



Research report

Replacement of meat by meat substitutes. A survey on person- and product-related factors in consumer acceptance

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ABSTRACT

What does it take to increase the consumption of meat substitutes and attract new consumers? We identified main barriers and drivers by a consumer survey ($n = 553$) in the U.K. and the Netherlands. Person-related factors (food neophobia and food choice motives) and product-related attitudes and beliefs towards meat and meat substitutes were compared between non-users ($n = 324$), light/medium-users ($n = 133$) and heavy-users of meat substitutes ($n = 96$). Consumer acceptance was largely determined by the attitudes and beliefs towards meat substitutes and food neophobia. Key barriers for non-users and light/medium-users were the unfamiliarity with meat substitutes and the lower sensory attractiveness compared to meat. In addition, non-users had a higher tendency to avoid new foods. Hence, the less consumers were using meat substitutes, the more they wanted these products to be similar to meat. Although non-users and light/medium-users did recognize the ethical and weight-control aspects of meat substitutes, this was obviously less relevant to them. Actually, only heavy-users had high motivations to choose ethical foods, which explains their choice for meat substitutes. In order to make meat substitutes more attractive to meat consumers, we would not recommend to focus on communication of ethical arguments, but to significantly improve the sensory quality and resemblance to meat.

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Introduction

Developing new food products that are attractive to consumers is a challenge (Costa & Jongen, 2006; Stewart-Knox & Mitchell, 2003; Van Trijp & Van Kleef, 2008). However, it is even more complex when these new foods are meant as a substitute for products that are highly appreciated, like meat (Wansink, Sonka, Goldsmith, Chiriboga, & Eren, 2005). This challenge is faced by researchers and developers of new sustainable meat substitutes that need to reduce the negative environmental impact of industrial-scale meat production for human consumption (Aiking, De Boer, & Vereijken, 2006; Helms, 2004; Jongen & Meerdink, 2001). A consequence of this environmental objective is that the focus is not only on consumer acceptance of meat substitutes in itself, but also on the potential of these products to actually replace meat in a meal. These new meat substitutes are thus not intended for vegetarians but need to attract new consumers, namely current

meat consumers, and ought to facilitate meat avoiders to decrease their consumption of meat even further. To generate input for product development and promotion strategies to increase the consumption of meat substitutes, more insight is needed on drivers and barriers among different consumer groups to use these products.

Meat substitutes: the state of affairs

Meat substitutes, also referred to as meat replacers, meat alternatives, or meat analogs (Davies & Lightowler, 1998; Kuntz, 1995; McIlveen, Abraham, & Armstrong, 1999; Sadler, 2004), are primarily vegetable based food products that contain proteins made from pulses (mainly soy), cereal protein, or fungi. There was a sharp increase in the consumption of these products around 2001 after a number of food safety crises (B.S.E., food and mouth disease) in the meat sector in the Netherlands (De Steur, 2001; PVE, 2003; Sadler, 2004). Soon after that period, the growth in the market stabilised (PVE, 2004) and sales of organic meat substitutes even decreased (Biologica, 2006). In fact, the quantity of consumed meat only slightly decreased (−2%) over the years 2000–2008 (Centraal Bureau voor de Statistiek, 2008). Market shares of meat substitutes

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are estimated at no more than 1–2% of the total Dutch meat market (Anonymous, 2004). Besides the quantity, also the frequency of consumption of meat substitutes is low. Meat is consumed 3 times a week or more by 80% of Dutch consumers in contrast to meat substitutes that are used by most meat substitute consumers only one or two times a week or even less (Aurelia, 2002). The difficulty with establishing a broad acceptance of meat substitutes is probably related to several aspects. Firstly, these types of products are relatively new. Soy products, such as tofu & tempeh, appeared on the Western market in the 1960s, while other meat substitutes (e.g. Tivall and Quorn) were introduced less than 25 years ago (Davies & Lightowler, 1998; McIlveen et al., 1999; Sadler, 2004). Even new sources of protein have been applied, such as mycoprotein for the product Quorn (Peregrin, 2002). Secondly, a large difference in the perceived product quality of meat and meat substitutes is likely to play an important role. Both experience quality attributes such as convenience, freshness, and sensory characteristics, and credence quality attributes (e.g. healthiness) are important for consumer's buying behaviour of meat. Meat is especially appreciated for its sensory properties, its unique taste and texture (Grunert, Bredahl, & Brunsø, 2004; Issanchou, 1996). A few studies investigated consumers' evaluation of both meat and meat substitutes and found that meat substitutes stayed behind in overall evaluation and in particular the sensory appreciation, but also on other attributes such as price and luxury (Aiking et al., 2006; McIlveen et al., 1999; Van der Lans, 2001; Van Trijp, 1991). Current meat substitutes may be three to four times more expensive than meat products (Apaiah, 2006). However, meat substitutes did score higher on animal and environmental friendliness attributes compared to meat (Van der Lans, 2001). Meat substitute products are currently primarily aimed and used by vegetarians and semi-vegetarians and have a strong emphasis on health and ethical quality aspects (Hoek, Luning, Stafleu, & de Graaf, 2004; Janda & Trocchia, 2001; Kuntz, 1995; McIlveen et al., 1999; Sadler, 2004).

In short: there seem to be a discrepancy between meat and meat substitutes with respect to the frequency of use, degree of newness, product quality attributes, and their types of consumers.

Theoretical background and framework of the study

There are two approaches from different fields that can be used to obtain more insight how to increase the usage frequency of certain products: usage segmentation and the Stages of Change model.

Usage segmentation uses behavioural variables (e.g. brand usage, product category usage, product usage) as a means to construct market segments. Consumers are divided in segments according to their level of use or user status, such as heavy-users, medium-users, light-users and non-users. The advantage of this approach is that it differentiates actual product usage, as opposed to psychographic segmentation that groups consumers based on personality and lifestyle (Assael, 1995; Kotler, Armstrong,

Saunders, & Wong, 1999; Weinstein, 2004). The profiles of light and non-users are especially worthwhile to investigate further, because they are what heavy-users used to be (Wansink, Sonka, & Park, 2001). Companies target consumers by usage category in order to increase consumption and thereby 'move them up the usage ladder' (Weinstein, 2004).

From the health-related behavioural field, there is a model that considers changes in (consumption) behaviour over time: the Stages of Change model (Prochaska & DiClemente, 1982, 1983; Prochaska, DiClemente, & Norcoss, 1992). Prochaska and others proposed that change occurs through a series of stages or also referred to as a sequence of cognitive and behavioural steps (Kristal, Glanz, Curry, & Patterson, 1999): precontemplation (unaware, not interested in change); contemplation (thinking about changing); decision or preparation (making definite plans to change), action (actively modifying behaviour) and maintenance (maintaining the new, favourable behaviour). In relation to eating behaviour, these stages correspond with the balance between the perceived benefits and barriers to change one's diet. The model has been used to describe behaviour towards a healthier diet, mostly on an increase in fruit and vegetable consumption or a reduction in fat intake – see the review by Spencer, Wharton, Moyle, and Adams (2007). The practical implication of this model is that these processes of change can guide intervention programs or communication strategies that are stage-matched, which means they are specifically designed to match the cognitive/behavioural state of individuals in a certain stage of change (Kristal et al., 1999).

We used the key characteristics of the approaches described above as a framework for a study to identify underlying drivers and barriers in consumer acceptance of meat substitutes. A basic element was that the degree of consumer acceptance is indicated by current consumption behaviour, which was used for segmentation. Individuals were assigned to one user group according to their usage of the product category meat substitutes (non-users, light/medium-users, and heavy-users). Secondly, we assumed that there is a temporal pattern: heavy-users changed from non- to light/medium-users over time. Thirdly, the movement to another acceptance level is under influence of particular drivers and barriers, which differ between the different levels of acceptance. We hypothesized that these drivers and barriers are factors related to the personal influences on the choice of certain foods in general, such as food neophobia and food choice motives, and factors that are related to the product namely attitudes and beliefs specifically towards meat and meat substitutes (see Table 1). The expected role of each of these factors is briefly discussed below.

Food neophobia is the tendency to avoid new foods and was conceptualised by Pliner and Hobden (1992) as a personal trait that can be quantified by the Food Neophobia Scale (FNS). Several studies have shown that it is related to the extent in which consumers accept new and/or unusual foods (e.g. Henriques, King, & Meiselman, 2009; Olabi, Najm, Baghdadi, & Morton, 2009; Raudenbush & Frank, 1999; Tuorila, Lähteenmäki, Pohjalainen,

Table 1
Summary of hypothesized drivers and barriers to use meat substitutes more frequently.

			Non-user to light/medium-user	Light/medium-user to heavy-user
Drivers →	Person-related	Food choice motives	High interest in health, ecological welfare and weight control	Particularly high interest in ecological welfare
	Product-related	Attitudes and beliefs	More positive about meat substitutes than meat, e.g. for health and sensory aspects	Much more positive about meat substitutes than meat, e.g. for sensory and ecological welfare aspects
Barriers ←	Person-related	Food neophobia	Food neophobic	
	Product-related	Food choice motives	High interest in sensory appeal, price and familiarity	
		Attitudes and beliefs	Much more positive about meat than meat substitutes, e.g. for health, sensory, luxury aspects, satiety, 'power' image, and price	More positive about meat than meat substitutes, e.g. for convenience and social influence

& Lotti, 2001). Since meat substitutes are relatively new products on the market, we expected that especially food neophobia acts as a barrier on the first trial with meat substitutes, in other words that current non-users would be relatively food neophobic (see Table 1). We assumed that food neophobia would not act as a major barrier on light/medium-users to increase their consumption of these products further because previous consumption generally has a positive effect on acceptance (Pliner, Pelchat, & Grabski, 1993; Raudenbush & Frank, 1999; Tuorila, Meiselman, Bell, Cardello, & Johnson, 1994).

Food choice motives, i.e. the importance that individuals attach to factors such as health, price, sensory appeal and convenience, are also of influence in the choice for certain foods (Pollard, Steptoe, & Wardle, 1998; Steptoe, Pollard, & Wardle, 1995). There are few studies available in the public domain that have assessed food choice motives specifically with respect to meat substitutes, but there are publications on comparable moderate shifts in the diet, like semi-vegetarianism, eating less red meat, eating a plant-based diet, and so on. There are usually multiple motives behind these types of dietary choices, such as a higher interest in health, weight control and the natural content of foods, and a higher concern for animal welfare and environmental issues. In contrast, strict vegetarians seem to have less diverse reasons and are primarily motivated by compassion for animal welfare and the environment (Hoek et al., 2004; Janda & Trocchia, 2001; Lea, Crawford, & Worsley, 2006; Lindeman & Sirelius, 2001; Lindeman & Väänänen, 2000; Pollard et al., 1998; Santos & Booth, 1996). Based on these findings we hypothesized that initial drivers to become a light/medium-user of meat substitutes would be a greater importance attached to the food choice motives health, natural content, weight control and ecological welfare (includes animal welfare and environmental issues), see Table 1. Heavy-users of meat substitutes would probably be more dissociated from meat, alike vegetarians. We therefore expected that a high interest in ecological welfare with respect to foods would be a strong driver to increase the consumption of meat substitutes towards heavy usage.

Particular motives can also act as barriers on the acceptance of meat substitutes. Verbeke and Vackier (2004) described how some meat consumers are mainly hedonic-oriented when making food consumption decisions. In general, meat lovers seem to be largely driven by sensory aspects, price, a sense of tradition, and less by a concern about methods of meat production (Grunert, 1997; Issanchou, 1996; Richardson, Shepherd, & Elliman, 1993; Verbeke & Vackier, 2004). Based on this information and an explorative study (unpublished results), we expected that a higher interest in sensory appeal, price and familiarity in food choice would be major barriers for non-users to become light/medium-users of meat substitutes (see Table 1). The influence of other food choice motives on the acceptance of meat substitutes, such as mood, convenience, and political values, was investigated as well. Consumers who are heavily involved in the ethical aspects of foods, might find other aspects, for example price, of lesser importance (e.g. Vanhonacker & Verbeke, 2009). Therefore we did not expect that other food choice motives would act as barriers to become a heavy-user (see Table 1).

Besides the general personal factors food neophobia and food choice motives, product-related attitudes and beliefs towards meat and meat substitutes are likely to play a role in the choice for these products. The attitude towards a product becomes more or less favourable depending on how well product attributes match consumers' goals. The choice between alternatives (i.e. meat or meat substitutes) will subsequently be determined by the beliefs about these products and the trade-off between the positive and negative consequences consumers expect after buying (Brunson, Scholderer, & Grunert, 2004; Grunert et al., 2004; Kotler et al.,

1999). In the previous section we described how meat attributes and meat substitute attributes are perceived to be different. We therefore assumed that a more positive attitude towards meat substitute attributes than meat attributes acts as a driver, and when this difference is even higher the consumption of meat substitutes can increase to heavy usage (see Table 1). Specific attitudes and beliefs might play a role between user groups: a more positive attitude towards sensory and health aspects of meat substitutes acting as a driver to progress from non-user to light/medium-user, while attributes related to ecological welfare might come into play from light/medium-users to heavy-users. The other way around, a more positive attitude towards meat attributes can act as a barrier. As for health for example, this is in line with previous findings that the perceived healthiness of meat predicts the degree of meat consumption (Lea & Worsley, 2001; Richardson et al., 1993). Since meat is generally less expensive than meat substitutes in the supermarket, the lower perceived price of meat might also be a barrier. Other studies have shown that a premium for organic alternatives (organic meat) was a critical limiting factor in consumer acceptance (Grunert et al., 2004; Van Loo et al., 2010). We thought also that strong beliefs related to symbolic meanings of meat (e.g. power, masculinity) and being a central part of a proper meal (e.g. satiating power) (Allen & Baines, 2002; Fiddes, 1991; Holm & Møhl, 2000; Meiselman, 2000) would have a negative effect on acceptance of meat substitutes. In addition, more practical constraints would come up when products are actually used, such as the perceived convenience aspects of meat and a positive social influence of other household members to have meat for dinner. These might act as barriers to use meat substitutes more frequently among light/medium-users to become heavy-users.

When meat substitutes share certain attributes with meat they might be more attractive to certain consumers. Tuorila et al. (1994) suggested that there is positive bias to the familiar and that resemblance to a more familiar food increases liking. Conversely, individuals who avoid the consumption of meat might have a higher tendency to dislike products that are similar or remind them to meat (Fessler, Arguello, Mekdara, & Macias, 2003; Rozin, Markwith, & Stoess, 1997). We therefore wanted to explore whether persons who are more positive about meat and its attributes would prefer meat substitutes that are more similar to meat and vice versa. We expected that light/medium-users would like to see meat-like product characteristics in a meat substitute, while heavy-users would prefer meat substitutes that are less similar to meat.

In summary, this paper describes which drivers and barriers act on the acceptance of meat substitutes by comparing different user groups (non-users, light/medium-users and heavy-users of meat substitutes) for factors that affect food choice in general (personal influences food neophobia and food choice motives), and specifically the choice for meat or meat substitutes (product-related attitudes and beliefs).

Methods

We performed a cross-national consumer survey in two Western European countries with different acceptance levels of meat substitutes in order to obtain respondents with varying degrees of usage. The U.K. market for meat substitute products is considered one of the most developed in the world. For example, Quorn was introduced first in the UK and more than 5 years later available in other Western European countries (Sadler, 2004), such as the Netherlands. We therefore selected the United Kingdom (UK), with a relatively high acceptance of these products and the Netherlands (NL), having a lower level of acceptance. This approach offered the possibility to compare different user groups

Table 2
Recruitment scheme for respondents.

	United Kingdom	The Netherlands
Cities	Bristol	Amersfoort
Towns	Tetbury	Soest, Veghel
Supermarkets	Tesco, Somersfield, ASDA, Sainsbury's, Safeway, Waitrose	Albert Heijn, C1000, Lidl, Super de Boer, Edah, Jumbo, Aldi
Distributed questionnaires	1500	750
Returned questionnaires (response rate)	253 (16%)	318 (42%)

within and between countries for the factors put forward that could play a role in replacement of meat by meat substitutes.

Respondents

Table 2 gives an overview of the recruitment scheme of this study. Respondents were recruited at supermarket exits in cooperation with a market agency in 2003. Several supermarkets were selected to obtain a sample reflecting consumers that shop at different chains of supermarkets with varying price range in both cities and smaller towns. Most of the questionnaires (80%) were distributed in the cities. Across weekdays, weekend days and at different points in time, respondents were personally asked to fill out a questionnaire at home. The questionnaire was entitled 'Eating habits and Eating preferences' to avoid a direct reference to meat or meat substitutes. Some of the respondents (19% of total sample) also participated anonymously in a short oral survey about meat substitutes performed by the marketing agency (results not described in this study). Finally, 235 English and 318 Dutch questionnaires were returned to the research team. Differences in response rates can probably be explained by the fact that Wageningen University is a very well known university in the Netherlands and obviously less known by the public in the U.K. Each respondent received an incentive of a national lottery ticket (equals ± 3 Euros) after sending back the questionnaire. The obtained consumer samples from the UK and the Netherlands were comparable for socio-demographic characteristics, although Dutch consumers were somewhat higher in age and had more children (see Table 3).

Based on information about the frequency of use of meat substitute products (Aurelia, 2002), respondents were classified into three categories of user status within each country: non-users (meat substitute consumption categories: never; tried it once), light/medium-users (meat substitute consumption categories: less than

once per month; once per month or more, but less than once per week), and heavy-users (meat substitute consumption categories: once a week or more). Although vegetarians were not our primary interest with regard to the background of this research, in some of the analyses this group was taken separately to examine if non-vegetarian users of meat substitutes were driven by the same motives or shared other characteristics (Hoek et al., 2004). In order to avoid diverse interpretations of the term 'vegetarian' with respect to the omission of different types of meat and other animal food sources in the diet, this was not specifically stated as a dietary lifestyle question within this survey. Vegetarians were identified on the basis of their frequency of meat consumption (as applied in Dutch Food Consumption surveys, see Hulshof, Kistemaker, & Bouman, 1998): less than once a week (meat consumption categories: never; less than once a week).

We also used the stage algorithm as a means to combine current consumption rates with the length of time of a person's meat substitute consumption and the person's intentions for the future. As a first step to use the Stages of Change model for segmentation of consumers in relation to acceptance of meat substitutes, we used similar time frames to assess maintenance of the consumption behaviour (6 months) and future intentions (coming month and coming 6 months), as previously used in studies of dietary behaviour change (Kristal et al., 1999). The following five categories were derived: (1) precontemplators (current consumption of meat substitutes less than once a week and no intention to use these products more frequently), (2) contemplators (current consumption of meat substitutes less than once a week and intention to use these products more frequently in the coming 6 months, but not in the coming month), (3) consumers in preparation (current consumption of meat substitutes less than once a week and intention to use these products more frequently in the coming month), (4) consumers in action (current consumption of meat substitutes once a week or more, for less than 6 months), (5) consumers in maintenance (current consumption of meat substitutes once a week or more, for at least 6 months).

Questionnaire

The total questionnaire (127 items) consisted of several sections, from food choice in general towards specific questions about meat and meat substitutes successively: Food Neophobia Scale (FNS), Food Choice Questionnaire (FCQ), Consumption of meat and meat substitutes, Attitudes and beliefs towards meat and meat substitutes, Desired product characteristics, and Socio-demographic characteristics. Separate parts of the total questionnaire were previously tested by pilot studies. There was only one version of the questionnaire: the items of FNS and FCQ were listed in the same order as the original questionnaires (described below), and for practical reasons we kept the order of the remaining items unchanged for all distributed questionnaires. Translations were performed by a professional translation agency (AVB, Amstelveen, The Netherlands) using a translation and back translation procedure with different translators (FNS and FCQ translated from English to Dutch, self-developed parts from Dutch to English).

Socio-demographic characteristics

Based on previous studies (Hoek et al., 2004; Lea & Worsley, 2001), basic socio-demographic data were assessed that could be a factor in the substitution of meat in the diet: date of birth, sex, number of adults in household (aged 18 or older), number of children living at home (younger than 18), education level (6 classes from elementary education to polytechnic or university education), and address details.

Table 3
An overview of the sample characteristics.

	United Kingdom	Netherlands	Total sample
Sample size: <i>n</i>	235	318	553
Age: mean (SD)	40.9 (15.4) ^a	44.9 (14.6) ^a	43.2 (15.0)
Females: %	61.2	68.4	65.3
Household size: mean (SD)	2.8 (1.5)	2.9 (1.3)	2.8 (1.4)
Children in household: %			
0	75.9 ^b	61.1 ^b	67.3
1 or 2	19.3 ^b	31.8 ^b	26.6
≥ 3	4.8 ^b	7 ^b	6.1
Education: %			
Low	4.3	8.3	6.6
Medium	28.3	25.9	26.9
High	67.4	65.8	66.5

^a Significant difference in age ($t(1, 530) = -3.1, p < 0.003$).

^b Significant difference in percentage of children ($\chi^2(1, 542) = 10.5, p < 0.002$).

Consumption of meat and meat substitutes

To avoid any ambiguity about the term 'meat'¹ and 'meat substitute'² this was specified prior to this section of the questionnaire. We also specified the type of meal at which these products are eaten, namely the main hot meal of the day, in order to exclude cold meat (substitute) products, such as those eaten with lunch. These products were not within the scope of this research. Enquiries were made about the respondents' usual consumption of meat and meat substitute products during the hot meal using the following answering categories for the frequency of meat consumption: never; less than once per week; once or twice per week; three or four times per week; five times or more per week. Categories used for the consumption of meat substitutes were: never; tried it once; less than once per month; once per month or more, but less than once per week; once or twice per week; three or four times per week, five times per week or more. Other questions related to consumption meat substitutes were: 'When did you start using meat substitutes?' (categories: less than 1 month ago; 1–6 months ago; 6–12 months ago; 1–5 years ago; 5–10 years ago; 10 or more years ago), 'Do you expect to eat meat substitutes more frequently during the coming 6 months?' (yes/no), 'Do you intend to eat meat substitutes more frequently during the coming month?' (yes/no).

Food Neophobia Scale (FNS)

The ten-item questionnaire developed by *Pliner and Hobden (1992)* was used to assess the trait food neophobia and rated on a 7-point scale ranging from 'strongly disagree' to 'strongly agree'.

Food Choice Questionnaire (FCQ)

As a measure for food choice motives, we used FCQ (*Stephens et al., 1995*) supplemented with three scales on ethical food choice (*Lindeman & Väänänen, 2000*), due to the role of vegetarian or other ethical motives in the replacement of meat by meat substitute products. The 11 motives assessed by the extended FCQ were: *health* (6 items), *mood* (6 items), *convenience* (5 items), *sensory appeal* (4 items), *natural content* (3 items), *price* (3 items), *weight control* (3 items), *familiarity* (3 items), *ecological welfare* (5 items), *political values* (4 items), and *religion* (2 items). The 44 items were prefaced by the statement: 'It is important to me that the food I eat on a typical day...'. To be consistent with the other parts of the questionnaire, we used a 7-point scale ranging from 'strongly disagree' to 'strongly agree' (comparable to the categories described by *Prescott, Young, O'Neill, Yau, & Stevens, 2002*) as an alternative for Stephens's four categories ('not at all important' to 'very important'). Since texture³ has not a commonly used equivalent in the Dutch language ('textuur') this was clarified in both the English and Dutch questionnaire.

Attitudes and beliefs towards meat and meat substitutes

Because we were particularly interested in the attitudes of consumers towards meat and meat substitutes, and not only in general food choice motives, we developed a 45-item question-

¹ The term *meat* refers to all meat products eaten during the main hot meal of the day, varying from steak and schnitzel to cubes of ham, pieces of bacon or minced meat in sauces. In this survey meat also includes poultry such as chicken or turkey, but not fish. It also does not include cold meat products used for sandwiches such as sausage or ham.

² The term *meat substitutes* refers to protein-containing foods that are primarily vegetable-based and that replace the function of meat as a meal component used for hot meals. Examples include vegetarian schnitzels, burgers, tofu, tempeh, and stir-fry products. These products can also be meal components in ready-made meals. It does not include fish, eggs, cheese, nuts or legumes.

³ The term *texture* refers to the characteristics you perceive when you have the food in your mouth and/or when you chew it. Examples include: hard, soft, crispy, granular, juicy, tough, etc.

naire for this purpose. The topics of FCQ were rewritten towards product-specific statements. For example, the FCQ item *weight control* 'It is important to me that the food I eat on a typical day is... low on fat' was converted to 'These products are low in fat'. The ethical aspects (original FCQ scales *ecological welfare*, *political values* and *religion*) were combined into *ethical*, which were 3 items on animal friendliness, environmentally friendliness, and ethical production. We also extended the attitudes and beliefs items with the hypothesized aspects that might play a role in the acceptance of meat substitutes: *luxury* (e.g. 'These products are suitable for special occasions'), *social influence* (e.g. 'My fellow household members don't like to eat these products'), *power* (e.g. 'These products give me strength') and *satiety* (e.g. 'These products are not very filling'). Respondents without a fellow household member were allowed to skip the *social influence* items. In relation to *natural content*, one statement was included on genetic modification ('These products are genetically modified') with an explanation of this term.⁴ As a result, the attitudes and beliefs section of the questionnaire covered 13 different themes in total. Each item was rated for both meat and meat substitutes on a 7-point scale from 'strongly disagree' to 'strongly agree', in order to determine the relative differences between meat substitutes and meat for all these different aspects. This enabled us to identify which characteristics of meat substitutes are perceived as positive or negative compared to meat.

Desired new meat substitute attributes

To explore the degree of desired similarity to meat, we generated fourteen statements (semantic differential scales) that were rated after the question: 'What characteristics should a new meat substitute have for you to eat it with your hot meals on a regular basis?'. In addition, it was explicitly stated that respondents could indicate what they thought was desirable for them, and that ratings did not necessarily had to be based on existing meat substitute products. The statements reflected several intrinsic and extrinsic product attributes (one statement for each characteristic) based on qualitative pre-studies: sensory attributes (anchored little-much similar to meat): texture, taste, appearance, and smell. Nutritive attributes (anchored less-more than meat): protein, calories, and vitamins & minerals. Extrinsic attributes and preparation (anchored little-much similar to meat): product name, preparation, and packaging. Extrinsic attributes (anchored less-more than meat): price, indicated shelf life, distance from meat display, and contents of the package.

Data analyses

Socio-demographic and consumption characteristics were compared across user groups, and between the UK and the Netherlands by *t*-tests, ANOVA and χ^2 -tests. We investigated the correlation between meat consumption and meat substitute consumption with a Kendall's tau-*b* correlation coefficient. The validity of the FNS was explored by a free principal component analysis (varimax rotation) with reversed positive items. Two (UK) or three (NL) factors were derived, so unidimensionality could not be guaranteed for all the items. In the UK sample the first factor explained 42% of the variance and in the NL 33% of the variance. The internal consistencies for the ten items calculated were somewhat higher for the UK (Cronbach alpha = 0.84) than for NL (Cronbach alpha = 0.76). (Ratings for item 3 and 8 might be influenced by vegetarians who try to

⁴ Genetically modified means that hereditary materials has been modified in order to change the characteristics of plants, animals, bacteria, fungi or yeasts' (*Voedingscentrum*).

Table 4
User groups and frequency of meat and meat substitute consumption.

		Consumer group	UK	NL	Total sample
Sample size: <i>n</i>			253	318	553
Meat consumption: %	<1× per week	Vegetarians	10.3 ^a	6.0 ^a	7.8
	1–4× per week		61.5 ^a	41.5 ^a	50.0
	>5× per week		28.2 ^a	52.5 ^a	42.2
Meat substitute consumption: %	Never, seldom	Non-users	44.7 ^b	68.9 ^b	58.6
	<1× per week	Light/medium-users	35.3 ^b	15.7 ^b	24.1
	>1× per week	Heavy-users	20.0 ^b	15.4 ^b	17.4

^a Significant difference in meat consumption between countries ($\chi^2(1, 552) = 28.8, p < 0.001$).

^b Significant difference in meat substitute consumption between countries ($\chi^2(1, 553) = 19.0, p < 0.001$).

avoid animal substances, therefore we repeated the analyses with vegetarians excluded. This resulted in an improvement of the UK loadings (all on Factor 1) but did not result in any differences in the NL sample.) Since our samples were rather small and not representative samples, we did not have enough support to eliminate certain items and therefore we performed the analyses (*t*-tests, ANOVA) with the total scores of the 10 items as an indicator of food neophobia. With respect to FCQ, factor loadings on the 11 factors were largely similar to the factors described by Lindeman and Sirelius (2001) and Pollard et al. (1998) for both country samples and Cronbach alpha's were in general fairly high (0.55–0.91). The FCQ factors were compared between user groups, and countries by ANOVA and *t*-tests. The internal structure of the self-developed product-related attitudes and beliefs questionnaire largely maintained after confirmatory factor-analysis, and Cronbach alpha's ranged from 0.43 to 0.79. Differences between user groups were investigated by ANOVA on relative scores (ratings for meat – ratings for meat substitutes, to illustrate the gap between the two type of products). Finally, we constructed an overall regression model (CATREG) to predict the consumption level of meat substitutes. CATREG is a categorical regression procedure with optimal scaling, which can be used when there is a combination of nominal, ordinal and interval independent variables (Dusseldorp & Meulman, 2001; Van der Kooij, Meulman, & Heiser, 2006). The dependent variable was the degree of meat substitute consumption (non-users, light/medium-users, and heavy-users) and the independent variables were the total FNS score, the 11 FCQ factors, the 13 product-related attitudes and beliefs, and 5 socio-demographic variables (country, household size, sex, age, education). We did not include interaction terms in the model. The explained variance was moderate (adjusted *R*-square 47%), however the results are reported to illustrate the relative importance of each of the variables.

We also wanted to investigate whether the classification into stages of change led to different conclusions than with user group classification. However, the number of respondents in the contemplation (*n* = 7), preparation (*n* = 8) and action phase (*n* = 14) was too small for analyses, therefore the stages of change were rearranged into three stages: precontemplation, contemplation/preparation, and maintenance/action (similar to stages by Lea et al., 2006). We repeated the analyses described above for the rearranged stages of change, and checked the results with those obtained by the user group classification (not reported in this paper). The picture remained largely the same, as the respondents in contemplation/preparation were not found to be different from respondents in precontemplation. Results are therefore only reported for the user group classification, which is more evenly distributed.

With respect to the handling of missing values and respondent's compliance; we went manually through all questionnaires and checked for dishonest answer patterns, which was not observed. Only 19 respondents were found to have missings in 2 or more sections of the questionnaire.

Respondents were excluded from calculation of total scores (FNS, FCQ factors, product-related attitudes and beliefs), when they had one or more missing values in that particular section of the questionnaire. Cases with missing values were excluded analysis by analysis, cases used in the analysis were *n* = 538 for FNS, *n* = 545–553 for FCQ factors, *n* = 470–525 for product-related attitudes and beliefs, *n* = 543–546 for desired meat substitute attributes, *n* = 361 for CATREG with user groups as dependent variable. All analyses were conducted with SPSS statistical software (version 11.0 and 17.0) and *p*-values below 0.05 were considered statistically significant.

Results

Socio-demographic and consumption characteristics

In general, heavy-users of meat substitutes were a minority among the respondents, and there were more light/medium-users and heavy-users in the UK sample than in the NL sample. Vegetarians represented only a small portion of the samples (see Table 4). The heavy-user group contained 84% of the Dutch vegetarians while for the UK 46% of the vegetarians were in the heavy-user group. The most important difference in socio-demographic profile between user groups was the level of education: non-users were relatively lower educated than light/medium-users (UK: $\chi^2(1, 185) = 3.9, p < 0.05$, NL: $\chi^2(1, 264) = 4.0, p < 0.05$) and in the UK non-users had also a lower education than heavy-users ($\chi^2(1, 148) = 5.0, p < 0.03$). Other socio-demographic characteristics of user groups were slightly different between the two country samples: UK non-users (mean age 43.9 years) were older than light/medium-users (mean age 38.3 years) and heavy-users (mean age 38.7 years) ($F(2, 224) = 3.57, p < 0.04$). There were no significant differences in age between NL user groups. There were also more females (80.4%) among the UK heavy-users than in the non-user (54.8%) and light/medium-user groups (58.5%) ($\chi^2(2, 232) = 9.2, p < 0.02$). There were no differences in sex distribution between the NL user groups.

We found that meat substitutes were actually used as a replacement of meat in the diet. Approximately one-third of the heavy-users of meat substitutes ate meat less than once a week, while 74% of the respondents who ate meat 5 times per week or more, had never or rarely used a meat substitute. The replacement of meat by meat substitutes is also demonstrated by the inverse correlation of the consumption of meat vs. meat substitutes of $-0.35 (p < 0.001)$ in the overall sample. The data also supported that acceptance of meat substitutes is a time-dependent process: 55% of heavy-users indicated that they started to use meat substitutes for a long time ago (over 10 years) while 53% of light/medium-users started with these products until 5 years ago.

Considering the different stages of change, we found that there were very few respondents in the intermediate stages (*n* = 15) and that there were actually two segments: most respondents (57% of the overall sample) were not even considering to use meat

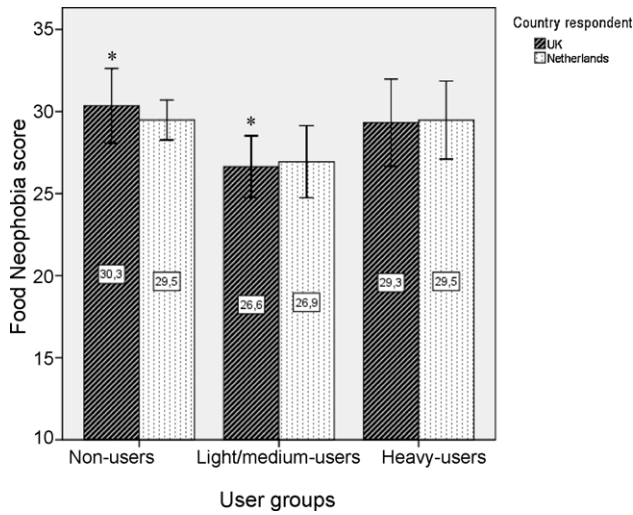


Fig. 1. Total food neophobia scores of non-users, light/medium-users and heavy-users of meat substitutes. Theoretical food neophobia score ranges from 10 (extremely food neophilic) to 70 (extremely food neophobic), items were rate on a 7-point scale. Error bars display $\pm 2SE$ around the mean, data labels display mean values. *Significant difference between user groups.

substitutes and were in precontemplation, whereas 41% was in the action/maintenance stage (maintenance 38% and action only 3%). There was a difference between country samples ($\chi^2(1, 548) = 27.3, p < 0.001$). The majority of NL respondents (65%) was still in precontemplation, as opposed to UK respondents of which 54% was in action/maintenance. The outcome largely corresponds with the distribution in Table 4, because the arrangement of the stages of change is now merely a reclassification of the meat substitute user groups: 99% of the non-users were in the precontemplation group, while the action/maintenance group consisted of the heavy-users and 98% of the light/medium-users of meat substitutes. We therefore only describe the results for the meat substitute user groups in the next sections.

Food neophobia

In line with our expectations, we found that non-users of meat substitutes were more food neophobic than light/medium-users and that light/medium-users were not different from heavy-users with respect to food neophobia. Considering user groups within countries, there were differences between user groups in the UK ($F(2, 1229) = 3.2, p < 0.05$), caused by significant higher scores by non-users compared to light/medium-users (see Fig. 1). The same trend was observed within the NL sample, although this was not statistically significant. Overall, we did not find a significant difference in food neophobia scores between the two country samples (UK mean FNS score 28.8, NL mean FNS score 29.1).

Food choice motives

The largest differences in food choice motives were found between non-users and heavy-users; heavy-users gave higher ratings for *ecological welfare* (UK $\Delta 0.6, F(2, 232) = 3.9, p < 0.0009$; NL $\Delta 0.8, F(2, 311) = 8.5, p < 0.0003$) and *political values* (UK $\Delta 0.6, F(2, 231) = 4.0, p < 0.002$; NL $\Delta 0.7, F(2, 317) = 5.4, p < 0.006$) which is also shown in Fig. 2 (UK sample). The UK heavy-users even gave higher scores than light/medium-users for *ecological welfare* and *political values*, while in NL this was only the case for *political values*. Other differences between the groups were observed for *natural content* (higher scores by heavy-users than non-users in NL, higher scores by heavy-users than light/medium-users in UK), *familiarity* (more important to non-users than light-medium-users in UK and NL), *convenience* (light/medium-users gave lower scores than non-users and heavy-users in NL), and *sensory appeal* (more important to non-users than light/medium-users in UK). When we excluded vegetarians from these analyses, the significant differences in importance of *ecological welfare* disappeared, and in the NL sample there was also no effect of *political values* left. The main differences were then between non-users and light/medium-users; non-users found *convenience* and *familiarity* more important, and *natural content* less important, while light/medium and heavy-users were less different from each other.

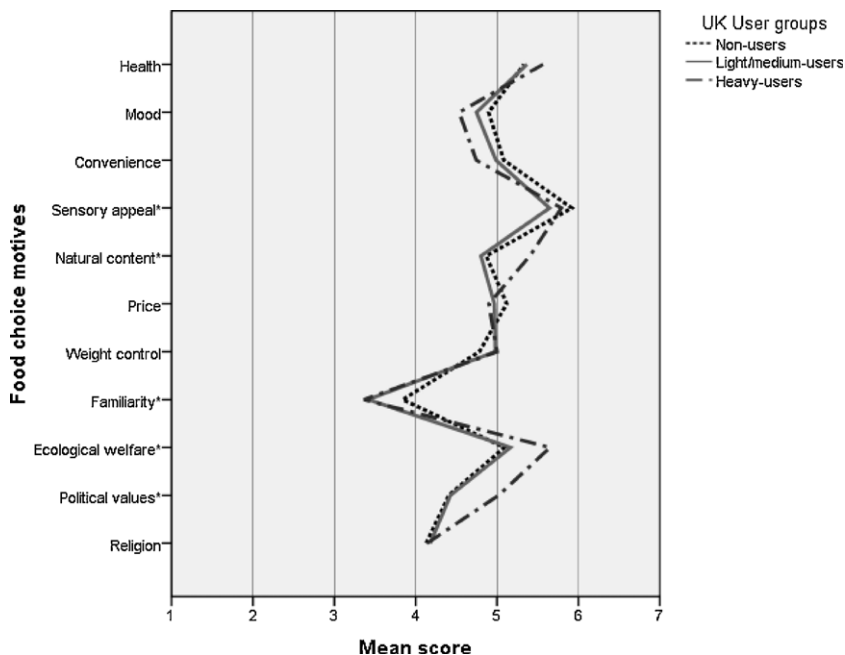


Fig. 2. Food choice motives of non-users, light/medium-users and heavy-users of meat substitutes in the U.K. *Significant difference between user groups.

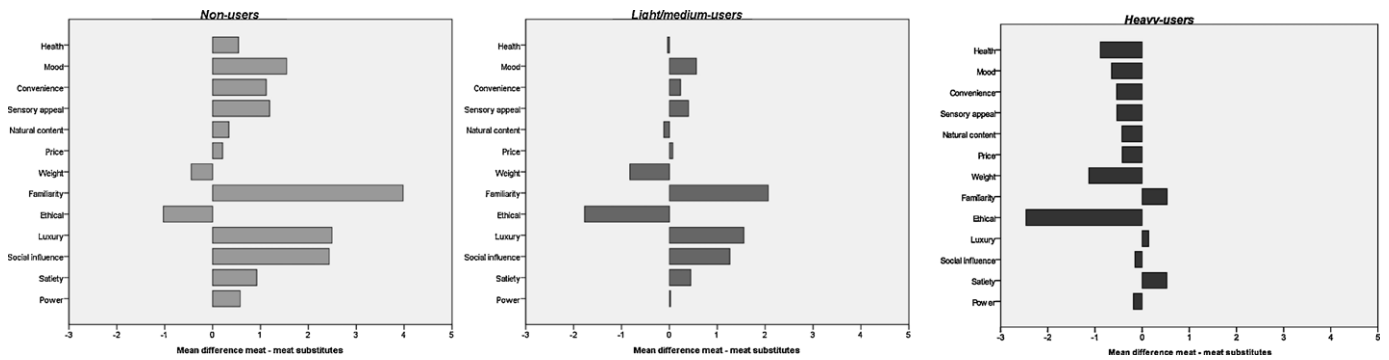


Fig. 3. Attitudes and beliefs towards meat substitutes relative to meat (NL user groups). The theoretical range is –6 to 6. Items were scored on 7-point scales separately for both meat and meat substitutes. Positive scores indicate a more positive attitude/belief towards meat, negative scores indicate a more positive attitude/belief towards meat substitutes.

Attitudes and beliefs towards meat and meat substitutes

Attitudes and beliefs towards meat and meat substitutes differed considerably between user groups (see Fig. 3, NL sample shown). Bars that are in the positive area represent aspects that are seen as more positive for meat, while negative bars are seen as positive aspects for meat substitutes. There were significant differences for all rated aspects between the user groups. In general, Fig. 3 shows that non-users had very positive attitudes and beliefs towards meat. They found meat products better for health and mood, more convenient, more sensory attractive, and more satiating. Particularly, non-users thought of meat as being more suitable for special occasions (*luxury*) and have a partner/housemate who likes meat (*social influence*). Meat substitutes scored only positive for *ethical* aspects and *weight control*. Light/medium-users displayed approximately the same positive and negative attitudes and beliefs as non-users, although they were slightly less in favour of meat. The picture changes radically when looking at scores from heavy-users who have a far more

positive attitude towards most aspects of meat substitutes, except for the aspects *familiarity*, *luxury*, and *satiety*. We did not find any significant differences between the country samples for attitudes and beliefs towards meat and meat substitutes.

Desired new meat substitute attributes

Fig. 4 clearly shows a trend that the less meat substitutes were consumed, the more respondents preferred a product that is similar to meat. Those who rarely used meat substitutes indicated to prefer a product with meat *sensory properties*: meat-like texture, taste, smell and appearance. On the opposite, heavy-users of meat substitute preferred a product that is not similar to meat for these characteristics. (In the UK, a similar trend was observed.) The same pattern was found for *product name*, *preparation* and *packaging*. Most respondents indicated to prefer a cheaper product with more *protein*, less *calories* and more *vitamins & minerals* than meat, independent from their usage of meat substitutes.

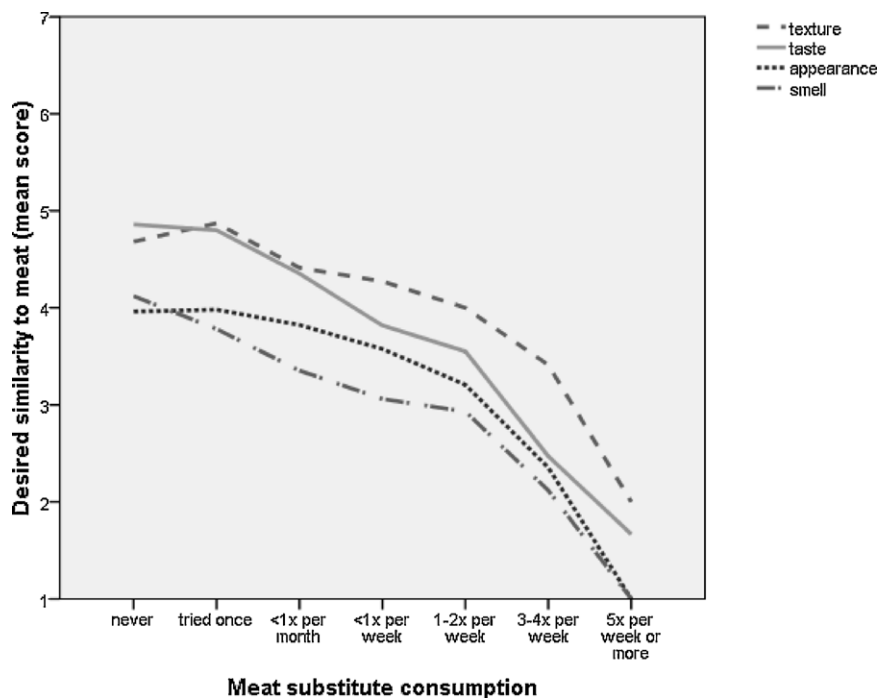


Fig. 4. The desired similarity to meat for sensory attributes of new meat substitutes in relation to current meat substitute consumption (NL respondents). Items were rated on a 7-point scale with anchors dissimilar–similar to meat.

Table 5
Key factors determining meat substitute acceptance.

Type of factor	Factor	Beta-coefficient	P-Value
Product-related	Familiarity with product	0.37	<0.001
Person-related	Food neophobia score	-0.15	0.002
Product-related	Attitudes and beliefs about sensory appeal	0.14	0.015
Person socio-demographics	Country	0.13	0.006
Product-related	Social influence housemate/partner	0.13	0.008
Person socio-demographics	Age	-0.10	0.048
Person socio-demographics	Household size	-0.07	0.014

Y = categories of meat substitute consumption (non-users, light/medium-users, and heavy-users). The factors that contributed significantly to the model are listed.

Key factors in meat substitute acceptance

Table 5 displays the relative importance of the different factors in acceptance of meat substitute consumption. The most important determinant in the usage level of meat substitutes was familiarity with the product: perceived unfamiliarity with meat substitutes resulted in a lower usage frequency. Other strong barriers were high food neophobia and the belief that meat substitutes are less sensory attractive. A housemate/partner who is positive about meat substitutes and to a lesser degree the socio-demographic factors: living in the UK, a younger age and smaller household, contributed positively to a higher consumption of meat substitutes. After exclusion of vegetarians from these analyses the same picture emerged.

Discussion

In this study we investigated which drivers and barriers act on the acceptance of meat substitutes. The basic assumption was that different levels of acceptance, as expressed by user groups (non-users, light/medium-users and heavy-users of meat substitutes), are under the influence of different factors. We distinguished person-related factors that affect general food choice and product-related factors that are specifically related to meat or meat substitutes.

The role of product-related factors in acceptance of meat substitutes

The product-related factors, so the particular attitudes and beliefs towards meat substitutes and meat, determined the acceptance of meat substitutes more than general food choice motives. Key barriers for non-users and light/medium-users seemed to be the unfamiliarity with these products and negative beliefs about the sensory appeal compared to meat.

Meat substitutes were obviously seen as relatively unfamiliar foods. Surprisingly, even for heavy-users of meat substitutes, meat was still more familiar than meat substitutes. After all, meat offers a sense of tradition and familiarity. It still has a central position in Western food culture and is the centre of meals (Barrena & Sánchez, 2009; Douglas & Nicod, 1974; Holm & Møhl, 2000; Meiselman, 2000). How unfamiliarity affects the appreciation of food products was demonstrated previously by Raudenbush and Frank (1999). For both neophilics and neophobics they found more positive evaluations of familiar foods compared to unfamiliar foods. Especially neophobics were less willing to try novel foods, even after tasting. A similar effect was observed in our study, which underlines the important role of product familiarity in acceptance of new foods. The unfamiliarity of meat substitutes compared to meat is thus a critical product feature that is now limiting consumer acceptance.

Our initial assumptions about the important role of the sensory appeal of meat and meat substitutes were confirmed. It contributed for a large part to the overall quality perception:

when one was more positive about the sensory aspects of meat, meat substitutes were used less, and vice versa. The results of our study also confirmed that consumers who do not or rarely use meat substitutes appreciate meat-like sensory properties in a new meat substitute product. Meat's unique taste and texture properties are not reflected in meat substitutes currently on the market (Aiking et al., 2006; McIlveen et al., 1999; Sadler, 2004), which is obviously a substantial barrier for new users, but also relevant to light/medium-users. The desired sensory quality of meat is most likely also connected to the familiarity of the specific meat taste and texture. The other way around, heavy-users indicated to appreciate a new meat substitute which is dissimilar to meat. It is likely that this was caused by the specific motives of vegetarians in this user group who do not want to be reminded of meat and usually have developed a strong dislike of the sensory properties of meat (Fessler et al., 2003; Rozin et al., 1997).

It seems that the overall personal evaluation of meat substitutes vs. meat determines the choice for one of these products, instead of a single product-related factor. At the start of the study we assumed that an overall more positive attitude towards meat substitutes than meat acts as a driver to use meat substitutes, whereas an overall more negative attitude towards meat substitutes acts as a barrier, which was confirmed. Non-users were negative about meat substitutes on most aspects, light/medium-users were more balanced, but still more positive about meat, while heavy-users were distinctively in favour of meat substitutes. Products can be seen as bundles of product attributes with varying capacities for delivering certain benefits and satisfying needs (Kotler et al., 1999). So in the choice between alternative products (i.e. meat or meat substitutes) a trade-off is made which product is able to meet these needs most. This was illustrated by the fact that meat substitutes did receive high scores on the ethical and weight control aspects by non-users and light/medium-users, which is in line with previous image reports (Van der Lans, 2001; Van Trijp, 1991), but this did not actually contribute to the acceptance of these products. Ethical and weight control aspects were clearly less relevant for these user groups and therefore did not compensate for other negative product-related attitudes and beliefs that were more important to them.

The role of person-related factors in acceptance of meat substitutes

The most important person-related factor that determined meat substitute acceptance is food neophobia. Non-users were significantly more food neophobic than light/medium-users of meat substitutes, as we initially hypothesized. Food neophobia was obviously an important barrier in acceptance of meat substitutes and especially had its effect on first trials of these products. Our results are in line with previous reports that food neophobia affects the degree of acceptance of novel or unfamiliar products, both before actually tasting (willingness to try) and after tasting (Arvola, Lähteenmäki, & Tuorila, 1999; Henriques et al., 2009; Pliner, Lähteenmäki, & Tuorila, 1998; Tuorila et al., 1994) The

tendency to avoid and dislike these products are thus presumably also a barrier for repeated use of meat substitutes. The barrier food neophobia might even be more important in the real market place, since the sample of our study can be considered rather food neophilic (40% of respondents had total food neophobia scores between 10 and 25) compared to representative samples (Henriques et al., 2009; Pliner & Hobden, 1992; Tuorila et al., 2001).

Surprisingly, food neophobia scores of heavy-users of meat substitutes were comparable to those from non-users. We initially expected that food neophobia scores of heavy-users would be lower, since they were the first consumers who tried the product and continued to use it. One way to explain this is a picky eating style of vegetarians or vegetarian-oriented respondents in the heavy-user group. Tuorila et al. (2001) pointed out that the Food Neophobia Scale has two dimensions namely the disinterest in trying new and ethnic foods and a concern vs. carelessness with respect to trying unknown foods. The latter might be particularly applicable to vegetarians. When we excluded vegetarians, the average food neophobia scores of Dutch heavy-users were indeed comparable to those from light/medium-users. It would therefore be interesting to test the applicability of the Food Neophobia Scale for consumers with a specific dietary orientation, such as vegetarians.

There were some differences in food choice motives between user groups, although these were not main determinants of the acceptance of meat substitutes in our study. Our hypothesis that a higher interest in health, ecological welfare and weight control was a driver for non-users to become light/medium-users was incorrect. Light/medium-users and semi-vegetarians do display a similar type of dietary behaviour, eating less meat, but have a different kind of internal motivations for doing so (Hoek et al., 2004). Drivers for light/medium-users were more likely a need for variety and interest in new foods, since they had a lower interest in familiarity, sensory appeal (UK) and convenience (NL) than non-users. Our hypothesis that a higher interest in ecological welfare acts as a driver to become a heavy-user was confirmed. In addition, other ethical aspects – political values – and a higher interest in the natural content of foods also played a role, which was influenced by vegetarians who express a certain ideology by their choice not to eat meat (Hoek et al., 2004; Jabs, Devine, & Sobal, 1998; Janda & Trocchia, 2001; Lea & Worsley, 2001; Lindeman & Väänänen, 2000).

The relation between product- and person-related factors

A strong point of our study is that we combined measures on general personal characteristics (food neophobia and food choice motives) and attitudinal questions specifically related to the products in one survey. It should be noted that using general personality characteristics alone is usually not very effective in explaining specific behaviours, and thus needs a specification towards certain product categories (Van Raaij & Verhallen, 1994; Wansink, Sonka, & Park, 2000). Consistent with the means-end approach to consumer behaviour, situation-specific food product perceptions can finally be linked to higher abstract values as long as that food product assists in achieving certain personal values (as operationalized by the food-related lifestyle measurement – Brunsø & Grunert, 1998; Grunert, 2006). Similarly, food choice motives can be related to an individual's value system as demonstrated by Lindeman and Sirelius (2001). It is important to be aware of the fact that these links from products to values are only present in an individual when these products, or characteristics are meaningful to achieve the personally desired values. The importance of this link was illustrated by the non-users in our study. They recognized that meat substitutes were more ethical than meat, but this did not make them choose these products, because they lacked a strong ethical value orientation.

We did not actually analyse how the intermediate relation runs from person-related factors to product-related factors and how this ultimately affects acceptance of meat substitutes. Other researchers have investigated this in more detail from different perspectives, suggesting a partial effect of personal characteristics on food choice by mediation or moderation. This seems to be different across types of food products and is related to the involvement in those foods. Chen (2007) did a study on organic foods and reported that food neophobia moderated food choice motives (natural content and political values), and that food neophobia moderated the attitudes towards organic foods. Eertmans, Victoir, Vansant, and Van den Bergh (2005) discussed that food neophobia affected the impact of the food choice motive weight control on the consumption of particular food groups, namely water, light drinks and fruits. Obviously, person-related factors do have some relation with product-related attitudes and beliefs and ultimate product choice, but it needs further investigation how strong and in what way this exactly affects the choice for meat or meat substitutes.

Methodological considerations

With respect to the theoretical framework and assumptions of this study, we have seen that these are partially confirmed and need some adjustments. We initially assumed that there were different drivers and barriers between user groups. This was confirmed for food neophobia and some of the food choice motives. However, product-related attitudes and beliefs were more gradually distributed across the user groups, going from relatively negative scores for most aspects by non-users, to relatively positive scores by heavy-users.

We assumed that there is a temporal pattern, meaning that the acceptance of meat substitutes occurs over time. We were not able to actually test and quantify this because we performed a cross-sectional study. However, we did find that heavy-users used meat substitutes already for a longer period of time, sometimes for over 20 years.

We used key characteristics of the stages of change model and usage segmentation for the design and analysis of the study. Usage segmentation is only based on a behavioural outcome measure, which is generally seen as a shortcoming because it is often difficult to explain reasons behind the usage behaviour (Weinstein, 2004). Therefore we combined the usage data with product-related attitudes and personal characteristics in order to infer the underlying factors that determined meat substitute consumption. An interesting feature of the stages of change construct is that it combines *current* consumption behaviour with *intended* consumption behaviour. It thereby extends the usage segmentation with intermediate consumer groups, i.e. consumers who are in contemplation and in preparation, and potentially provides better insight in perceived drivers and barriers to increase frequency of consumption. However, we reported primarily on the meat substitute user groups since the classification into stages of change was uncertain. The sample size of the intermediate consumer groups was too small for analyses in our survey and a recombination into three stages of changes was merely another way of classifying into user groups. The number of consumers observed in the different stages of change may reflect the actual market situation but may just as well be caused by an irrelevant stages of change algorithm. For instance, the time frames that are commonly applied (6 months periods), and that were also used in this study, might be relevant for health-related behaviours but not for the use of meat or meat substitutes. Valid and reliable staging algorithms are currently only available for fruit and vegetable consumption and dietary fat intake (Spencer et al., 2007). To our knowledge, there are no studies that have used the stages of

change construct for the acceptance of meat substitute products. The closest related study is from *Lea et al. (2006)*, who used the stages of change model to segment the population with respect to the consumption of a plant-based diet. They commented that the concept 'a plant-based diet' was unknown to respondents, which is in line with comments on stages algorithms that do not allow for the fact that consumers eat products instead of nutrients or diet types (*Spencer et al., 2007*). It needs further research whether the stages of change model is applicable for non-health related dietary behaviour at all, such as environmentally responsible behaviour. Based on the experiences with this study, we propose that issues involving long-term benefits for the environment probably involve different psychological processes than health issues that are beneficial for the person himself. For future research we recommend to explore other segmentation approaches that might give more distinction and insight. *Wansink, Sonka, & Park (2004)* suggested to use the so called seeker avoider segmentation when the product category is not purchased frequently and when there is a strong attitude towards the product category, as it is the case with meat substitutes.

The survey had a number of limitations. The questionnaire was quite long and the samples were not representative for the U.K. and The Netherlands. We therefore cannot exclude that response bias occurred, especially in the U.K. Conclusions can only be drawn about the differences between the selected user groups rather than between countries. With respect to the content of the questionnaire: we did not assess the perceived degree of newness of actual meat substitute products by consumers. This is of relevance, given the role of product familiarity and food neophobia in acceptance of meat substitutes. In addition, questions were asked about the entire meat substitute category which obviously constitutes from a range of different products that vary in sensory properties and overall similarity to meat. We found that the explained variance of the regression model was only moderate. Clearly, there are other factors, which were not measured by this survey, that play a role in consumer acceptance of meat substitutes. The regression model was included as a means to describe the *relative* importance of the factors described in this paper, and should therefore not be used as a model that fully predicts meat substitute consumption in the real market place. This point also relates to our measurement tool, a questionnaire. The use of a survey has the major disadvantage that consumers might say things that they are not actually doing (*Köster, 2003*). In addition, consumers are likely to make a trade-off between different attributes and benefits, such as price against animal welfare, taste against environmental friendliness, etc. (e.g. *Grunert et al., 2004; Napolitano et al., 2010*). Other experimental set-ups might give a better understanding, such as experimental auctions or conjoint choice experiments (e.g. *Cardello, Schutz, & Leshner, 2007; Jaeger et al., 2004; Napolitano et al., 2010*).

Conclusions and implications

This study showed that the key barriers for current non-users of meat substitutes were related to the product, namely the relatively unfamiliarity and low sensory appeal of these products compared to meat. In addition, the person-related factor food neophobia initially also plays a role. Both non-users and light/medium-users had overall far more positive attitudes and beliefs towards meat, so in the choice between alternatives the scale will currently tip towards meat instead of meat substitutes. The vast amount of meat consumption instead of meat substitutes is likely to continue up till today. In order to increase the consumption of meat substitutes, the benefits to consume these types of products need to outweigh the barriers. Current perceived barriers need to be lowered and drivers enforced. Essentially this means that establishing a good fit

of the product with the behaviour, perception and needs of non-users and light/medium-users, which is clearly different from current heavy-users of meat substitutes.

Personal characteristics of consumers, such as food neophobia and food choice motives, are very difficult to transform. However, what can be done is to take these personal characteristics seriously into consideration in the development and positioning of new meat substitutes. With respect to food neophobia, *Tuorila et al. (1994)* reported that providing certain verbal information, e.g. about product use, enabling resemblance to more familiar foods, and bringing about product exposure, reduced the initially negative neophobic response. With respect to internal motivations and how this affects the daily choice of foods, this study shows that current non-users and light/medium-users of meat substitutes are not focusing on ethical aspects, in contrast with heavy-users and vegetarians. Although non-users and light/medium-users do acknowledge the ethical aspects in meat substitutes, it is not something they are aiming for in a food product. Providing information and increasing the awareness on the environmental benefits of eating meat substitutes is not likely to be very effective.

Therefore, the primary task is to improve the product. The product attributes of meat substitutes need to fit with the orientation of non-users and light/medium-users on familiarity and sensory attractiveness in foods.

Corresponding to earlier remarks of *Sadler (2004), McIlveen et al. (1999), and Kuntz (1995)*, we confirm that future growth opportunities exist for products that are more similar to meat and that overall sensory quality needs further improvement. A meat-like product could also help in overcoming unfamiliarity and uncertainty regarding new meat substitutes, which is essential to attract current non-users. In order to develop new sustainable meat substitutes that substantially replace meat on the plate, more research is needed on the identification and technological realization of the desirable meat like properties, and the effect of repeated exposure on consumer acceptance.

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