Older consumers' attitudes towards food carriers for protein-enrichment

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A B S T R A C T

Understanding the demands of older consumers is of importance for successful development of functional foods targeted at this segment of the population. This study aimed to examine older adults' attitudes towards food carriers for protein enrichment. In total 182 consumers (mean age: 66.6 ± 6.9) participated in a survey designed to evaluate their willingness to try and purchase 16 target food carriers for protein enrichment. Food carriers were chosen to vary systematically on three fundamental dimensions: healthiness (healthy vs. unhealthy), novelty (traditional vs. novel), and types of meal (meal-component vs. snack). Results showed that among the carrier formats, older consumers were most willing to purchase and try healthy, traditional meal component foods enriched with protein. By segmenting older consumers using a latent class approach, an increase in purchase willingness of protein-enriched foods was found when protein-enriched foods were tailored to particular segments, suggesting that a segmentation-based approach to product development would be beneficial. Future studies may need to explore older consumers' actual purchase intention through the tasting of appealing protein-enriched foods in real life, which might help reduce older consumers' skepticism towards protein-enriched foods.

1. Introduction

The world's population aged 65 and above is growing markedly, causing an expected rise in expenditure on elderly care (WHO, 2015). One of the most significant societal challenges connected to the ageing process is *sarcopenia* (age-related loss of skeletal muscle mass). It is a chronic process characterized by a progressive reduction in skeletal muscle mass every ten years after age 30 (Baumgartner et al., 1998), and is associated with functional problems such as frailty and difficulty carrying out daily tasks, that may substantially decrease life quality (von Haehling, Morley, & Anker, 2010). Previous research has reported that sarcopenia leads to functional decline or even a decrease in independence among 30% of individuals over 60 years old and more than 50% of older adults aged above 80 years old (von Haehling et al., 2010; Paddon-Jones & Rasmussen, 2009). Together with physical exercise, an adequate dietary protein intake throughout the day is a crucial factor to prevent or delay the sarcopenic process (Fielding et al., 2011; Giacalone et al., 2016; Lonnie et al., 2018; Paddon-Jones & Rasmussen, 2009; Yang et al., 2012). Moreover, dietary and lifestyle regimes before the onset of sarcopenia are also important to prevent this condition, since

muscle strength in old age reflects both the rate of muscle mass loss and the muscle mass-peak achieved in early life (Robinson, Cooper, & Aihie Sayer, 2012).

In this context, the food industry can help older consumers fulfill their nutritional needs by developing and commercializing appealing protein-enriched foods, which may increase protein intake without changing consumers' common meal frequency and size (Wendin, Höglund, Andersson, & Rothenberg, 2017a). Although protein-enriched foods are commonly used for older adults in geriatric care, independently-living older consumers may not have sufficient nutritional knowledge to be interested in these products (Thompson Martin, Kayser-Jones, Stotts, Porter, & Froelicher, 2006). Yet, from both a public health and a commercial perspective, independently living older adults are the most important market segment given their size, growth trend and spending power (Doets & Kremer, 2016; Hasler, 2000; Song, Giacalone, Johansen, Frøst, & Bredie, 2016; van der Zanden & van Trijp, 2016).

Developing successful new functional products for older consumers presents several challenges, ranging from sensory changes and often a reduced palatability associated with protein-enrichment (Höglund

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et al., 2017; Wendin et al., 2017a), to the diverse and often negative attitudes towards novel foods and beverages amongst this consumer segment (van der Zanden, van Kleef, de Wijk, & van Trijp, 2015).

Generally, older consumers may be expected to be receptive attitudes toward functional foods, because of their increased health awareness and heightened interest in chronic disease prevention (Ares & Gámbaro, 2007; Ozen, Pons, & Tur, 2012; Vella, Stratton, Sheeshka, & Duncan, 2013). Hence, successful development of functional foods and beverages should effectively translate the health benefits into products and also clearly communicate these benefits to targeted consumers (van der Zanden & van Trijp, 2016).

With regards to protein-enriched products, functional components can be incorporated into a variety of food carriers. However, past research indicates that not all combinations of functional components and carriers will be equally attractive, meaning that adequate product diversification will be required to effectively target older consumers (Krutulyte et al., 2011; van der Zanden et al., 2015).

Generally speaking, healthy food products are expected to be perceived as more appropriate as carriers for protein enrichment for enrichment by older consumers, relative to products considered as less healthy (Balasubramanian & Cole, 2002). However, research indicates that the elderly are quite heterogeneous with regards to their health-orientation while making food choices (Bech-Larsen & Grunert, 2003; Krutulyte et al., 2011; Locher et al., 2009; van der Zanden, van Kleef, de Wijk, & van Trijp, 2014). For example, product choices of consumers who experience health problems are more likely to be driven by health-related considerations (Locher et al., 2009). It is however not clear how healthiness is evaluated in the context of protein-enrichment: for instance, a few studies have suggested that certain consumers may prefer unhealthy foods as carriers for functional ingredients, possibly because unhealthy carriers would get more benefits from nutritional improvements (Bech-Larsen & Grunert, 2003; Krutulyte et al., 2011; van der Zanden & van Trijp, 2016).

The familiarity of food carriers could be an important factor affected older adults' attitudes toward functional products (Cliceri et al., 2017), and previous research indicated that older adults find it easier to accept familiar and traditional products (Beelen, de Roos, & De Groot, 2017; Laureati, Pagliarini, Calcinoni, & Bidoglio, 2006). This consumer group tends to be neophobic and less willing to purchase novel products, which raises the challenge of how to make such functional products familiar enough to easily be incorporated in consumers' existing dietary practices (Giacalone & Jaeger, 2016). In this case, using traditional foods as carriers of functional ingredients could be a strategy to decrease the novel notion and increase the familiarity of the new products. However, as noted with regards to health-orientation, the literature shows that older consumers were heterogeneous in their attitudes and preferences towards novel foods (Lambert-Pandraud & Laurent, 2010; van der Zanden et al., 2015).

Another important aspect to consider is the situational appropriateness of protein enriched foods targeted at older consumers. Previous research into this topic has typically focused on meal-type (snack vs. meal-component), and indicated that staple foods and meal components that play substantive roles in diets, e.g. bread, pasta, and margarine, tend to be more easily accepted as carriers of functional ingredients (Baltas, 2001; Bech-Larsen & Grunert, 2003; Dean et al., 2012; Grunert, Brunsø, Bredahl, & Bech, 2001; Hoek, Luning, Stafleu, & de Graaf, 2004; Poulsen, 1999; Siegrist, 2008; van Kleef, van Trijp, & Luning, 2005). However, adequate protein intake throughout the day is suggested to be necessary in order to improve muscle size and function, and therefore both protein-enriched meal components and snacks might eventually be needed to meet older people's nutritional needs (Tieland, Borgonjen-Van den Berg, van Loon, & de Groot, 2012; Fielding et al., 2011).

To summarize, the literature healthy, meal-component, familiar or traditional products enriched with protein have the highest likelihood of being accepted by older consumers. However, the proportion of this segment is unknown so far, and the literature is generally indicative of a high heterogeneity amongst older consumers. A recent study by van der Zanden et al. (2015) explored a segmentation-based approach to evaluate older Dutch consumers' acceptance towards protein-enriched functional foods varied in healthiness, novelty and meal-type dimensions. It was found that most participants were willing to try healthy meal component enriched functional products but had great heterogeneity in acceptance of food carriers varied in novelty dimension. Market segmentation and targeting were suggested to be helpful in fulfilling the demands of older adults and improving the overall acceptance of protein-enriched products targeted at older consumers (van der Zanden et al., 2015).

Situated within this context, the present study aims to a) segment Danish older consumers on their attitudes toward carriers for protein-enrichment, b) identify carrier formats that each segment would be most willing to purchase and c) explore the demographic characteristics of different segments. These results could help the food industry find the right directions in developing appealing protein-enriched foods targeted at the older consumer market. In addition, this study is designed as an extension of previous work in the Netherlands (van der Zanden et al., 2015), conducted with a new independent population sample. An additional aim is therefore to evaluate the validity of the previous findings, and to enable a cross-cultural investigation between Denmark and the Netherlands.

2. Methods

2.1. Pilot test – selection and sorting of food carriers

A step-wise confirmatory pilot test was conducted to select and sort carriers into different formats for the main study, as in van der Zanden et al. (2015). The food carrier formats were designed to vary systematically on three dimensions: healthiness (healthy vs. unhealthy), novelty (novel vs. traditional), and types of meal (meal-component vs. snack).

This resulted in 2*2*2 = 8 categories: 1) healthy, traditional, meal-component; 2) healthy, traditional, snack; 3) healthy, novel, meal-component; 4) healthy, novel, snack; 5) unhealthy, traditional, meal-component; 6) unhealthy, traditional, snack; 7) unhealthy, novel, meal-component; and 8) unhealthy, novel, snack.

The pilot test was conducted through an online survey, using EyeQuestion® software version 3.9.4 (Logic8 B.V., the Netherlands). In the first step, a total of 21 carriers depicted through product images and corresponding name tags were selected. Older participants were asked to sort carriers into the following categories: "more on the healthy side" vs. "the unhealthy side", "more on the traditional side" vs. "the novel side" and "more like a meal-component" vs. "a snack". Each of the carriers was selected to represent one of the eight food categories and also corresponded to a relevant previous study to some extent (van der Zanden et al., 2015). In step two, 16 carriers were selected based on the results of step one and submitted to the final confirmatory sorting survey. For each food category, two carriers were confirmed as highly valid representatives to be evaluated in the main study, based on the frequency with which participants assigned them to each category (see Table 1 and Fig. 1).

Participants in the pilot tests were recruited through three channels: 1) sending email invitations with the survey link to consumers in the database of FOOD Design and Consumer Behavior, University of Copenhagen; 2) posting advertisements online, e.g. the Facebook groups of University of Copenhagen; 3) directly approaching older adults encountered at public spaces such as parks, on campus and on the street. A total of 115 independently-living older Danish consumers aged 55 + participated in the pilot test (N = 63 and N = 52 in the first and second pilot test, respectively).

Table 1
Frequency of carriers sorted in corresponding food category and the final set that each carrier belongs to (n = 52).

Carrier	Healthy	Unhealthy	p value	Traditional	Novel	p value	Meal component	Snack	p value	Set/category
Bread	48	4	***	49	3	***	51	1	***	Healthy, traditional, meal component
Milk	50	2	***	47	5	***	52	0	***	Healthy, traditional, meal component
Rye cracker	44	8	***	41	11	***	9	43	***	Healthy, traditional, snack
Cheese cube	46	6	***	41	11	***	15	37	***	Healthy, traditional, snack
Meat substitute	41	11	***	3	49	***	50	2	***	Healthy, novel, meal component
Soy drink	49	3	***	5	47	***	46	6	***	Healthy, novel, meal component
Muesli bar	31	21	*	10	42	***	1	51	***	Healthy, novel, snack
Yoghurt drink	42	10	***	12	40	***	15	37	***	Healthy, novel, snack
Sauce/dip	9	43	***	44	8	***	44	8	***	Unhealthy, traditional, meal component
French fries	7	45	***	43	9	***	40	12	***	Unhealthy, traditional, meal component
Danish pastry	3	49	***	44	8	***	3	49	***	Unhealthy, traditional, snack
Chips	2	50	***	47	5	***	0	52	***	Unhealthy, traditional, snack
Burritos	16	36	***	5	47	***	38	14	***	Unhealthy, novel, meal component
Exotic sauce	21	31	*	5	47	***	51	1	***	Unhealthy, novel, meal component
Nacho chips	3	49	***	14	38	***	1	51	***	Unhealthy, novel, snack
Ice cream bars	4	48	***	6	46	***	0	52	***	Unhealthy, novel, snack

Note: Significant differences between frequencies were analyzed through one-tailed Fisher's Exact test. ***p < 0.001, **p < 0.01, *p < 0.05.

2.2. Main study - evaluation of food carriers

Like the two pilot tests, the main survey was also conducted using EyeQuestion® software version 3.9.4 (Logic8 B.V., the Netherlands). The questionnaire of the main study contained three sections. At the beginning, a brief introduction of protein and protein-enrichment was given to provide participants with some necessary background knowledge. This introduction was followed by the first section, which focused on the actual product evaluation. Here, carriers for protein enrichment chosen on the basis of the two pilot studies were presented to participants in a randomized order. Images with the corresponding description were used as stimuli (Fig. 1). Each image was followed by three questions (Fig. 2) designed to measure older consumers' attitudes towards carriers for protein-enrichment. The first question ("*To what extent do you think that this product type is appropriate for protein-enrichment?*") focused on the perceived appropriateness of each carrier for protein enrichment. The second question ("*To what extent would you be willing to buy and try this type of product, if it is enriched with protein?*") measured participants' willingness to trial purchase each carrier enriched with protein. The third question ("*Imagine that you are satisfied with the taste and price, how often would you eat this product, if it is enriched with protein?*") asked participants to rate their prospective repeat purchase frequency. A screenshot of the product evaluation section is shown in Fig. 2 (here translated into English, the actual survey was conducted in Danish).

Responses to the first two questions were given on a 7-point scale ranging from 1 ("not at all") to 7 ("very much"). For the third question, participants chose their response from seven frequency options, which were "never", "less than once per month", "once per month", "once every two weeks", "once per week", "several times per week" and "every day". In the remainder of this paper, these three measurements will be referred to as perceived appropriateness for protein-enrichment, willingness to trial purchase and prospective consumption frequency, respectively.

The second section of the survey focused on older adults' attitudes towards different strategies of increasing protein intake. The questions were as follows: "*Imagine that your doctor suggests you increase your protein intake through the following three options, to what extent does each of the options appeal to you?*". The options were: 1) increase the intake of foods rich in protein; 2) consume protein-enriched foods; 3) consume nutritional supplements (pills, shakes etc.) containing protein; 4) not applicable, if you do not want to use any of these options. Participants were required to allocate ten points across the above four options to indicate their preferences for each option. Afterward, participants' preferences towards protein sources to be used for enrichment were evaluated. Here, participants were asked to allocate ten points over four options, which were: 1) plant protein; 2) dairy protein; 3) meat protein; 4) not applicable, if you do not want to use any of these options.

In the third and last section of the survey, participants' background information was collected. These included basic demographics (age, gender, marital status, education level, household size) and food neophobia level, evaluated using the standard 10-question food neophobia scale (FNS; Pliner & Hobden, 1992).

Participants were recruited from the consumer database of the FOOD Design and Consumer Behavior Section, University of Copenhagen. In total, 250 independently living older Danish consumers

Fig. 1. Sixteen product images with name tags used for sorting of carriers in the pilot test. Translations, first line from left to right: soy drink, ice cream bar, meat substitute, burritos, yoghurt drink, cheese cubes, rye crackers, French fries; second line from left to right: chips, bread, exotic sauce, nacho chips, muesli bar, Danish pastry, milk, sauce or dressing.

Fig. 2. Screenshot of the product evaluation section from the main survey (English translation).

aged 55 + were invited through emails containing the link to the online survey. The incentive for participating was a lottery of cinema gift cards (value = 140 DKK/card[1]) which were won by one-third of all main study participants. One-hundred-eighty-two consumers (63 men and 119 women) aged 66.6 ± 6.9 years old (ranging between 56 and 83 years old) successfully completed the survey.

2.3. Data analysis

The same set of analyses as in the study in the Netherlands (van der Zanden et al., 2015) was carried out, in order to enable a clear and valid comparison between the two studies.

Data of the pilot sorting test was analyzed through one-tailed Fisher exact tests, in order to uncover significant differences in the frequency with which consumers categorized the carriers on the three focal dimensions (i.e. healthiness, meal-type and novelty).

For the main study, a Latent Class Analysis (LCA) was performed to examine heterogeneity among the respondents. This analysis categorized consumers into segments, based on their willingness to trial purchase for carriers enriched with protein. For each segment, beta coefficients were estimated through a multiple linear regression analysis. In order to characterize the different consumer segment in terms of their background characteristics, multivariate ANOVA with Bonferroni-correction was used to analyze all continuous data (e.g., age, FNS), Pearson's Chi-square tests and Kruskal-Wallis tests with pairwise comparisons were used to analyze the categorical data (e.g., gender, marital status, and educational level). All analyses were carried out using SPSS Statistics 24 (IBM, USA), except the LCA which was carried out using the statistical software LatentGOLD 5.1.
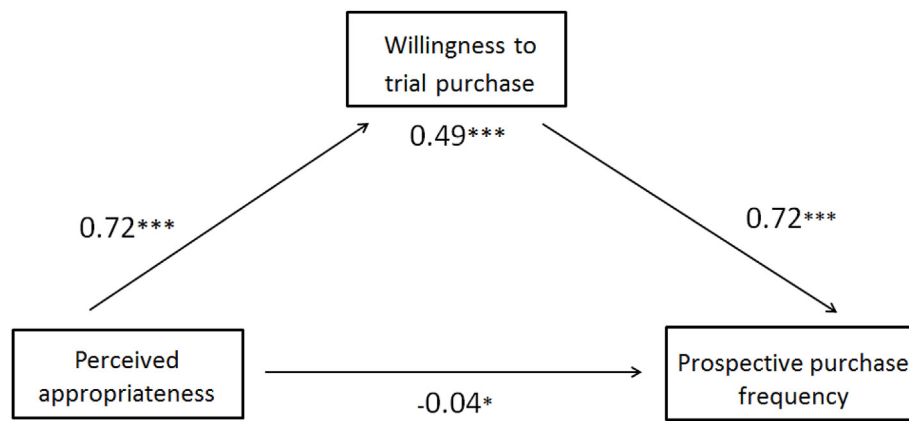
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[1] 140 DKK ≈ 22USD.

Fig. 3. Direct effect of perceived appropriateness on purchase frequency and indirect effect of perceived appropriateness on prospective. purchase frequency through willingness to trial purchase, with regression coefficients indicated. ***p < 0.001, **p < 0.01, *p < 0.05.

2.3.1. Selection of basis for segmentation – correlation among attitude measurements

The relationship among the three measures of consumers' attitudes towards carriers for protein-enrichment (see section 2.2) was explored to determine which measurement would provide the best basis for consumer segmentation.

Based on the preceding study (van der Zanden et al., 2015), it was assumed that perceived appropriateness of food carriers for protein-enrichment would affect consumers' willingness to trial purchase protein-enriched carriers, which would further influence consumers' potential purchasing frequency. The correlation among the three measures was examined using the bootstrapping procedure (Preacher & Hayes, 2004) to confirm whether willingness to trial purchase could be the mediating variable between perceived appropriateness and prospective repeat purchase frequency.

Fig. 3 showed that trial purchase willingness was significantly correlated (p < 0.001) with perceived appropriateness and prospective purchase frequency (beta coefficient = 0.72 in both cases). Moreover, when using trial purchase willingness as the mediator to complement the direct model between perceived appropriateness and prospective purchase frequency, the *indirect* relationship between appropriateness and purchase frequency was significant (beta coefficient = 0.49, p < 0.001), whilst the *direct* correlation between appropriateness and purchase frequency reduced in strength (beta coefficient = −0.04, p < 0.05). This confirmed that trial purchase willingness had a mediating effect on repeat purchase, and therefore can be a meaningful basis for segmenting older participants into segments.

2.3.2. Selection of segmentation solutions

Table 2 shows the estimation results of a total of seven LCA models, which included all solutions between one and seven segments. The degree of model fit to the data was evaluated based on three measurements: Bayesian information criterion (BIC; Schwarz, 1978), classification error and explained variance (R^2). Briefly, a small BIC value indicates a small deviation between the estimated model and the "real"

Table 2
Measurements of model fit for classification of one to seven-segment solutions.

Number of segment/model	BIC	Classification error	R^2
1	6640.29	0.00	0.03
2	6067.91	0.01	0.49
3	5919.17	0.04	0.62
4	5885.37	0.05	0.65
5	5890.78	0.05	0.66
6	5912.71	0.05	0.66
7	5945.67	0.05	0.66

model; a small classification error indicates that a smaller percentage of participants is categorized in a suboptimal segment; and a high R^2 value indicates that a good proportion of variance in the data is explained by the model. Segment sizes were also considered qualitatively.

The BIC criterion supported a 4-segment model (Table 2); however, the segments of the 4-segment model were too small to be reliable (less than 20 participants in two segments of the 4-segment model), and it was also observed that marginal gains in explained variance from 3-segment to 4-segment solutions were minimal. Therefore, the 3-segment model was chosen (R^2 = 0.62) for further analyses.

3. Results

3.1. Pilot test

Table 1 shows the results of the sorting task conducted in the second (confirmatory) pilot survey (N = 52). It lists the frequency with which participants sorted the carriers sorted in the available categories, while the last column indicates the final category set to which each carrier was assigned. It was confirmed through one-tailed Fisher exact tests that all carriers of different sets were significantly different from each other (p < 0.05) regarding their healthiness, novelty and meal-type. Therefore, they can be considered as valid representative carriers of each category and were considered as suitable for inclusion into the main study.

3.2. Main study

3.2.1. Identifying consumer segments in the 3-segment model

The final LCA model consisted of three segments that represented 43%, 36% and 21% of all participants. Table 3 shows the segment size and beta coefficients for each segment, indicating the effect of the three design variables (healthiness, novelty and types of meal) on consumers' willingness to trial purchase.

Significant differences in participants' willingness to trial purchase were found on the healthiness dimension (Table 3). Participants in Segment 1 and Segment 3 (64%) were significantly more willing to try protein-enriched food products using healthy rather than unhealthy foods as carriers (p < 0.05), whereas participants in Segment 2 (36%) were equally willing to purchase and try healthy and unhealthy carriers. A similar split was obtained for the novelty dimension, the majority of the respondents (64%) were equally willing to trial purchase traditional and novel products (Segments 1 and 3), whereas participants in Segment 2 were significantly more willing to try traditional products (p < 0.05). Finally, meal-type was not found to affect willingness to trial purchase to the same extent as the previous two dimensions, as all three segments were equally willing to try meal-

Table 3

Linear regression analysis indicating how carriers' healthiness, novelty and meal-type dimension affected consumers' willingness to trial purchase protein-enriched products (n = 182). Segment size and beta coefficients of each consumer segment are reported.

Measurements		Segment 1	Segment 2	Segment 3	Total
Group size (number)		43% (78)	36% (66)	21% (38)	100% (182)
Beta coefficients					
Healthiness	Healthy	0.36*	−0.15	0.19*	0.14
	Unhealthy	−0.36*	0.15	−0.19*	−0.14
Novelty	Traditional	0.05	0.24*	0.06	0.12
	Novel	−0.05	−0.24*	−0.06	−0.12
Meal-type	Meal-component	0.01	−0.13	−0.05	−0.06
	Snack	−0.01	0.13	0.05	0.06

Note: Dimensions with * have significant effects on ratings of willingness to trial purchase within segments at $p < 0.05$.

component and snack-type carriers enriched with protein (Table 3).

3.2.2. Consumers' attitudes towards eight Carrier categories

Mean ratings of perceived appropriateness, trial purchase willingness and prospective purchase frequency of eight carrier sets across the three segments are reported in Fig. 4. Since the ratings were given on a 7-point scale, products that scored above 3.5 on the willingness to trial purchase were regarded as being in the acceptable region, whilst products that scored below 3.5 were considered as being in the unacceptable region.

For the three attitude measurements, ratings made by Segment 3 were significantly higher for all eight carrier formats than ratings made by the other segments ($p < 0.05$). Moreover, willingness to trial purchase ratings made by Segment 3 ranged from 4.5 to 6.2, which indicated that protein-enriched foods were highly accepted by this group of consumers. Segment 2 had the lowest scores of the three segments on all three attitude measurements ($p < 0.05$), and mean ratings of willingness to trial purchase were all lower than 2. Segment 1 rated three out of four healthy carrier sets in the acceptable region (scores > 3.5), whilst all four unhealthy carrier sets and the healthy, novel, meal-component carrier set were evaluated as unacceptable (scores < 3.5).

Comparing different carrier sets, all three attitude measurements were significantly higher for healthy carrier sets than unhealthy carrier sets ($p < 0.05$). Among the four healthy sets, consumers preferred *meal-component* carriers if the carriers were *traditional* ($p < 0.05$), and they preferred *snack* carriers if the carriers were *novel* ($p < 0.05$). Among the four unhealthy sets, consumers were more willing to try meal-component carriers than snacks ($p < 0.05$), whilst no significant preferences between traditional and novel carriers were observed ($p > 0.05$).

Besides the examination of correlations among the attitude measurements (section 3.2.1), the differences between perceived appropriateness and trial purchase willingness were also examined per carrier format by means of an ANOVA analysis (not shown in Fig. 4). It was
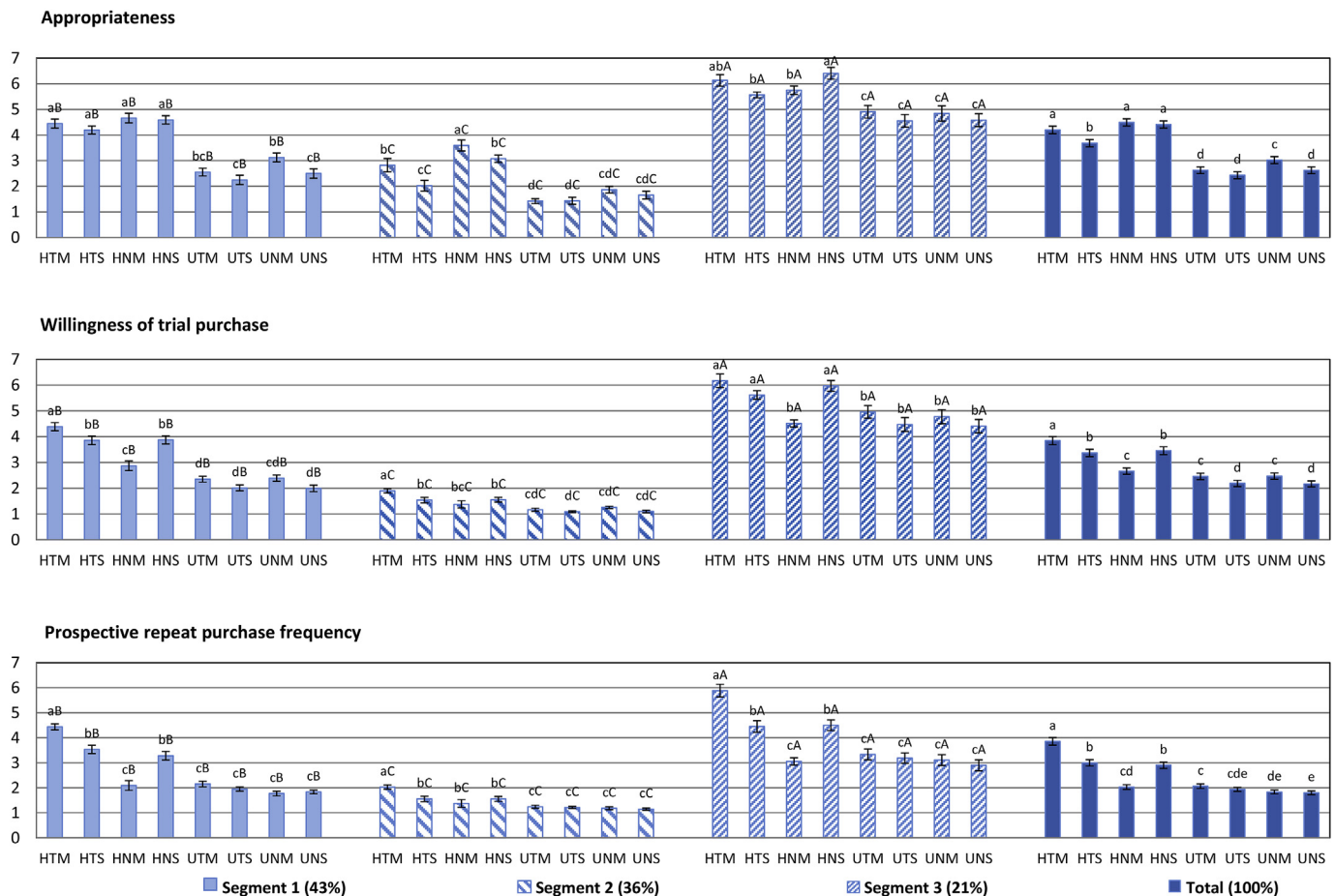

Fig. 4. Bar plots showing mean ratings for appropriateness, willingness to trial purchase and prospective repeat purchase frequency per carrier set, both for each consumer segment and overall. Abbreviations: H = heathy, U = unhealthy, T = traditional, N = novel, M = meal-component, S = snack. Different lowercase letters indicate significant differences within segments (Bonferroni $p < 0.05$). Different capital letters indicate significant differences of each carrier set across three consumer segments (Bonferroni $p < 0.05$). Options of the purchase frequency were: 1 = never, 2 = less than once per month, 3 = once per month, 4 = once every two weeks, 5 = once per week, 6 = several times per week and 7 = every day.

Table 4

Mean ratings of appropriateness, willingness to trial purchase and prospective repeat purchase frequency of all carrier sets and for tailored carrier sets for each consumer segment.

Measurements		Segment 1	Segment 2	Segment 3	Total
Appropriateness	All formats	3.5[bB]	2.2[c]	5.3[aB]	3.7[B]
	Tailored formats	4.5[bA]	1.9[c]	6.0[aA]	4.1[A]
Willingness to trial purchase	All formats	3.0[bB]	1.4[c]	5.1[aB]	3.2[B]
	Tailored formats	3.8[bA]	1.4[c]	5.6[aA]	3.6[A]
Prospective purchase frequency	All formats	2.6[bB]	1.4[c]	3.8[aB]	2.6[B]
	Tailored formats	3.3[bA]	1.5[c]	4.5[aA]	3.1[A]

Notes: Tailored sets were carrier sets that each subgroup was most willing to trial purchase: group 1 = healthy, traditional/novel, meal-component/snack; group 2 = healthy/unhealthy, traditional, meal-component/snack; group 3 = healthy, traditional/novel, meal-component/snack.
Different lowercase letters within the same row indicate significant differences across the three segments (Bonferroni $p < 0.05$). For each measurement, different capital letters indicate significant differences between the average ratings of all sets and average ratings of tailored sets per segment (Bonferroni $p < 0.05$).
Ratings of the perceived appropriateness for protein-enrichment and willingness to trial purchase were made on a 7-point scale ranging from 1 (not at all) to 7 (very much). Options of the purchase frequency were: 1 = never, 2 = less than once per month, 3 = once per month, 4 = once every two weeks, 5 = once per week, 6 = several times per week and 7 = every day.

found that for some carrier formats, scores of trial purchase willingness was significantly lower than perceived appropriateness ($p < 0.05$), especially the two novel meal-component formats which showed the most substantial deviation. This result suggests that even though consumers may regard some carriers as appropriate for enrichment, this is not a sufficient condition to guarantee consumers' actual intention to purchase these products.

In summary, consumers in Segment 3 (21% of the sample) were found to be most willing to try protein-enriched products. Segment 1 was characterized by a relatively lower willingness to trial purchase unhealthy carriers, whilst Segment 2 seemed to reject protein-enriched products in general. At an overall level, healthy, traditional, meal-component carriers were found to be most acceptable, followed by the healthy, traditional, snack category and the healthy, novel, snack category (Fig. 4).

3.2.3. Consumers' attitudes towards tailored Carrier formats for protein-enrichment

Table 4 reports average ratings on the three attitude measurements for all eight carrier sets across segments. Scores of "tailored" carrier sets, *i.e.*, carrier sets that each segment was most willing to buy and try (based on the regression beta coefficients reported in Table 3), were also presented and compared with the average ratings for all carrier sets (Table 4). The tailored carriers were the following:

- Segment 1 = healthy, traditional/novel, meal-component/snack;
- Segment 2 = healthy/unhealthy, traditional, meal-component/snack;
- Segment 3 = healthy, traditional/novel, meal-component/snack.

For segments 1 and 3 (64%) the tailored carrier formats obtained significantly higher ratings in all three attitudinal measures (Table 4). It is also interesting to notice that the willingness to trial purchase willingness of Segment 1 significantly increased from 3.0 (rejection region) to 3.8 (acceptance region) for the tailored carrier sets ($p < 0.05$). Therefore, most participants were more willing to consume protein-enriched products that were tailored to them. However, this was not the

Table 5

Characterization of the three consumer segments with regards to socio-demographic and Food Neophobia Score (FNS). Notes: Different lowercase letters within the same row indicate significant differences (Bonferroni $p < 0.05$).

Measurements	Segment 1	Segment 2	Segment 3	Total
Age (mean)	66.6	66.4	67.0	66.6
Gender (% female)	67.5[ab]	71.6[a]	50.0[b]	65.4
Marital status (% married)	49.4[b]	65.7[a]	39.5[c]	53.3
Household size (mean)	1.8	1.7	1.6	1.7
Education (%)				
- *Low*	18.2[a]	7.5[b]	2.6[b]	11.0
- *Middle*	23.4	23.9	23.7	23.6
- *High*	58.4[b]	68.7[a]	73.7[a]	65.4
FNS (mean)	29.2	29.1	28.9	29.1

Educational level: low = primary, middle and high school; middle = vocational school or technical college; high = university education.
FNS was obtained by summing the ratings of the 10-item food neophobia scale, among which scores of items 1, 4, 6, 9 and 10 were reversed before summing up (Pliner & Hobden, 1992). The range of FNS is 10–70.

case for Segment 2 (36%), for which no significant difference on all three measurements between tailored formats and all formats was found, consistently with the previous observation that this group of consumers seemingly rejects protein-enrichment in general.

3.2.4. Characterization of consumer segments based on background characteristics

Demographic characteristics and background information of the three segments were analyzed to generate insights about possible socio-demographic correlates of their different attitudes towards protein-enriched foods (Table 5). Additionally, consumers' preferences for different protein sources and strategies to improve protein intake were also evaluated (Table 6). In Tables 5 and 6, age, household size, food neophobia level, preferred format to increase protein consumption and preferred protein types (continuous data) were analyzed through multivariate ANOVA's with Bonferroni-correction post hoc tests. Gender, marital status and educational level (categorical data) were analyzed through Pearson's chi-squared tests and Kruskal-Wallis tests with pairwise comparisons.

Consumers in the three segments were found to significantly differ with respect to gender, marital status and education level ($p < 0.05$). Segment 3, the one most positively oriented towards protein-enriched foods, had the smallest percentage of married participants (39.5%) and also the highest percentage of males (50.0%), compared to other groups (Table 5). Segment 2, the group least willing to consume protein-enriched foods, had the highest percentage of married participants

Table 6

Preferences towards ways of promoting protein intake and protein types.

Measurements	Segment 1	Segment 2	Segment 3	Total
Preferred format				
- Foods rich in protein	6.6[bA]	8.1[aA]	5.2[cA]	6.8[A]
• Protein-enriched foods	1.7[bB]	0.7[cB]	3.4[aB]	1.7[B]
• Supplements (e.g. pills)	1.6[aB]	0.8[cB]	1.1[bC]	1.2[C]
• Not applicable	0.2[bC]	0.4[aC]	0.3[abD]	0.3[D]
Preferred protein type				
- Plant	2.6[bB]	3.1[aB]	3.2[aB]	2.9[B]
- Dairy	4.3[aA]	2.4[bcC]	4.4[aA]	3.6[A]
- Meat	1.6[aC]	0.8[bD]	1.6[aC]	1.3[D]
- Not applicable	1.5[bC]	3.7[aA]	0.8[cD]	2.2[C]

Notes: Different lowercase letters within the same row indicate significant differences at $p < 0.05$; for each measurement, different capital letters within the same column indicate significant differences at $p < 0.05$. The two measurements were assessed by allocating 10 points over the four options per measurement.

(65.7%) and females (71.6%). Also, Segments 2 and 3 had a significantly higher education level than Segment 1 (p < 0.05). No correlation was found, however, between education level and willingness to trial purchase enriched foods. Differences with respect to age, household size and food neophobia level between the three segments were negligible.

Regarding consumers' preferences towards ways to improve protein intake (Table 6), participants were overall mostly interested in consuming more protein-*rich* foods as a way to meet their daily protein intake, compared to protein-*enriched* foods and protein supplements, such as protein shakes and pills (p < 0.05). Among the three groups, Segment 3 had the highest interest in using protein-enriched foods to improve their protein intake and the lowest interest in consuming more protein-rich foods to promote protein intake (p < 0.05). Regarding the protein types that can be used for protein-enriched foods, most participants preferred dairy protein rather than plant and meat protein, except for participants in Segment 2, who instead showed a higher interest in using plant protein for enrichment (p < 0.05; Table 6).

4. Discussion

The main aim of the present study was to explore older consumers' attitudes towards protein enriched carriers varying in three fundamental dimensions (healthiness, novelty, and meal type).

The results obtained in the main study showed that the majority of participants were most willing to trial purchase protein-enriched foods when these were considered healthy. This finding indicates that older adults are cautious with unhealthy foods in general and regard healthy foods as credible carriers for functional ingredients, and is well in line both with the results obtained with Dutch consumers (van der Zanden et al., 2015) and with previous research more generally (Ares & Gámbaro, 2007; Poulsen, 1999; Vella et al., 2013).

Among the healthy carrier formats, *meal-component* (as opposed to *snacks*) carriers were found to be preferred when they belonged to the *traditional* category, whereas *snacks* were preferred if the carriers were *novel*. This may reflect the fact that meals are the most substantive part of a daily diet and, for most consumers, contribute more to nutritional intake than snacks do. Consumers could be less cautious when considering occasional novel snacks, but may be more reflective when incorporating novel meal-component foods into their diet.

Except for one segment (Segment 3), our participants exhibited low interest in trial and repeat purchasing protein-enriched foods. However, most participants considered tailored carrier formats, i.e., those most appealing to them, as more appropriate and were considerably more willing to try and repeat purchase tailored carriers enriched with protein. Thus, our results clearly demonstrate that an understanding of consumer needs and tailoring product development towards meeting specific consumer needs can improve the likelihood of acceptance of protein enriched food products amongst older consumers.

Furthermore, this study confirmed that trial purchase willingness could be a valid basis for evaluating consumers' various attitudes towards functional foods which, again, is well in line with the previous research conducted in the Netherlands (van der Zanden et al., 2015).

Importantly, the results showed that willingness to trial purchase was strongly correlated with perceived appropriateness and prospective repeat purchase frequency. This, in turn, suggests that providing older consumers with the chance to try protein-enriched foods tailored to them may substantially increase the likelihood of repeat consumption (Ares & Gámbaro, 2007; Krutulyte et al., 2011; van der Zanden et al., 2015). Therefore, promoting target consumers' willingness to trial purchase should be an essential step to increase the success of protein-enriched products (Grunert & van Trijp, 2014; van der Zanden et al., 2015).

Socio-demographic characteristics, especially gender and marital status, could explain older adults' heterogeneity in attitudes toward protein-enriched foods, albeit to a limited extent. Segment 3, the

consumer group with the largest percentage of unmarried males, was found to be significantly more positive towards protein-enriched foods compared to the other groups. Both Segment 1 and Segment 3 were positively influenced by the healthiness dimension, but Segment 3 had significantly higher purchase willingness on average, and was slightly less affected by perceived healthiness. Since single male adults may have less interest in grocery shopping and cooking (Brown, 2006), it is possible to assume that consumers in Segment 3 might see protein-enriched foods as a more convenient way to obtain a high protein intake (less preparation and cooking time required) compared to cooking protein-rich foods. Moreover, males might be more interested in the muscle-building function of protein-enriched foods, which could be another motivator to increase consumption intention (recall that Segment 3 had a significantly higher proportion of males than the other segments). Segment 2 showed the lowest interest in protein-enriched foods. It had the largest percentage of married females, and was influenced most strongly by the novelty dimension, where it showed a clear preference for traditional carriers.

These findings on the gender-related differences effects are not entirely consistent with previous work, and point at a certain inconsistency in the literature. On the one hand, some studies indicated that women were more likely to be consumers of functional foods compared to men (Childs, 1997; Gilbert, 1998; Poulsen, 1999), or reported no difference in equally willingness to consume functional products as males across genders (Siegrist, Shi, Giusto, & Hartmann, 2015; Urala & Lähteenmäki, 2007; van der Zanden et al., 2015; Verbeke, 2005). However, some other studies, including ours, found that women had more negative attitudes towards functional foods (Ares & Gámbaro, 2007; Ozen et al., 2012). These findings indicate that gender differences in attitudes towards functional food consumption could be product-dependent and country/region dependent (Ares & Gámbaro, 2007). In Denmark, our results suggest that older women might have lower interest in consuming protein-enriched functional foods compared to older male consumers. Married women could even be more skeptical about functional foods, perhaps because they are more likely to be the principal person responsible for food purchasing and preparation for their family. Effective product communication and increasing awareness of health recommendations regarding protein intake could be beneficial to reach this target segment (Wendin et al., 2017b).

Unlike gender, age did not explain heterogeneity in consumer attitudes, which might be the case because consumers of similar age do not necessarily prefer similar things, since the individual experiences during their lifetime have shaped their wants and beliefs differently (Moschis, 1994; van der Zanden & van Trijp, 2016).

Thus, instead of explaining older consumers' various preferences towards carrier formats based on differences in demographic characteristics, future studies may explore segments based on variables which are relevant to consumers' food related lifestyles – such as requirements of convenience, attitudes towards a healthy diet, interest in muscle building, weight control, grocery shopping and cooking – to better understand the underlying drivers of consumers' attitudes towards protein-enriched foods (De Jong, Ocke, Branderhorst, & Friele, 2003; Hoek et al., 2004; van der Zanden et al., 2015).

The last aim of the study was to validate the results of the original work and carry out a cross-cultural comparison of older Danish and Dutch consumers' attitudes. The results obtained with the older Danish consumers are generally well in line with those obtained in the Netherlands (van der Zanden et al., 2015), concerning the main finding that both older Danish and Dutch consumers regarded healthy carrier formats as the most positive food formats for protein-enrichment. However, compared to Dutch consumers, Danish consumers showed more interest in trying novel carriers enriched with protein and a lower degree of heterogeneity with regards to meal-type preferences. Moreover, female consumers in Denmark were more skeptical toward functional foods than their Dutch counterparts. The general interest in protein-enriched products among older adults was low in both

countries but, as in the original study, willingness to purchase did increase for protein-enriched foods tailored to specific segments (van der Zanden et al., 2015). Taken collectively, the results of both studies allow us to state with greater confidence that a consumer segmentation approach to product development is highly recommended to increase older consumers' willingness to buy protein-enriched foods.

The main limitation of this study is that product concepts, rather than actual products, were used to measure target consumers' attitudes, which might limit the ecological validity of the findings. Therefore, further studies based on real protein-enriched foods are advised to study consumers' actual consumption in real life, where the effects of factors such as sensory properties and consumption contexts could also be evaluated.

5. Conclusions

This study investigated older consumers' attitudes towards food carriers for protein enrichment with Danish participants through an online survey, extending previous results obtained with Dutch consumers (van der Zanden et al., 2015). Results showed that older consumers were most willing to try healthy, traditional meal-component foods enriched with protein. The general interest in protein-enriched products among older adults was low in both Denmark and the Netherlands, but consumers' purchase willingness increased substantially for protein-enriched foods tailored to them, suggesting that the market segmentation and targeting approach would be beneficial for product development within this product category.

In characterizing the different segments, the main differences pertained to gender, with single older men being significantly more positive towards protein enriched products than women. Other demographics did not explain differences among the consumer segments, and neither did food neophobia. Thus, future research is advised to include a broader range of background characteristics that may better explain older consumers' attitudes towards protein enriched products.

Finally, the results showed that willingness to trial purchase was strongly correlated with perceived appropriateness and prospective repeat purchase frequency. Therefore, promoting target consumers' willingness to trial purchase should be an essential step to increase the success of protein-enriched products (Grunert & van Trijp, 2014; van der Zanden et al., 2015). Future studies may look into feasible strategies to achieve that, such as the tasting of appealing protein-enriched foods in real life, which might reduce older consumers' skepticism towards protein-enriched foods.

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