84
I have the intention to use Spirulina-enhanced food in the near future (AI1)	Moons and De Pelsmacker (2012)	.84				.89				.93				.92					
I will recommend the use of Spirulina-enhanced food (AI2)		.82				.94				.90				.87					
I have the intention to use Spirulina-enhanced food on a regular basis (AI3)		.95				.93				.93				.95					
		CFA				CFA				CFA				CFA					
		$\chi^2(121)$=217.27 RMSEA=.05 SRMR=.06 NFI=.91 NNFI=.95 CFI=.96				$\chi^2(121)$=208.81 RMSEA=.04 SRMR=.05 NFI=.93 NNFI=.97 CFI=.98				$\chi^2(121)$=209.82 RMSEA=.04 SRMR=.05 NFI=.93 NNFI=.97 CFI=.97				$\chi^2(121)$=355.48 RMSEA=.05 SRMR=.05 NFI=.95 NNFI=.96 CFI=.97				

Notes: λCFA=Factor loadings in confirmatory factor analysis; M=construct mean; SD=Standard deviation; α= Cronbach's alpha; CR=Composite reliability; AVE=Average variance extracted

Appendix B. Description of Spirulina

Spirulina is a type of algae that is currently sold as dietary supplements, but that can also be used as an addition to food products. Spirulina is a rich source of proteins, vitamins, amino-acids, minerals and anti-oxidants, and has a lot of potential health benefits. It enhances the immune system, and has anti-inflammatory and antiviral effects. It is beneficial in controlling cholesterol and fighting obesity and diabetes. Anti-oxidants protect the cell structure, and thus help to prevent cancers. Spirulina is considered as an ecological friendly food product since it only demands a limited production surface and has low greenhouse gas emission effects. Despite its benefits, it has the disadvantage of a specific taste and colour. Adding it to food gives the food product a fishy taste and it makes food look blue- or greenish.

Note: The description of Spirulina is based on:

Draaisma, R.B., Wijffels, R.H., Slegers, P.E., Brentner, L.B., Roy, A., & Barbosa, M.J. (2013). Food commodities from microalgae. *Current Opinion in Biotechnology*, *24*(2), 169-177.

Belay, A. (2008). Spirulina (Arthrospira): production and quality assurance. *Spirulina in Human Nutrition and Health*, 1-25.

Becker, E. W. (2007). Micro-algae as a source of protein. *Biotechnology Advances*, *25*(2), 207-210.

Nuhu, A.A. (2013) Spirulina (Arthrospira): An important source of nutritional and medicinal compounds. *Journal of Marine Biology*, http://dx.doi.org/10.1155/2013/325636.