Projective mapping with food stickers: a good tool for better understanding perception of fish in children of different ages

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Abstract

The objective of this study was to better understand the perception of fish products among school children of three different age groups, 5-6 years, 7-8 years and 9-10 years. In order to do so, we used Projective Mapping (PM) withfood stickers and a word association task (WA). A total of 149 children from three public schools in the state of Parana, Brazil, have participated on this study. The age groups were interviewed (on 1-1 basis) by six monitors qualified to apply the sensory methods used.Ten stickers with drawings of *healthy* foods (sushi, salad, fruit, fish, chicken), and *less-healthy* foods (pizza, flan, cake, hamburger, french fries) were given to the children. They were then asked to stick them on an A3 sheet, in a way that the products they considered similar should be positioned close to each other, and those they considered very different should be kept apart. Afterwards, they were asked to described the images and group of images (ultra flash profile). The PM was easily used and understood by all children, and the use of images may potentially have eased its application. Result analyses showed different perceptions from the different age groups. Hedonic perceptions in relation to fish products had a higher weight in the perceptual spaces of older children. WA technique proved to be an important tool to understand fish perception by children, and reinforced the results previouly obtained by PM. These results may imply that there could be a window of opportunity in which younger children will be more open to eat fish.

Keywords: children; perception; fish consumption; projective mapping; napping; word association

1. Introduction

Low fish consumption has been a concern in several studies around the world, Tomić, Matulić and Jelić (2015) in Croatia, Dijk, Fischer, Honkanen and Frewer (2011) in Russia, Grieger, Miller and Cobiac (2012) in Australia and even in Norway (Skuland, 2015), where eating fish is a national tradition, this important source of protein has increasingly been given up. Such studies have been conducted because many researchers are aware of the health benefits provided by this food. Regular consumption is associated with lower chances of developing non-communicable diseases such as cardiovascular disease (Trondsen, Braaten, Lund, & Eggen, 2004).

Accordingly, Brazil seeks to encourage the consumption of fish nationwide. The Brazilian Government has adopted public policies to stimulate both aquaculture and the sustainable use of fish resources, in order to consolidate fisheries chain. Studies to understand the factors underlying the consumption of fish have been carried out and their positive results show that, although the Brazilian population does not have the habit of consuming fish, there is an intention to consume it (Mitterer-Daltoé, Carrillo, Queiroz, Fiszman, & Varela, 2013a; Mitterer-Daltoé, Latorres, Queiroz, Fiszman, & Varela, 2013b). This means that Brazilians are willing to consume fish in a daily basis, they say they want to consume (intention), but in fact, they do not eat fish (do not have the habit). Data show that Brazil is characterized by low fish consumption, 10.6 kg per capita (SNA, 2015), in contrast to the world average per capita consumption of 19.2 kg (FAO, 2014). Moreover, the consumption of fish range between Brazilian regions: in the extreme north region, 12 kg per capita; whereas in the southern region, fish consumption is three times lower (IBGE, 2011). Still, according to a forecast by the Food and Agriculture Organization (FAO), by 2030 Brazil will become one of the largest

fish producers in the world, domestic production will be able to reach 20 million tons (MPA, 2014). Therefore, the Brazilian population can be seen as potentially major fish consumers, not only for their positive attitude towards consuming fish, but also by the abundant fish supply they will have.

Studies also show that the Brazilian government should use strategies to encourage the habit of consuming fish (Mitterer-Daltoé et al., 2013b). It is known that the promotion of a new habit is more effective than trying to change the frequency of an already established behavior (Riet, Sijtsema, Dagevos, & Bruijn, 2011). Therefore, an interesting Brazilian government policy would be to target campaigns at young people, since the acquisition of a habit takes time and occurs gradually through repeated experiments (Popper & Kroll, 2005; Wood & Neal, 2009). According to Donadini, Fumi and Porretta (2013) patterns of healthy diets that include fish consumption should be established in childhood.

Moreover, and considering the actual scenario in Brazil, the inclusion of fish in school meals becomes an important strategy to encourage younger Brazilians to develop the habit of eating fish. Previous studies have shown the potential of introducing fish derivatives in school meals in Southern Brazil. Mitterer-Daltoé, Latorres, Treptow, Pastous-Madureira and Queiroz (2013c) have assessed how students aged from 5 to 18 years old in public schools accepted the inclusion of fish in school meals, and found an average acceptance rate of 82%. Latorres, Mitterer-Daltoé and Queiroz (2016) have assessed the acceptance of fish meatballs among children aged from 6 to 14 years old, and found an 87% acceptance rate; this study aimed to further evaluate the holistic perception of this product by children through the cognitive word association methodology.

Although the studies cited above indicated positive results with regard to fish insertion in school meals, there is a need for studies applying holistic techniques to explore the spontaneous perception of food among children (Varela & Salvador, 2014)

and their feasibility, as food choice goes further than liking, and those techniques can shed light into non-sensory parameters that are important for consumers.

Few studies can be found in the literature with this focus. Varela and Salvador (2014) applied structured sorting as a tool for assessing the nutritional and hedonic perception of healthy and unhealthy foods to children aged 5, 7 and 9 years. The authors pointed out that the technique was easily understood and carried out by the three age groups, and that children are able to classify food according to the perception of healthiness. Results showed that the application of structured sorting using images proved to be a promising tool for the multi-dimensional perception assessment in children.

Within the descriptive sensory methodologies, Projective Mapping emerges as a promising tool to be explored with children (Laureati, Pagliarini, Toschi, & Monteleone, 2015; Varela & Salvador, 2014). Projective mapping and derived techniques are simple user-friendly procedures that have gained popularity within the field of sensory and consumer science. The technique allows consumers to express perceptual similarities/ dissimilarities and grouping sets of products by placing them on a two-dimensional surface (Dehlholm, 2014; Laureati et al., 2015). Descriptive mapping techniques are usually supplemented with descriptors, a step known as ultra-flash profile (Carrillo, Varela, & Fiszman, 2012a; Dehlholm, 2014; Miraballes, Fiszman, Gámbaro, & Varela, 2014; Varela & Ares, 2012).

With presentation on a two-dimensional plane, and of easy and fast application, Projective Mapping is potentially a methodology to be easily applied with children. The possibility of turning it into a game during the test makes it an attractive technique, which ultimately favors the focus of children (Dehlholm, 2014; Laureati et al., 2015). Kimmel, Sigma-Grant and Guinard (1994) and Varela and Salvador (2014) also indicate that the use of figures can be a good strategy so that children understand sensory tests.

Word association (Benthin et al., 1995) is a qualitative technique that has been used in food science in the last years, to gather information about consumers' spontaneous perception. It involves presenting subjects with a stimulus and asking them to provide the first thoughts or images that come to their minds. Latorres et al. (2016) applied the word association with children and found that it could be effectively used for cognitive assessment of food in children with regard to fish products.

The objective of this study was to better understand the perception of fish products among school children aged from 5 to 10 years old. For that, we used Projective Mapping (PM) with food stickers and a word association task (WA).

2. Materials and Methods

2.1 Participants

Students (n = 149) from public schools of the municipal education network in Pato Branco city, state of Paraná, Brazil, participated in the study. The city is located in southern Brazil and computers, electronics and agriculture industries dominate its economy. Three groups of children with 5 and 6 years (n = 51; 25 girls, 26 boys), 7 and 8 years (n = 46; 24 girls, 22 boys) and 9 to 10 years (n = 52; 23 girls, 29 boys) were interviewed by six monitors with experience in the methodology applied. The interviews were conducted individually with each child for both Projective Mapping and for the word association technique.

2.2 Projective Mapping Task

When children were first introduced to the method, they were given geometrical figures of different colors (Carrillo, Varela, & Fiszman, 2012b; Miraballes et al., 2014). Students were asked to distribute the figures close together on the paper sheet

provided (A3, 42 x 29.7 cm) if they thought they were similar and apart from each other if they thought they were different (Carrillo, Varela & Fiszman, 2012a), according to their own criteria (color, shape, size, etc.).

Later on, ten stickers representing “healthy” and “unhealthy” foods were given to the children (Figure 1). The figures were presented all together and the children were requested to place them on the sheet in a way that the products they considered similar should be positioned close to each other, and those they considered very different should be kept apart. After defining the position of the figures on the sheet of paper, the children were told to stick them and explain the reasons why they placed each sticker or group of stickers as such. The monitors wrote their explanations alongside the figures.

2.3 Word Association Test

The word association technique was carried out after the completion of the Projective Mapping task, and following a break, with the same students. The following stimulus was read to the students: "Please tell me the first four words, sensations or feelings that come to your mind when you hear: “*Today you will have fish for dinner at home*" From their responses, monitors wrote the words or sentences in an identified sheet.

2.4 Data analysis

Projective Mapping (PM) data collection was based on Varela and Ares (2012); the coordinates of the location of the stickers were measured for each child in centimeters considering the bottom left corner of the paper sheet as the origin of the coordinates (0,0). The comments given for each of the figures are counted across children. The terms were grouped, taking into account synonymous and derived words, by consensus between three researchers participating in the study (Carrillo et al., 2012a).

Only terms that had been mentioned at least three times were used for the analysis and a table with the frequency of each term was built for each age group (Miraballes et al., 2014).

Data was analyzed by age group: 5-6yo , 7-8yo and 9-10yo. PM was analyzed by Multiple Factor Analysis (MFA) with XLStat system software (version 2015.5.01.23106). It was applied on the matrix data formed by food items in the rows, and individual participants' x,y coordinates in the columns. The table containing the terms generated in the descriptive step and their frequencieswas considered a set of supplementary variables and did not contribute to the construction of the MFA factors. Terms mentioned by at least 5% of the consumers were used for further analysis (Symoneaux, Galmarini, & Mehinagic, 2012).

Hierarchical cluster analyzes (HCA) with Euclidian distances, Ward's aggregation criterion and automatic truncation was used to identify food items with similar characteristics on the PM data within each age group.

The analysis of Word Association was based on Antmann, Ares, Salvador, Varela and Fiszman (2011). All the associations were included and terms with similar meaning were grouped. Three researchers performed the grouping procedure independently. After individually evaluating the data, they met to check and reach an agreement for their classifications. The final categories and their names were determined by a consensus between the researchers, considering their three independent classifications. Categories comprising terms mentioned by more than 5% of the participants of each age group were included in the analysis.

Global Chi-square was used for testing homogeneity of the contingency table of the terms generated in the descriptive step of the PM (product differences within each age group) and to test differences between age groups in the WA test (Symoneaux et al., 2012).

Correspondence analysis (CA) was used to determine the association between the age group and the words produced using the word association technique (Latorres et al., 2016). The data was analyzed using Statistica 12.7.

3. Results

3.1 Projective mapping task

Figures 2, 3 and 4 show the MFA plots, displaying the first two dimensions, for each age group. The analysis of the graphs made it possible to observe that different perceptions of the food images emerged from the different age groups. In the MFA plots, the two first factors had similar weights to explain the variability of the data for the three age groups. Up to four dimensions were analyzed and interpreted for the three groups of children and data was discussed accordingly throughout the manuscript when relevant, however higher dimensional plots were not displayed.

Age 5-6

The plot graph of the images corresponding to the group 5-6yo (Figure 2) suggested that these children classified foods by sweet (right-hand half of the map) or salty (left-hand part), represented by Factor 1 and by processed/prepared food (upper part of the map) and fresh vegetables and fruit (bottom part) represented by Factor two.

The food items present in quadrants 1 and 2 could be further subdivided by the HCA, forming two groups. Cluster 1, consisting of Flan and Cake, characterized by the attribute *sweet*. Cluster 2, included Fish food, Sushi, Chicken, Pizza, French fries and Hamburger, described as *meat*, *salty*, *fat*, *unhealthy*, *fishbones*, etc. Foods in quadrant

3 and 4, Salad and Fruits formed the third cluster and were described as *color*, *vegetables* and *healthy*.

When looking at the attribute plot, it is worth noting that the terms *like* and *dislike* appeared close to each other in the map; whereas *healthy* and *unhealthy* remained well separated. Also, *like* and *dislike* were not well correlated with the perceptual space represented by the first two factors of the MFA (towards the center of the plot), meaning that the associations made to those two terms were weak for this age group, when determining the main perceptual space. Chi-square by cell, applied to the terms generated by the descriptive step of the PM showed that there was not a significant difference in the frequency of *dislike* for the different images, with very low mention in all cases (less than 5). Also, *like* was significantly less mentioned, except for the Sushi drawing. The latter was highlighted in the third dimension of the MFA (not shown), where the Sushi image was separated from the rest, with *like* negatively associated with it. Another important point is the frequent use of the term *healthy*, significantly more linked to Fruits and Salads (26 and 24 mentions respectively), and significantly less used for the images of Hamburger, French fries, Pizza, Flan and Cake (one or two mentions). This is in accordance with the results from Varela and Salvador (2014), in which children of 5yo correctly classified healthy food under a pre-defined healthy category, via structured sorting. However, the present research goes further, as the descriptive step in PM gives a spontaneous description of the stimulus, verifying that they already have a “top of mind” perception associated to some healthy food categories. It is worth noting that fish was rarely regarded as *Healthy* in this age group.

Age 7-8

The analysis of the plot graphs of children aged 7 and 8 yo (Figure 3) showed that, again, at this age, the students separated desserts (at the left of the map) from the rest of the food items. But importantly, the second dimension separated “disliked” items such as Fish, Sushi, Salad and Fruit (in the upper part of the map), from “liked” items

(bottom part) where Pizza, Hamburger, French fries and Chicken were placed and perceived as *fried, salty, fat, eat out* and *unhealthy.* This behavior suggests that liking might start to be a more important factor for their food choice at this age. More concretely, the chi-square per cell on the PM description showed that the Sushi image was significantly more associated to *dislike*, and Pizza significantly more often associated to *like*. In addition, children in this group spontaneously mentioned the terms *healthy* and *unhealthy* more frequently that the smallest ones; Salad and Fruit images were more frequently associated to *healthy* (32 and 34 mentions), and significantly less used for the images of Hamburger, French fries, Pizza, Flan and Cake (with only one or two mentions). In addition, Hamburgers, French fries and Pizza were significantly more associated to the *unhealthy* term. The healthiness perception was also highlighted in the third dimension of the MFA (not shown), in which the Salad and Fruit images were separated from the rest of the images. Is it also worth noting, that the 7-8yo kids have spontaneously mentioned a higher number of usage-related terms than the 5-6yo: *eat out, reheated, meal, fried, cooked, eat with sauce, garnish*; this shows the wider food-related vocabulary and higher capacity to articulate in this group.

By HCA the stickers of the food items could be subdivided in four groups. Cluster 4, included Flan and Cake were mainly described as *sweet*. Cluster 5, consisting of Salad and Fruit were characterized by *healthy* and *vegetables.* Cluster 6, composed Sushi and Fish were associated to *fishbone, fried, dislike and never eat;* and Cluster 7 composed of others foods, represented by *salty, unhealthy, like, meat.*

Age 9-10

The liking dimension was correlated to *unhealthy* in the MFA plot (Figure 4). Food items more associated to *like* were Cake, Flan, French-fries, Pizza, Chicken and Hamburger. HCA separated those images into two distinct clusters, Cluster 8 formed by Cake and Flan, was associated to *sweet* and *birthday*. Cluster 9 formed by French

fries, Pizza, Hamburger and Chicken, was associated to the terms *fat, salty, family, unhealthy and pasta*. HCA highlighted a cluster (Cluster 10) formed by Fish and Sushi images described by the terms *fishbone, fried, never eat and oriental food*. In the other cluster, Salad and Fruits (Cluster 11) were associated to the terms *vegetable, healthy* and *always eat.*

The MFA plot pointed out that the older children (9-10yo) separated the food images mainly due to their healthiness perception; items more frequently described as *healthy* were fish, sushi, salad and fruits, located in the right part of the map and less healthy items on the left. This was also reflected in the analysis of the frequency of mention of the terms by chi-square, where salad and fruits images were spontaneously associated more often to healthy (almost all children used those terms, 45 and 51 respectively). The images of the Hamburger, French fries, Chicken, Pizza, Flan and Cake were significantly less associated to the term *healthy*; the word *unhealthy* was mentioned significantly more often linked to the Hamburger, French fries, and Pizza.

The liking dimension was correlated to *unhealthy* in the MFA plot. Food items more associated to *like* were Cake, Flan, French-fries, Pizza, Chicken and Hamburger. HCA separated those images into two distinct clusters, Cluster 8 formed by Cake and Flan, was associated to *sweet* and *birthday*. Cluster 9 formed by French fries, Pizza, Hamburger and Chicken, was associated to the terms *fat, salty, family, unhealthy and pasta*. HCA highlighted a cluster (Cluster 10) formed by Fish and Sushi images described by the terms *fishbone, fried, never eat and oriental food*. In the other cluster, Salad and Fruits (Cluster 11) were associated to the terms *vegetable, healthy* and *always eat.*

As in the previous group, 9-10 yo children mentioned several usage and attitude related terms, such as *snack, cooked, garnish, family, fried, eat out, oriental food, ingredient,* and *birthday*. They also classified the foods regarding their categories or associated them to other categories: *fat, meat, pasta, snack, vegetable, cheese, fish, oriental food,* and *ingredient.*

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316 **3.2 Word association task**

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318 Table 1 shows the categories obtained from the results of the word association
319 task using the stimulus "*Today you will have fish for dinner at home*". Seventeen
320 categories were built from the terms mentioned by the children (n = 148) by consensus
321 between the three researchers who participated in the present study. In total, 503
322 terms were mentioned by the 148 children. Most frequent categories for all the age
323 groups of children were *like*, representing 35% of the total produced terms, *fishbones*
324 (20%), *healthy* (10%), *dislike* (7%), *fried* (5%) and *go fishing* (3%), respectively.
325 According to Antmann et al. (2011), in the word association task, the most frequently
326 mentioned terms may be regarded as those most relevant and top of mind to
327 consumers.

328 Although not presenting significant difference between ages, the *dislike*
329 category is more frequent for older children. This behavior can be best viewed in Figure
330 5. In order to appreciate better the relationship between the ages groups and the words
331 produced using the word association technique, a correspondence analysis was
332 applied (Beh, Lombardo, & Simonetti, 2011).

333 Hedonic terms (Figure 5), particularly *dislike*, are more related to Group 9-10.
334 These results corroborate data previously presented by the Projective Mapping
335 technique; it was found that hedonic perceptions in relation to fish products had a
336 larger weight in the perceptual spaces from the oldest children.

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338 **4. Discussion**

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340 Fish perception in the PM task across age groups produced differences in the
341 perception of the presented food images and especially regarding fish could be noticed
342 among the different age groups. Both groups with older children mapped Fish and

Sushi together, mainly associated to disliking, while the youngest children grouped Fish and Sushi with the rest of the savory foods, and liking/ disliking was less correlated to the main perceptual space. Hedonic perceptions in relation to fish products had a larger weight in the perceptual spaces from the older children.

Inverse relationship between age and acceptance of fish products was found in studies of Latorres et al. (2016) and Mitterer-Daltoé et al. (2013c). Latorres et al. (2016) analyzed the acceptance of fish meatballs with children aged 6 to 14 years and realized that age was significantly and inversely correlated with the acceptance. The same behavior was observed in the study by Mitterer-Daltoé et al. (2013c), in which the acceptance of breaded fish was evaluated with students from public schools, aged 5 - 18 years, and again an inverse relation between acceptance and age was reported. In this study, the authors also identified the age 12 as the critical age where there is clear evidence of the falling of the acceptance rate of breaded fish. This result that was in accordance to that by Peterson, Christou and Rosengren (2006), where the authors aimed to determine the children age when the sensory information, represented by somatosensory, vision, vestibular and visual preference, is comparable to adults, suggesting that children do not demonstrate adult-like use of sensory information prior to age 12 years. Myrland, Trondsen, Johnston and Lund (2000) revealed that households with children under 12 have increased consumption of fish, because they did not have the influence of factors such as "unpleasant smell during preparation" and "flavor"; and opposite effect when there is the presence of adolescents (from 12 years) who indicate negative relation to fish consumption, for not appreciating the smell and taste of this food.

Another study conducted by Pagliarini, Gabbiadini and Ratti (2005) aimed to evaluate the acceptance of meals offered in the cafeterias of schools in Milan, Italy. They found that the preference for the majority of the dishes of younger children (7 years old) differed from the older ones (10 years old) and younger children gave higher acceptability scores for most dishes than older children.

In all these studies, the conclusion is the same: children become increasingly aware of their preferences and critical in their choices with growing age. These results show that younger children are more receptive to the introduction of more varied food, including fish in their common diets. Thus, there are possibly opportunities that can provide unhealthy eating habits to be shifted in the very young population, since, habit formation occurs gradually over repeated experiences. According to Riet et al. (2011) promoting new behavior is more effective than changing frequently performed behavior. Within this context, school lunch should play an important role as it provides an opportunity to insert particular food consumption habits to reach younger children and in a continuous way. This a good strategy in an attempt to promote fish consumption habits, since healthy dietary patterns that include fish consumption are established early in childhood influence dietary habits during adult life with effects on health (Donadini et al., 2013; Kaar, Shapiro, Fell, & Johnson, 2016).

Perhaps, food neophobia could help explain as the inverse relationship between age and fish products acceptance or positive hedonic perceptions with children. Food neophobia is defined as the reluctance to eat, or the avoidance of new foods (Dovey, Staples, Gibson, & Halford, 2008; Kaar et al., 2016) and has been linked with parents food pattern (Kaar et al., 2016) and age (Fernández-Ruiz, Claret, & Chaya, 2013; Siegrist, Hartmann, & Keller, 2013). Kaar et al. (2016) revealed that similarities in parent-child food preferences could be related to food neophobia, and therefore, the food offered by parents to their children are also related. These authors also showed the relationship between food neophobia and the negative impact on food variety and the consumption of highly recommended foods, such as vegetables or fish. Another study with children revealed that the more frequently a lunch item was served at home, the less there were leftovers (Caporale, Policastro, Tuorila, & Monteleone, 2009). Though focusing adulthood, Fernández-Ruiz et al. (2013) reported a positive relationship between age and level of food neophobia.

Since fish is currently not part of the consumption habit of southern Brazil population (Mitterer-Daltoé et al., 2013b), low exposure might be a potential responsible for the rejection of fish in older children, since there is no supply of this food in their homes and since the older children are more critical in their choices. In this scenario, again, school lunch arises as a good opportunity to change this behavior. Even as Herman (2015) also highlights the social facilitation of eating, that is, people eating more in groups than when alone. Transposing to the context of school lunch, this may suggest that when a child eats some food that others are also eating, his/her behavior is facilitated toward food intake.

In the present work, the spontaneous association of some of the food images to healthy or unhealthy started already with the young children (5-6) and was even stronger in the bigger children. However, while Fruits and Vegetables were described as *healthy* and, Hamburger, French fries, Pizza, Flan and Cake were significantly less associated with healthiness by the three groups, the images of Fish and Sushi were not associated to the *healthy* in any of the groups. This suggests that they might not have a formed idea of fish nutritional characteristics, probably because of the low exposure of the children to fish at home and at school (so they do not discuss it characteristics). According to the menu presented by the School Feeding Division of Pato Branco city's Education Department, fish meats are seldom offered to children in school meals, predominating as protein source beef, chicken and eggs instead. As side dish it is usually offered rice, beans, pasta, with lettuce and tomato salad at lunch; also banana, orange, apple, milk and cake in the morning and afternoon snacks. Meals follow the Resolution of the National Fund for Education Development, which recommends the use of basic foodstuffs in order to respect the food habits and cultures of each region (FNDE, 2013). Therefore, the low frequency of fish consumption by the target group of children of the present study is confirmed, resulting in a low familiarity to this important food.

To get a general idea of the different age groups' ability to generate responses to questions about food and nutrition, Slaughter and Ting (2010) applied an open-ended interview to 100 Australian participants in five different age groups (5yo, 8 yo, 10yo, 14yo, 20 yo), from preschool to university. The results of the study revealed that at 5 years, causal reasoning linking food and health was largely absent; that between 5 and 8 years there has been significant increase in thinking about food and nutrition; and between 11 and 14 years responses that reflected physiological reasoning increased significantly. Another work aimed to document evaluation of the healthy food and drink with children (3-5 years) (Tatlow-Golden, Hennessy, Dean, & Hollywood, 2013). The results showed that children at this age have the ability to identify healthy foods and relate them to the growth and health, but considerably less ability to reject unhealthy items.

In short, education programs in schools are important and can result in healthier habits in adulthood. Studies, such as those conducted by Mustonen and Tuorila (2010), showed positive results when applying sensory education with children. The researchers worked with children ranging from 8 to 12 years and reported that the effects of sensory education in phobia of new foods was more effective with younger children, including fish food, reinforcing the tendency of children to suffer changes in eating habits. Tatlow-Golden et al. (2013) even go beyond, and also show the importance to teach children about less healthy foods in the preschool years (5 years) and not only teach what is healthy.

The results obtained by word association technique highlighted the positive perception of fish by children. The fact that the category *like* having been frequently cited for the stimulus "Today you will have fish for dinner at home," indicated positive intention of fish consumption by all the groups of children, since there was no significant difference between age groups. In Latorres et al. (2016), the stimulus applied was the fish meatball received during school meals through the statement "Please write down the first four words that come to your mind when you remember the

meatball that you consumed at school today"; the authors verified that the hedonic dimension had the highest number of cited terms, and the most frequent category was tasty.

The category *like*, obtained by the word association suggested more positive perception by the older children when compared with the results revealed by projective mapping. This behavior may possibly be a result of differences in methodologies applied; in the Projective Mapping together with the assessment of fish products, the children had other foods that they could compare that were very attractive, suggesting that among the food, fish is possibly not the first choice. In a work by Pagliarini et al. (2005) fish stood behind roasted pork loin, roasted pork with apple sauce, cooked ham and dried salted beef in preference of school children aged between 7 and 10 years old. Thus, for fish insertion-strategy success in school meals, the food should be offered as a single main course and not as an option among other more “attractive” foods or fish cooked in several different ways. Not at least until the fish consumption habits are part of the behavior of children.

Fish can become more attractive to children through industrialized products such as nuggets, meatballs and hamburger (Latorres et al., 2016; Mitterer-Daltoé et al., 2013c) and this device becomes even more important by the category *bones* pointed out.

The *fishbones* category, highlights the concern of children with their presence. Smell and fishbones are considered one of the main fish consumption barriers (Leek, Maddock, & Foxall, 2000; Mitterer-Daltoé et al., 2013b), and these concerns show the offering other fish products (such as fingers, bites, hamburgers, etc.) would be an important fish insertion strategy in the school feeding and subsequent insertion of that food consumption habits in a population. Previous studies have revealed the importance of the of food appearance for children (Donadini et al., 2013; Latorres et al., 2016), and within that context fish products such as burgers, nuggets and meatballs

480 come with great potential for acceptance among school children (Latorres et al., 2016;
481 Mitterer-Daltoé, et al., 2013c).

482 *Fried*, and *go fishing* categories showed the main fish preparation for
483 consumption. The city in study, is not located in a coastal area, so the primarily activity
484 in fish production and fish farming is known as fish and pay. Fish and pay are rural
485 properties (smallholdings) characterized by a complex of artificial lakes where fishing is
486 practiced as a leisure activity. In these places, there are also restaurants where there is
487 a supply of fish, often served deep fried. Thus, for some of these children the
488 relationships they have with fish is to go fishing and eat it fried.

489 Based on the present results, future studies with bigger groups of children and
490 families in this target group should focus in more detail on the influence of familiarity to
491 different types of food in relation to fish perception, to further confirm our hypothesis; it
492 would also be interesting when working with wider groups to look into potential gender
493 differences.

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495 **5. Conclusion**

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497 Results show that Projective Mapping methodology was easily understood by
498 the three age groups, and the use of images might have facilitated the application of
499 this technique with children. Different perceptions arose from the different age groups;
500 an especially positive perception towards fish products was found in the youngest
501 group of children. This fact suggests the need and potential for fish introduction in the
502 early years of life. Within this context, school meals emerge as an important strategy to
503 promote eating habits in childhood, especially for enhancing and promoting fish
504 consumption habits.

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