Consumer testing with children on food combinations for school lunch
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Abstract

Awareness of how important food and food culture are to the quality of children’s life is a presupposition that promotes research in the sector of school lunch. The aim of this work was to evaluate liking for meals supplied to primary school refectories of the Municipality of Milan. It appears particularly interesting to investigate consumption of meals in Italy in view of both food combinations and the nutritional aspect of the Mediterranean diet. In addition, meals are typically subdivided into four distinct components in Italy. All the children (120) involved, aged between 7 and 10, supplied liking scores as shown in a previous work [Italian J. Food Sci. 2 (2003) 215] for a set of first courses, second courses, vegetables and fruit/dessert.

From results it can be seen that preferences for most dishes of younger children (7 years old) differed from those of the older ones (10 years old). Also, unlike 8-, 9- and 10-year-old children, 7-year-old children supplied steadily higher acceptability scores than the intermediate score on the evaluation scale used. Based on our data, it was shown that children become increasingly aware of their preferences and critical in their choices with growing age.

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1. Introduction

Awareness of how important food and food culture are to the quality of life of people, especially children, not only in terms of health but also from a social, cultural point of view, is a presupposition that promotes research in the sector of school lunch in Italy (Pagliarini, Ratti, Balzaretti, & Dragoni, 2003).

Beyond the intrinsic quality of food preparations, liking for school lunch by children is affected by several various factors, which are mainly connected to environmental conditions of use, absence of a food education program, influence on assessment developed both among children and with a leader, influence deriving from a comparison with home lunch, and also relating to how familiar children are with a specific food product (Birch, Birch, Marlin, & Kramer, 1982; Leon, Couronne, Marcuz, & Koster, 1999; Schraadt, 1991; Spaeth, Chambers, & Schwenke, 1992).

Parents, teachers, public officials, and restaurateurs are often responsible for making available the food items consumed by children; in many situations the preferences of the child are considered and followed, in many others they are not. In particular, economic and nutritional factors determine the options open to children in the public sector of the school system (Ahlstrom, Baird, & Jonsson, 1990; Noble, Corney, Eves, Kipps, & Lumbers, 2000).

Having lunch at school has an important educational function because the diet implies a number of hidden significances, namely a physiological significance to learn to feed properly (Bellù & Cucco, 1997; Bellù et al., 1995), a cultural significance to know different varieties and origins of foods (Baxter, Thompson, & Davis, 2000), and a psychological significance to understand why a specific food product may arouse emotions (Kimmel, Sigman-Grant, & Guinard, 1994). Importantly, healthy eating habits established in childhood can reduce the risk of developing diet-related diseases in
adulthood, by which time the re-education of one’s dietary habits may be difficult to maintain. Additionally, it has been suggested that children are more receptive to dietary changes than are adults, so there may be a window of opportunity which unhealthy dietary practices can be corrected during childhood (Baxter, Schroder, & Bower, 2000).

Therefore, it appears particularly interesting to investigate consumption of school meals by children in Italy because the Mediterranean diet is important as a result of its food combinations, nutritional aspects and subdivision into the following four components: first course, second course, vegetables and fruit/dessert.

On the other hand, very few studies concerning consumption of meals by primary school children have been published in Italy (Caporale, Cantore, & Monteleone, 2003; Monteleone, Caporale, Cantore, & Carlucci, 2003; Pagliarini et al., 2003).

The aim of this work was to evaluate liking for meals supplied to school refectories of the Municipality of Milan in agreement with Pagliarini et al. (2003). Eight classes from the same school were chosen for a total of 120 children. Children involved provided an acceptability score for a set of first courses, second courses, vegetables and fruit/desserts.

Moreover, we were interested in investigating the role played by different food components in determining acceptance of different meals and evaluating how the factor age may affect children’s preferences.

2. Materials and methods

2.1. Sample selection

Formulations (i.e. first course, second course, vegetables and fruit/dessert) reflecting the meals evaluated were reported in Table 1.

2.2. Subjects

For panel formation eight classes from the same school were selected as follows: two second-, two third-, two fourth- and two fifth-grade classes consisting of 15 pupils each for a total of 120 children.

All of the children, aged between 7 and 10, invariably had lunch at 12:30–13:00.

2.3. Methodology

A 7-point facial hedonic scale from super good (7) to super bad (1) was chosen to identify liking for the four meals supplied to school refectories of the Municipality of Milan in agreement with Pagliarini et al. (2003). Eight classes from the same school were chosen for a total of 120 children. Children involved provided an acceptability score for a set of first courses, second courses, vegetables and fruit/desserts.

Table 1
List of the formulations tested

<table>
<thead>
<tr>
<th>Formulations</th>
<th>First course</th>
<th>Second course</th>
<th>Vegetables</th>
<th>Fruit/dessert</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Penne with pesto</td>
<td>Cheese</td>
<td>Boiled potatoes (with parsley)</td>
<td>Apple</td>
</tr>
<tr>
<td>B</td>
<td>Risotto with pumpkin</td>
<td>Roasted turkey</td>
<td>Boiled potatoes (with parsley)</td>
<td>Apple</td>
</tr>
<tr>
<td>C</td>
<td>Pasta with tomato sauce</td>
<td>Roasted pork loin</td>
<td>Mashed potatoes</td>
<td>Orange</td>
</tr>
<tr>
<td>D</td>
<td>Barley soup</td>
<td>Chicken breast</td>
<td>Boiled zucchini</td>
<td>Pear</td>
</tr>
<tr>
<td>E</td>
<td>Vegetable purée with rice</td>
<td>Vegetable omelette</td>
<td>Red salad and fennels</td>
<td>Apple</td>
</tr>
<tr>
<td>F</td>
<td>Fusilli with oil and parsley</td>
<td>Turkey with tomato and oregano sauce</td>
<td>Mashed potatoes</td>
<td>Pear</td>
</tr>
<tr>
<td>H</td>
<td>Risotto with tomato</td>
<td>Roasted pork with apple sauce</td>
<td>Grated carrots</td>
<td>Orange</td>
</tr>
<tr>
<td>I</td>
<td>Ravioli with butter and sage</td>
<td>Cooked ham</td>
<td>Boiled zucchini</td>
<td>Apple</td>
</tr>
<tr>
<td>J</td>
<td>Pasta and bean soup</td>
<td>Roasted turkey</td>
<td>Boiled potatoes (with parsley)</td>
<td>Apple</td>
</tr>
<tr>
<td>K</td>
<td>Pasta with tomato and oregano sauce</td>
<td>Vegetable omelette</td>
<td>Tomatoes</td>
<td>Apple</td>
</tr>
<tr>
<td>L</td>
<td>Vegetable soup</td>
<td>Dried salted beef</td>
<td>Green salad and carrots</td>
<td>Peach juice</td>
</tr>
<tr>
<td>M</td>
<td>Risotto with saffron</td>
<td>Fish fingers</td>
<td>Boiled potatoes (with parsley)</td>
<td>Pear</td>
</tr>
<tr>
<td>N</td>
<td>Risotto with tomato</td>
<td>Turkey with tomato and oregano sauce</td>
<td>Mashed potatoes</td>
<td>Pear</td>
</tr>
<tr>
<td>O</td>
<td>Pasta with tomato sauce</td>
<td>Small Mozzarella cheese balls</td>
<td>Tomatoes</td>
<td>Apple</td>
</tr>
<tr>
<td>P</td>
<td>Risotto with pumpkin</td>
<td>Haké with tomato sauce</td>
<td>Boiled potatoes (with parsley)</td>
<td>Banana</td>
</tr>
<tr>
<td>Q</td>
<td>Creamed vegetable soup and croutons</td>
<td>Cooked ham</td>
<td>Tomatoes</td>
<td>Apple</td>
</tr>
<tr>
<td>R</td>
<td>Pasta with tomato and Ricotta cheese</td>
<td>Roasted turkey</td>
<td>Boiled potatoes (with parsley)</td>
<td>Pear</td>
</tr>
<tr>
<td>T</td>
<td>Pasta with tomato sauce</td>
<td>Roasted pork loin</td>
<td>Mashed potatoes</td>
<td>Apple</td>
</tr>
<tr>
<td>U</td>
<td>Pasta with legumes</td>
<td>Roasted pork loin</td>
<td>Mashed potatoes</td>
<td>Peach juice</td>
</tr>
<tr>
<td>X</td>
<td>Risotto with beet tops</td>
<td>Roasted turkey</td>
<td>Boiled potatoes (with parsley)</td>
<td>Apple</td>
</tr>
<tr>
<td>Y</td>
<td>Vegetable soup</td>
<td>Roasted pork loin</td>
<td>Boiled potatoes (with parsley)</td>
<td>Apple</td>
</tr>
<tr>
<td>Z</td>
<td>Pizzoccheri with potatoes</td>
<td>—</td>
<td>Buttered French beans</td>
<td>Chocolate pudding</td>
</tr>
</tbody>
</table>
meal components according to Pagliarini et al. (2003). Tests started in April and ended in June 2002 accounting for a total of 22 sessions and 4600 filled in cards.

2.4. Data analysis

Sensory data were submitted to one-way Analysis of Variance (ANOVA), by applying the Scheffé test ($p < 0.05$) to verify whether there were significant differences between formulations. The significance of effects was tested with $F$ test by Statgraphics Plus (version 5) software.

3. Results and discussion

In our previous study it was demonstrated that children of the same age from different grades showed homogeneous preferences.

In the processing below, the variable grade membership was not taken into account, and the variable age was only considered in the following way: 7 years (second-grade classes), 8 years (third-grade classes), 9 years (fourth-grade classes) and 10 years of age (fifth-grade classes). Two classes were taken into account in order to examine at least 30 children per age category. It was first investigated whether our untrained young assessors may be reliable in assigning scores to meals. Since the experimental design did not include replicates of menus served, replicates of repeated dishes (risotto with pumpkin, pasta with tomato sauce, risotto with tomato, vegetable soup, roasted pork loin, roasted turkey, cooked ham, mashed potatoes and boiled zucchini), except for fresh raw vegetables and fruit/dessert because of their intrinsic variability, on different days were studied in order to check repeatability of assessors. Data were subjected to both $t$ test ($p < 0.05$), when two replicates were performed, and one-way Analysis of Variance (ANOVA), by applying the Scheffé test ($p < 0.05$) to verify whether there were significant differences between dishes.

Most repeated dishes, except for risotto with tomato ($F_{7\text{years}} = 10.85^{***}$; $F_{10\text{years}} = 6.84^{*}$), roasted pork loin ($F_{7\text{years}} = 27.90^{***}$); cooked ham ($F_{7\text{years}} = 15.85^{***}$; $F_{10\text{years}} = 24.35^{***}$) and mashed potatoes ($F_{7\text{years}} = 3.61^{***}$; $F_{10\text{years}} = 5.24^{***}$) showed no significant differences. Therefore, these untrained young consumers may be considered reliable on the whole.

Results from 7-to-10-year-old children were thus compared by one-way analysis of variance to verify whether there were significant differences according to the age.

With reference to first courses, in order to facilitate a comparison between formulations B and P (corresponding to risotto with pumpkin), C, O and T (corresponding to pasta with tomato sauce), H and N (corresponding to risotto with tomato), L and Y (corresponding to vegetable sauce), a mean was first calculated, and all of the formulations were then evaluated together. As a result, the total of samples tested corresponded to 17 first courses.

In Figs. 1–4, a line was drawn at point 4, which marked the “maybe good” or “maybe bad” score (mean data point on the evaluation scale).

Fig. 1 shows results from a comparison between first courses.

Generally speaking, the most preferred first courses appeared to be: risotto with pumpkin (samples B and P), fusilli with oil and parsley (sample F), risotto with tomato (samples H and N), ravioli with butter and sage (sample I), pasta with tomato and oregano sauce (sample K), risotto with saffron (sample M), creamed vegetable soup with croutons (sample Q) and risotto with beet tops (sample X). The most disliked first courses appeared to be: barley soup (sample D) and pasta and bean soup (sample J). It can also be observed that, unlike older children, 7-year-old children invariably provided a higher score than 4 for all first courses. It may be suggested that older children may be more confident in their preferences and, hence, make critical choices. In addition, the behaviour of younger children (7 years old) differed from that of the older ones (10 years old) for all first courses that showed a significant difference ($p < 0.05$).

In order to obtain a detailed investigation, children’s preferences were further compared to verify whether there were significant differences according to the age by classifying first courses into two groups as follows: soups (samples D, E, J, L, Q and Y) and solids (samples A, B, C, F, H, I, K, M, N, O, P, R, T, U, X and Z). Finally, samples were further subdivided into pasta-based (samples A, C, F, K, O, R, T and U) and rice-based dishes (samples B, H, M, N, P and X), soups (samples D, E, J, L, Q and Y) and the remaining dishes (samples I and Z).

Results from comparisons were reported in Table 2.

Both comparisons invariably showed significant differences in liking for first courses, except for dishes I and Z. During data processing the behaviour of 7-year-old children was again very different from and their liking for all samples higher than that of 10-year-old children. As mentioned previously, this behaviour may be explained by the fact that children become increasingly selective with growing age.

With reference to second courses, in order to facilitate a comparison between formulations B, R, X and J (corresponding to roasted turkey), C, T, U and Y (corresponding to roasted pork loin), E and K (corresponding to vegetable omelette), F and N (corresponding to turkey with tomato and oregano sauce), I and Q (corresponding to cooked ham), a mean was first calculated, and all of the formulations were then evaluated.
together. As a result, the total of samples tested corresponded to 12 second courses, as shown in Fig. 2.

From data observation, it can be seen that there were significant differences in the following second courses according to the age: cheese (sample A), roasted turkey (samples B, R, X and J), roasted pork loin (samples C, T, U and Y) and vegetable omelette (samples E and K). Therefore, preference for second courses resulted to be more homogeneous among differently-aged children. Generally speaking, the most preferred second courses appeared to be: roasted pork loin (samples C, T, U and Y), roasted pork with apple sauce (sample H), cooked
ham (samples I and Q), dried salted beef (sample L), fish fingers (sample M), small Mozzarella cheese balls (sample O). The most disliked second course appeared to be cheese (sample A), although 7- and 8-year-old children assigned to this dish a higher score than 4.

In order to obtain a detailed investigation, children’s preferences were further compared to verify whether there were significant differences according to the age by classifying second courses into two groups as follows: cold (samples A, I, L, O and Q) and hot dishes (samples B, C, D, E, F, H, K, M, N, P, R, T, U, X, Y and J). In addition, samples were further subdivided into meat (samples B, C, F, H, N, R, T, U, X, Y and J), fish (samples M and P), cheese (samples A and O), eggs...
Generally speaking, the most preferred vegetables appeared to be: green salad and carrots (sample L), tomatoes (samples O, Q, U and K), mashed potatoes (samples C, F, N, T and X). The most disliked vegetables appeared to be: boiled zucchini (samples D and I) and red salad and fennels (sample E).

In order to obtain a detailed investigation, children’s preferences were further compared to verify whether there were significant differences according to the age by classifying vegetables into two groups as follows: raw (samples A, B, C, D, F, I, M, N, P, R, T, X, Y, J and Z). In addition, samples were further subdivided according to the vegetable type into differently prepared potatoes (samples A, A, B, C, M, N, P, R, T, X, Y and J), French beans (samples B and Z), zucchini (samples D and I), tomatoes (samples O, Q, U and K), salad (samples E and L) and carrots (sample H).

Results from comparisons were reported in Table 4.

As it can be seen, there were significant differences in all the above-mentioned vegetable subgroups, except for salad (samples E and L). Also, the behaviour of 7-year-old children invariably differed form that of 10-year-old children.

With reference to fruit/dessert, too, in order to facilitate a comparison between formulations A, E, I, O, Q, T, X, Y, K and J (corresponding to apple), B, D, F, M, N and R (corresponding to pear), L and U (corre-
respectively). Children eating at refectories of Italian schools.

more pleasant recipes and more balanced dishes for ingredient combinations should, therefore, result in restaurants. Using proper cooking methods and suitable refectories should develop into children-oriented res-

this issue in detail, taking into account that school in their food choices with growing age.

assumed that children become increasingly more critical assigned lower, more varied scores. It may therefore be formulations than older children (10 years old), who years old) provided higher acceptability scores for most served that children's preferences changed during pri-

4. Conclusions

From data analysis it can be firstly noticed that replicates of most dishes on different days did not show significant differences in acceptability. These results demonstrated that evaluation cards were effective, and assessors were reliable, despite their young age.

Secondly, from average acceptability scores it appeared that the most preferred first courses included solids, especially rice-based dishes; among second courses the highest acceptability scores were obtained by charcuterie and meat-based dishes; finally, cooked veget-

With reference to the difference in age, it was ob-

erved that children's preferences changed during primary school years; in particular, younger children (7 years old) provided higher acceptability scores for most formulations than older children (10 years old), who assigned lower, more varied scores. It may therefore be assumed that children become increasingly more critical in their food choices with growing age.

Further research will have to be carried out to go into this issue in detail, taking into account that school refectories should develop into children-oriented re-

Table 4

Means for acceptability for different subgroups of vegetables

<table>
<thead>
<tr>
<th>Significance of subgroup for vegetables</th>
<th>7 years</th>
<th>8 years</th>
<th>9 years</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw vegetables ($F = 9.64^{***}$)</td>
<td>5.42(^a)</td>
<td>4.89(^b)</td>
<td>4.59(^b)</td>
<td>4.48(^b)</td>
</tr>
<tr>
<td>Cooked vegetables ($F = 18.91^{***}$)</td>
<td>5.12(^a)</td>
<td>4.74(^a)</td>
<td>4.18(^b)</td>
<td>4.26(^b)</td>
</tr>
<tr>
<td>Potatoes ($F = 9.72^{***}$)</td>
<td>5.38(^a)</td>
<td>5.13(^b)</td>
<td>4.54(^c)</td>
<td>4.89(^c)</td>
</tr>
<tr>
<td>French beans ($F = 6.69^{***}$)</td>
<td>4.93(^a)</td>
<td>4.17(^b)</td>
<td>3.36(^b)</td>
<td>3.48(^b)</td>
</tr>
<tr>
<td>Zucchini ($F = 7.09^{***}$)</td>
<td>3.97(^a)</td>
<td>2.87(^b)</td>
<td>2.80(^b)</td>
<td>2.33(^b)</td>
</tr>
<tr>
<td>Tomatoes ($F = 4.93^{**}$)</td>
<td>5.55(^a)</td>
<td>5.24(^b)</td>
<td>4.68(^b)</td>
<td>4.78(^b)</td>
</tr>
<tr>
<td>Salad ($F = 1.54$ n.s.)</td>
<td>5.08</td>
<td>4.52</td>
<td>4.43</td>
<td>4.32</td>
</tr>
<tr>
<td>Carrots ($F = 6.58^{***}$)</td>
<td>5.80(^a)</td>
<td>4.40(^b)</td>
<td>4.50(^b)</td>
<td>3.77(^b)</td>
</tr>
</tbody>
</table>

Within row values marked with different letters are significantly different (n.s., **, *** denotes not significant, significant at 0.01 and 0.001, respectively).

sponding to peach juice), C and H (corresponding to orange), a mean was first calculated, and all of the formulations were then evaluated together. As a result, the total of samples tested corresponded to 6 fruit/desserts.

From data in Fig. 4 it can be observed that a high score for all fruit/dessert samples was assigned, and homogeneous preferences were obtained regardless of the age; significant differences were only found in apple and pear.

Fruit/dessert samples were not further subdivided because of the restricted number of subgroups.

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References


