Fish as an alternative protein – A consumer-oriented perspective on its role in a transition towards more healthy and sustainable diets

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**ABSTRACT**

Fish has several benefits that make it a desirable part of a healthy diet. It is also a high-protein product that can be used as a relatively efficient meat replacer. Both from a health and sustainability perspective, however, it is important to consider the optimum number of fish servings per week and to examine whether fish and plant protein can be brought under the same heading of alternative protein sources. To explore the consumer perspective on these issues, this paper draws on a brief literature study and a re-analysis of survey data from the Netherlands collected earlier. The hypothesis was that affinities with fish consumption and plant-based protein sources are to a certain extent related to each other, based on common relationships with food involvement, which set them apart from meat. The results showed that the hypothesis needed to be nuanced: fish consumption was associated exclusively with affinity with spicy meals based on authentic plant protein sources (e.g. nuts) and this relationship was partially based on food involvement. The results are in line with current Dutch recommendations that encourage consumers to eat one serving of fish per week and that stimulate those who already eat more than one serving of fish to replace the rest by plant-based protein sources.

1. Introduction

The scientific literature on healthy and sustainable diets is consistently supportive of a move away (i.e. a transition) from animal-based diets towards more plant-based diets (Springmann et al., 2018; Willett et al., 2019). Many studies in recent years have focused on the impacts of meat consumption and the importance of meat reduction (Springmann et al., 2018; Westhoek et al., 2014), but the positioning of seafood within the sustainable diet literature is less clear (Farmery, Gardner, Jennings, Green, & Watson, 2017; Seto & Fiorella, 2017). Fish falls under the generic category of meat, but fish and meat are usually considered distinct entities (Rozin, Hornes, Faith, & Wanskin, 2012). Fish has several benefits that make it a desirable part of a healthy diet (Thilisted et al., 2016), such as a high content of omega-3 fatty acids, which have essential roles in the body and are associated with a lower risk of all-cause mortality (Zhao et al., 2016; Zheng et al., 2012). Fish is also a high-protein product that can be used as a relatively efficient meat replacer in high-meat eating countries, because it causes less environmental pressure than other animals that are fit for human consumption (Perignon et al., 2016; Reynolds, Horgan, Whybrow, & Macdiarmid, 2019; van Dooren, Keuchenius, de Vries, de Boer, & Aiking, 2018). However, much more integrated research is necessary to assess how both capture fisheries and the relatively new field of aquaculture can sustainably meet increasing global demands for fish (Bogard, Farmery, Little, Fulton, & Cook, 2019). Hence, it is important to consider the optimum number of fish servings per week, beyond which there are no additional health gains (Kromhout, Spaaij, de Goede, & Weggemans, 2016), but only sustainability losses due to overfishing (Pauly et al., 2002).

This non-linearity has not, so far, been addressed in consumer studies on meat and fish consumption (e.g. Carlucci et al., 2015; Pieniak, Verbeke, Olsen, Hansen, & Brunse, 2010; Schösler, de Boer, & Boersema, 2012). It opens up new questions about how and under what conditions changes in fish consumption can contribute to a transition towards more healthy and sustainable diets, with a low level of animal protein intake. The present paper puts forward the view that these questions can at least partially be answered by a brief literature study and a re-analysis of survey data collected earlier for a purpose not addressed in the original paper. The purpose is a comparison of different categories of fish consumers in the Netherlands and their affinities with plant-based protein sources; the original research was presented by Schösler et al. (2012) in a paper on meat replacement. As explained below, the topic of meat replacement creates a focus that is too narrow to provide a full understanding of the potential role of fish.
1.1. Background

The objective of boosting a transition towards more healthy and sustainable diets requires a broad perspective on the various sources of high-quality protein, such as legumes (pulses, beans), nuts, meat, dairy and fish. Although these protein sources are often considered as alternatives to one another in many culinary traditions, they have their own typical food characteristics, which are largely unique (Drewnowski & Poulain, 2018; Willett et al., 2019). For instance, a study of French adults has shown that their (self-reported) intakes of different animal and plant protein sources were differently related to their overall diet quality scores (i.e. an integrated index of nutrient adequacy), and that only the intakes of plant protein, fish, milk, and yogurt protein were uniformly positively associated with high diet quality scores among both men and women (Camilleri et al., 2013; see also; de Gavelle, Huneau, & Mariotti, 2018). From a nutritionist perspective, therefore, a shift from the current Western (or Westernized) diet to a nutritionally adequate, low animal protein diet is not just a matter of limiting the intake of (in particular) animal protein sources, but also of diversifying the intake of (in particular) plant protein sources (Drewnowski & Poulain, 2018; Salomé et al., 2019).

Some of these insights have now been incorporated into the development of dietary guidelines at the country level, which present science-based nutritional information in the form of simple, food-based messages and graphics, adapted to the food culture of a population (Dwyer, 2012). These guidelines were originally intended to promote overall health and prevent chronic diseases, but now have broader objectives. Each set of recommendations represents, in fact, a trade-off between various aspects of food, including nutrition, health and increasingly also the environment, economic and socio-cultural dimensions (FAO, 2020). A recent study, which provides a detailed overview of these guidelines around the world in July 2018 (Herforth et al., 2019), notes that there is a common theme in the guidelines of several countries (mainly in Europe) that can be summarized as the recommendation to “eat two servings of fish weekly” to “eat one serving of fish, preferably oily fish weekly”. The authors comment, however, this strong emphasis on fish as an important or even non-substitutable food is in need of reconsideration from a sustainability standpoint (Herforth et al., 2019, p. 603).

The Netherlands forms an exception to this general pattern, as it recently decided to revise its recommendation from “eat two servings of fish weekly” to “eat one serving of fish, preferably oily fish weekly”. The main argument for this revision is that the positive health effects of fish oil do not increase beyond the level of one portion of fish per week (Health Council of the Netherlands, 2015; Kromhout et al., 2016), whereas a higher intake does have a negative environmental impact (Brink et al., 2019). It should be added that this recommendation is not an isolated message; it fits into an optimized week menu with a maximum of two servings of red meat, two servings of white meat (maximum 500 g meat), one serving of fish, and two servings of plant-based protein sources such as legumes or nuts (e.g. see de Boer & Aiking, 2019). This means that a low level of fish consumption can be part of a diet that is more healthy and has a lower environmental impact than current food consumption in the Netherlands (Brink et al., 2019). From the perspective of consumer behavior, these recommendations mean that consumers are to a certain extent encouraged to eat fish and that those who already eat more than one serving of fish are encouraged to replace the rest by plant-based protein sources. Whether these recommendations are realistic and workable requires further research, but these questions can at least partially be answered by a brief literature study and a re-analysis of existing data.

1.2. Affinities with fish consumption

Work on fish in the field of consumer research can be distinguished into studies on fish as a separate topic and fish as a protein source that provides an alternative to traditional meat consumption. Studies in the first category are usually focused on describing differences between low and high fish consumers that can be interpreted as motivation drivers and barriers. Unlike meat, there appears to be no gender difference in liking fish (Rozin et al., 2012). The extensive international review by Carlucchi et al. (2015) reveals that, in many developed countries, the main driver of fish consumption is a positive attitude towards eating fish among a large majority of consumers, who generally perceive fish as healthy food, although they often do not achieve the intake level that is recommended in their country. According to this review, the most important barriers to fish consumption are sensory disliking of fish, lack of user convenience, lack of confidence in one’s own ability to select and prepare fish, health risk concerns, lack of fish availability and too high prices (Carlucchi et al., 2015). These barriers reflect typical differences between consumers with strong or weak habits of eating fish.

A second key factor, mentioned by Carlucchi et al. (2015), is the degree to which consumers are involved with food. The latter is also relevant to other protein sources as the concept of involvement refers to motivational differences between consumers who are highly interested in food and food choice processes and those who are not; the former care more than the latter about the quality of their choices and prefer to make informed decisions (Avnet, Laufer, & Higgins, 2013; de Boer, Hoogland, & Boersema, 2007; Peter & Olson, 2002). A marketing study in several North-West European countries on consumers’ quality perceptions (good taste, healthiness, value for money, convenience and availability) of proteins from the sea (salmon and cod) and land (chicken, pork, and beef) shows that consumers with a high level of food involvement have more positive judgments about fish than consumers who are locally involved with food, while there are much less differences in the perception of the terrestrial meats (Torrisen & Onozaka, 2017). The low involvement group values convenience, and shows less interest in the remaining quality dimensions, although they share the healthy fish image. These results are very important for the position of fish as a deliberately chosen alternative to meat. According to Torrisen and Onozaka (2017), low involvement consumers might not consider seafood a substitute for meat, in contrast to higher food involvement groups. Hence, recent work has shed more light on fish as a habitual choice and as a potential alternative to meat.

1.3. Affinities with plant-based protein sources

Studies on the affinities of non-vegetarian consumers with plant-based protein sources may have one of two foci. The first focus involves consumer affinities with plant-based meat substitutes that, to a certain extent, imitate meat; the second focus involves consumer affinities with authentic plant-based protein ingredients (Lemken, Spiller, & Schulze-Ehlers, 2019; Schöslér et al., 2012). Meat imitation is a relatively recent phenomenon that is intimately related to the rise of convenience foods and the small market share of consumers with an interest in occasional meat-free meals (Sadler, 2004). Convenient substitutes imitate the place of meat in the meal and require no vegetarian cooking skills (Schöslér et al., 2012). The current products, such as soy-based meat substitutes, are not very appealing to the taste of the majority of consumers in Western countries, but there are consumer niches that are interesting enough for producers (Elzerman, Hoek, van Boekel, & Luning, 2011; Hoek et al., 2011). A large sample study in Switzerland shows that the likelihood of consuming soy-based meat substitutes is low but somewhat higher among consumers with a low level of meat consumption, higher estimates of the environmental impact of meat, lower estimates of the environmental impact of soy-based meat substitutes, high health consciousness, low disgust sensitivity, and who are female, younger, and better educated (Siegrist & Hartmann, 2019). In the Netherlands, more than occasional use of these products is not recommended by the dietary guidelines, due to high levels of salt (Brink et al., 2019).

The plant-based protein ingredients that are recommended by nutritionists around the world, such as pulses (Herforth et al., 2019), seem
to have lost their appeal to non-vegetarian consumers in Western countries, even where they were traditionally consumed in regular meals, such as in France (Melendrez-Ruiz, Buatois, Chambaron, Monnery-Patris, & Arvisenet, 2019). In the eyes of many consumers, pulses are products with a clear nutritional value, but also old-fashioned sources of flatulence, likely to increase body weight—an image that Schneider (2002) attributes to an inadequate level of innovation for developing products adapted to modern life. Although there are consumers who specifically dislike the taste or texture of pulses (Melendrez-Ruiz et al., 2019), various countries host consumer segments with a more positive appreciation (Vainio, Niva, Jallinoja, & Latvala, 2016), which would rather substitute meat directly with lowly processed legumes than having highly processed meat substitutes (Lemken et al., 2019). Schösler et al. (2012) asked consumers in the Netherlands to rate the attractiveness of a dozen of meat-free meal options. This study revealed two variants of affinity with existing plant-based meals, one focused on meals with plant-based meat substitutes (minced-meat made from soy) and the other on meals with authentic plant protein sources (nuts, chickpeas and lentils). From the perspective of these consumers, one of the appeals of the latter might have been the ethnic background of the meals, which makes them slightly different than the meals with pulses they are familiar with. This demonstrates that the appreciation of pulses and other plant-based proteins depends on the meal context in which they are presented (Elzerman et al., 2011; Meiselman, 1996) and suggests that it is feasible to develop more attractive meal concepts for these products.

1.4. Affinities with fish and plant-based protein sources

There is limited work that brings affinities with fish and plant protein under the same heading of alternative protein sources. A Finish study on self-reported changes in the consumption of beef, beans, and soy products, which used fish consumption as an inactive background variable, found that one of its consumer segments had parallel dietary change expectancies to increase fish, beans and soy products (Vainio et al., 2016). Additionally, a study in Portugal, where fish is an important component of the daily diet, investigated the relationships between various food consumption orientations and current eating habits regarding lunch and dinner meals with meat, fish and plant protein (Graça, Truninger, Junqueira, & Schmidt, 2019). The results show some interesting parallels between the food consumption orientations that are related to the consumption of fish meals and of plant-based meals. Food consumption orientations expressing health and naturalness concerns correlate with more frequent consumption of both fish meals and plant-based meals per week (and less frequent meat meals). Two differences are that consumers who emphasize convenience tend to eat fish less often and that consumers who particularly value social image aspects (i.e., eating to present one-self positively in social contexts) tend to eat less plant-based meals (Graça et al., 2019). However, the paper does not reveal how fish consumption itself is related to affinities with plant-based meals.

1.5. Present study

A re-analysis of the data presented by Schösler et al. (2012) can add in several ways to the work described above. The original study investigated consumer affinity with various protein sources that could reduce meat consumption in the Netherlands, but did not pay much attention to the position of fish. However, the data set covers the distinct fish consumption categories that are currently relevant from a health and sustainability perspective (e.g. Brink et al., 2019; Zheng et al., 2012) and can be fruitfully used to compare these categories in terms of involvement with food and affinities with plant-based protein sources. This comparison includes the two variants of affinity with existing plant-based meals, regarding meals with plant-based meat substitutes and meals with authentic plant protein sources, the latter of which are recommended by the dietary guidelines. The overall hypothesis is that affinities with fish consumption and plant-based protein sources are to a certain extent related to each other, based on common relationships with food involvement, which set them apart from meat. In order to bring affinities with fish and plant protein under the same heading of alternative protein sources, relationships with meat consumption and replacement are also included. In this way, it is possible to explore whether fish consumption could also be a helpful step to open up pathways to other alternative proteins.

2. Method

2.1. Data

Schösler et al. (2012) collected their data based on a stratified nationwide sample, drawn from a large panel of consumers in the Netherlands with Internet access who are willing to participate in web-based research for a small reward. The field work took place in November 2010 and was completed with 1083 participants (response rate in two weeks 68%). Building on earlier research, the questionnaire included modules on type and level of involvement with food, meat consumption and replacement, fish consumption, affinities with plant-based foods, and some socio-demographics. For the present analyses, a small percentage of self-declared vegetarians was excluded. The participants’ answers to a single item on their fish eating frequency were relabeled to correspond to four distinct consumption categories (e.g. Zheng et al., 2012): 1 never, 2 very low (1–3 servings/month), 3 low (1 serving/week), and 4 moderate (2–4 servings/week). Zheng et al. (2012) also used the category high (> 4 servings/week), but as only a few participants fell into this category, they were left out of the analysis, leaving 1067 participants. The percentage of women was 50%; the mean age was 49.1 (about half the adult population in the Netherlands is older than 50 years of age).

2.2. Measures

For the analysis of the fish consumption categories, the following variables were used. Type and level of involvement with food was measured in combination with two important motivational orientations regarding food, which were developed by de Boer et al. (2007) building on Higgins’s (1997) concepts of promotion and prevention and Schwartz et al.’s (2001) value theory, namely (a) promoting taste and pleasure through food and (b) paying reflective attention to the wider implications of food choices (e.g. on health or well-being). The items presented short, positively worded portraits of persons with different degrees of involvement in food, both in taste-oriented and reflection-oriented ways. The female version of a taste-oriented item is: “She likes many different foods. She is also a great taster.” Also included is curiosity about new tastes. The opposite is a preference for ordinary meals. An example of a reflection-oriented item is: “She is very mindful of food. She wants to eat sensibly.” The set also includes a preference for fresh and natural products. In this case the opposite is being easy about food. Participants were asked to compare the portrait to themselves and to rate on a 7-point scale “how much like you” the person is. Replicating de Boer et al. (2007), the two independent components of food involvement, taste-oriented and reflection-oriented, could be measured reliably (Cronbach’s alpha .74 and .62).

The questions about meat consumption and replacement were single-item measures of specific aspects. One question asked for the number of meat eating days (“How many days per week do you eat your main meal with meat (including chicken)?”). The question on the preferred meal format was a choice between two photos showing a meal consisting of separate components (a cutlet, potatoes and a vegetable arranged separately) and a meal that mixes ingredients (ground meat in a pasta dish). The question was “Which of these types of meal do you prefer?” and had a dichotomous response format. The subject of meat
substitution was introduced neutrally, without mentioning the motives that people might have for skipping meat in their dishes. The participants who reported to eat meat less than 5 days per week were asked whether they deliberately replaced meat by something else ("no", "yes sometimes", "yes, always") and, if yes, what they used instead (deliberate meat replacement).

All participants were asked to rate a dozen of meat-free meal options (pictures of meals with descriptive sentences) in terms of attractiveness and chance that they would prepare a similar meal at home, given that ingredients are easily available. The pictures showed plant-based meals and also some meals with insects, but the latter are not presented here. The ratings were made on a 7-points Likert scale. Principal component analysis revealed the presence of two variants of affinity with existing plant-based meals, one focused on meals with plant-based meat substitutes (such as a meal with Tofu stir-fry or Tivall vegetable steak) and the other on meals with authentic plant protein sources (such as Indian Dal with chickpeas or pasta pesto with nuts). In both cases, the levels of affinity could be measured reliably (Cronbach's alpha .94 and .89, respectively). Additional variables in the analyses were gender, age, education and household size. Except for the meat eating frequency item, the other measures were transformed into z-scores (mean = 0, standard deviation = 1).

### 2.3. Analyses

The hypothesis was investigated with three different analyses. By performing a multinomial logistic regression, it was determined how much the fish consumption categories were associated with taste-oriented and reflection-oriented involvement with food, and with the variables gender, age, education and household size. Next, one-way ANOVAs (with Bonferroni post-hoc analysis) were used to compare the distinct fish consumption categories according to meat eating frequency, preferred meal format, deliberate meat replacement, and affinities with plant-based protein sources. Finally, a multiple regression analysis was applied to examine how the different categories of fish consumption were related to affinities with plant-based protein sources, using taste-oriented and reflection-oriented involvement with food as additional predictors. In this analysis, the four categories were represented by three specially coded variables (using backward difference coding), which allowed us to compare the differences between adjacent categories, such as "low" versus "moderate".

### 3. Results

#### 3.1. Predicting fish consumption

The fish consumption of the (non-vegetarian) participants was categorized as “never” (10% of the 1067 participants), "very low" (36%), "low" (38%), and “moderate” (16%), which means that about half of them ate less than one serving per week. Gender did not make a difference. The results of the multinomial logistic regression models, presented in Table 1, revealed various relationships between the predictors and the fish consumption categories. The two uncorrelated measures of involvement with food were both positively associated with fish consumption and significantly differentiated the “never” and “moderate” categories, as well as one of the in-between categories ("very low" or "low"). For instance, the coefficients in Table 1 indicate that a one unit increase in taste-oriented involvement with food (e.g., one standard deviation) was associated with an increase of the odds of "low" (+23%) and "moderate" (+49%) fish consumption and a decrease of the odds of "never" (−33%), in comparison with the reference category ("very low"). The results for reflection-oriented involvement were very similar. Additionally, age and education significantly contributed to the prediction of specific categories. As age increased, specifically the likelihood of "low" fish consumption increased; a higher education level predicted more "moderate" fish consumption.

| Predictor                              | Odds ratios for the categories |
|----------------------------------------|--------------------------------|
|                                        | Never | Low | Moderate |
| Taste-oriented involvement with food   |       |     |          |
| (conventional vs. tasteful)            | .67***| 1.23**| 1.49***  |
| Reflection-oriented involvement with food | .79†  | 1.19 | 1.50***  |
| (being easy vs. mindful)               |       |     |          |
| Age                                   | .99   | 1.41***| 1.06     |
| Level of education                    | .91   | 1.05 | 1.28**   |
| Household size                        | .96   | .94  | 0.82†    |

Notes: The reference category is “Very low” (36%); Nagelkerke R² square = 0.124 (Chi-square = 129.52, df = 15, p < .001). * Standardized variable.

#### 3.2. Differences between the fish consumption categories

Table 2 displays the differences between the means of the fish consumption categories for meat eating frequency, preferred meal format, deliberate meat replacement, and affinities with plant-based protein sources, together with the results of the ANOVAs. The number of meat eating days was associated with fish consumption in a decreasing way, although those who never ate fish did not have the highest number of meat eating days (5.6). Those with a very low fish consumption were slightly higher (5.8) than those with a low fish consumption (5.5) and the moderate fish consumers had the lowest number of meat eating days (4.5). The fish consumption categories showed small differences in preferred meal format, but moderate fish consumers relatively often preferred a meal that mixes ingredients. As noted before, the participants who reported to eat meat less than 5 days per week (n = 240), had been asked whether they deliberately replaced meat by something else. The degree of deliberate replacement was noticeably associated with the fish consumption categories; it was low in the categories “never” and “very low”; but increased in the categories “low” and “moderate”. Those who reported replacement often mentioned fish as one of their options. The two uncorrelated measures of affinity with existing plant-based meals were both positively associated with fish consumption, but affinity with plant-based meat substitutes showed smaller differences than affinity with authentic plant protein sources. The latter affinity was particularly high among moderate fish consumers and particularly low among those who never ate fish.

#### 3.3. Predicting affinity with meals based on plant protein sources

The results of the stepwise multiple regression models predicting levels of affinity with meals based on authentic plant protein sources are presented in Table 3. The first step of the analyses shows the three specially coded variables that represent the differences between adjacent fish consumption categories. The differences between “very low” and “no” and between “moderate” and “low” were statistically significant, which is a recalculation of the data given in Table 2. Additionally, the regression analyses were meant to show whether these differences remained significant when controlling for other variables. It appeared that number of meat eating days (negative sign), preference for meal with combined ingredients, taste-oriented and reflection-oriented involvement with food, as well as age and level of education (positive sign) all contributed to the prediction and that the regression coefficients of the fish consumption categories decreased in a stepwise manner. However, the difference between “moderate” and “low” remained significant, although the unstandardized coefficient B
The hypothesis of this study was that affinities with fish consumption and plant-based protein sources are to a certain extent related to each other, based on common relationships with food involvement, which set fish and plant protein apart from meat. The hypothesis was stated in the context of a brief literature study, which examined whether consumer affinities with fish and plant protein can be brought under the same heading, and which suggested parallels in the underlying food choice motives. The analyses showed that the hypothesis needed to be nuanced in two respects: fish consumption was associated with less meat eating days and a higher level of reflection-oriented involvement with food (results not shown, final $R^2 = 0.064$).

The low fish eaters (38%) were currently on target with their fish consumption, but their average number of meat eating days (5.5) was significantly higher than the newly recommended, more sustainable intake level that is recommended. The latter figure agrees with a recent study about fish consumption in the Netherlands and other European countries (European Commission, 2018). Some of them may just have adopted the tradition of eating fish once a week, without being active in deliberately replacing meat. In other words, these consumers do not see fish as an alternative for meat (see also Torrisen & Onozaka, 2017). This category, with a relatively low level of education and not being active in deliberately replacing meat, had on average the highest number of meat eating days (5.8) and, on the other hand, very low or no fish consumption were both typically different from low fish consumption.

4. Discussion and conclusion

The hypothesis of this study was that affinities with fish consumption and plant-based protein sources are to a certain extent related to each other, based on common relationships with food involvement, which set fish and plant protein apart from meat. The hypothesis was stated in the context of a brief literature study, which examined whether consumer affinities with fish and plant protein can be brought under the same heading, and which suggested parallels in the underlying food choice motives. The analyses showed that the hypothesis needed to be nuanced in two respects: fish consumption was associated with less meat eating days and a higher level of reflection-oriented involvement with food, but was not related to fish consumption or taste-oriented involvement with food (results not shown, final $R^2 = 0.064$). Together with a higher age and a higher level of education. The results further demonstrated that, on the one hand, moderate fish consumption and, on the other hand, very low or no fish consumption were both typically different from low fish consumption.

4.1. Strategic implications

These results have several strategic implications for our picture of how fish can contribute to more healthy and sustainable diets, with a low level of animal protein intake. It appears that there are in fact two types of strategic problems, due to a consumption level that is either too low or too high. First, it is important to repeat that fish is a desirable part of a healthy diet and that about half of the participants did not achieve the intake level that is recommended. The latter figure agrees with a recent study about fish consumption in the Netherlands and other European countries (European Commission, 2018). Our results suggest that reluctance around fish and fish dishes among those who ate no fish (10%) is partly due to a low ability and/or willingness to expand their food and taste experiences, which seriously limits the options for alternative protein. Many of those who did eat fish had a very low level of fish consumption (36%). This went together with a low reflection-oriented (but more convenience-oriented) involvement with food and not being active in deliberately replacing meat. In other words, these consumers do not see fish as an alternative for meat (see also Torrisen & Onozaka, 2017). This category, with a relatively low level of education, had on average the highest number of meat eating days (5.8) and may be a challenging target group for diet quality improvement because that specifically requires doing a fish day instead of a meat day. That is, diet modelling studies show that an increased intake of fish makes a diet healthier (i.e. increases the Healthy Diet-index), but less environmentally sustainable (i.e. increases the Greenhouse Gas Emissions Index), except when fish replaces meat (van Dooren et al., 2018).

The low fish eaters (38%) were currently on target with their fish consumption, but their average number of meat eating days (5.5) was significantly higher than the newly recommended four (Brink et al., 2019). Some of them may just have adopted the tradition of eating fish once a week, without being active in deliberately replacing meat. Such an adherence to traditional consumption habits can partially be explained by their higher age. The moderate fish eaters (16%) were more active in deliberately replacing meat, for which they often used fish, but they also had on average too many meat eating days (4.5). Given the fact that they ate more fish than the newly recommended, more sustainable amount of one serving, it is important that they had a high level of taste-oriented involvement with food and a high level of affinity with spicy meals based on authentic plant protein sources (and less so with plant-based meat substitutes). This correlational evidence suggests that fish eating might be a helpful step to get consumers out of routinized meat eating by decreasing their focus on meat-centered dishes and subsequently may enable a shift towards more plant-based meals with a spicy flavor.
4.2. Limitations

One of the limitations of this paper is that it draws on a re-analysis of consumer survey data from one country. However, the findings add to the still limited available publications on fish and affinities with plant-based protein (Graça et al., 2019; Vainio et al., 2016). The limitations apply primarily to the position of meat substitutes in the analysis, as there are currently many claims about newly developed products that are expected to better compete with the taste and the texture of meat, although consumers often seem to be skeptical about such claims (Slade, 2018). Moreover, this product development is only beginning to include fish or cell-based seafood (Krueger, Rubio, Datar, & Stachura, 2019).

Another limitation is that the data do not provide more insight into factors that make plant-based protein more appealing to Western consumers, which is a serious issue (Melendrez-Ruiz et al., 2019). Promoting plant-based meals with a spicy flavor is one option, which may be in particular appreciated by higher educated consumers (Bourdieu, 1984). More generally, it is important to develop new meal ideas highlighting that not just meat can be the centerpiece of a dish but also a skillfully prepared vegetable (Gomez & Bouty, 2011). However, the impact of a low involvement with food should not be neglected. The predominance of meat-centered meals among many lowly involved consumers suggests that it may be necessary to help them extend their food experiences and improve their diet quality. An example from the recent literature is developing and promoting meals that tastefully combine small amounts of fish or meat with diversified plant-based protein, such as a mixture of legumes and vegetables in a burrito bowl (Spencer, Kurzer, Cienfuegos, & Guinard, 2018). This approach will, among other things, require greater meals-oriented marketing to stimulate these consumers and to address the potential social image aspects of plant protein sources, mentioned by Graça et al. (2019).

4.3. Concluding remarks

From a policy perspective, it can be concluded that the results are in line with dietary guidelines that encourage consumers to eat one serving of fish per week and that stimulate those who already eat more than one serving to replace additional fish by plant-based protein sources. The former corresponds with a new guideline in the Netherlands and the latter is a potential extension. The overarching notion of a varied week menu with meat, fish and plant protein may also help to promote positive pathways to alternative protein sources. The recent rapport of the EAT commission (Willett et al., 2019) acknowledges the importance of plant protein and responsibly caught fish; it recommends to increase awareness of the impacts of animal-based protein on the environment, the urgency of this issue and the availability of healthy and tasty solutions.

Developing the positioning of fish in the protein transition requires more insight into consumer behavior, more recent data, and much more attention to regional variations in ecological, cultural and economic conditions. Obviously, there are differences between countries in the ambitions they have to achieve dietary improvements and the role they envisage for fish, which may vary around the world (Herforth et al., 2019). Future initiatives could focus on promoting the differences in nutrition and sustainability between different types of seafood, farmed and wild-captured, which vary across regions (Farmery et al., 2017). As noted by several scholars (e.g. Seto & Fiorella, 2017), and given the decline of many global fish stocks, our conceptions of a sustainable food system should be broadened to explicitly include the food resources that originate in our oceans, rivers, and lakes.

Ethical statement

The paper does not involve new human participants. The data were collected in an earlier study (Schösler, H., De Boer, J., & Boersema, J. J. (2012). Can we cut out the meat of the dish? Constructing consumer-oriented pathways towards meat substitution. Appetite, 58(1), 39–47), which was carried out by marketing firm TNS-NIPO, now part of Kantar TNS Nederland.

Appendix A. Supplementary data

Supplementary data to this article can be found at https://doi.org/10.1016/j.appet.2020.104721.

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