Research Article

Child Involvement in Choosing a Recipe, Purchasing Ingredients, and Cooking at School Increases Willingness to Try New Foods and Reduces Food Neophobia

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ABSTRACT

Objective: To investigate the effect of involving children in their feeding process (choosing a recipe, purchasing the ingredients, and cooking) on their lunch food choice in a school environment.

Design: Quasi-experimental.

Setting: Two schools in Bilbao, Spain.

Participants: A total of 202 children (aged 8−9 years) participated in the study (43% girls), with 99 in the nutrition education (NE) group and 103 in the hands-on (HO) group.

Intervention: Three 1-hour workshops (1 workshop/wk), different for each group: HO, cooking-related activities, and NE, healthy habits promotion through nutrition education activities.

Main Outcome Measures: Food neophobia, diet quality, cooking self-efficacy and attitudes toward cooking, and food intake and selection of the experimental lunches.

Analysis: Chi-square test of independence, ANCOVA, and *t* tests were performed.

Results: Students from the HO group selected and ate more spinach/broccoli ($P < 0.001$ and $P = 0.02$, respectively) for the first lunch; and selected more spinach/broccoli ($P = 0.04$) for the second lunch. After the intervention, improvements were observed for spinach liking and neophobia for the HO group and cooking self-efficacy and KidMed score for both groups.

Conclusions and Implications: Both interventions succeeded in improving children's diet quality, but only the HO group reduced food neophobia levels. Therefore, involving children in choosing a recipe, purchasing ingredients, and cooking may promote changing eating behaviors toward healthy habits such as increasing vegetable consumption.

Key Words: children food neophobia, vegetable intake, recipe choice, ingredients purchasing, cooking (*J Nutr Educ Behav.* 2021;53:279−289.)

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INTRODUCTION

Although a balanced and varied diet is beneficial for health, the European population, in general, is not meeting the established recommendations for fruit and vegetable intake.[1] This trend is also visible in the European child population.[2] In Spain, despite multiple healthy eating campaigns supported by the government, the fruit and vegetable consumption of children remains low: only 20% to 30% and 10% of children consume the recommended quantity of fruits and vegetables, respectively.[3] Given that childhood is the key period when eating behaviors are established and maintained throughout adolescence and adulthood,[4,5] it is vital that young children develop a preference for fruits and vegetables. Nevertheless, during this stage, food neophobia described as a reluctance to eat new foods[6] could appear, which could hinder their willingness to try fruits and vegetables.

Previous studies[7−10] indicate that making children active participants in

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the various steps of meal preparation could promote healthy eating habits. Indeed, Chu et al[11] observed that life skills taught to children, such as cooking easy-to-prepare healthy meals, could be maintained throughout adulthood, and these skills could be helpful for developing healthy dietary habits. Similarly, Hartmann et al[7] asserted that becoming skilled at cooking could lead people to make healthier food choices. This direct contact with fruits and vegetables might be beneficial for their acceptance because it promotes familiarity and greater knowledge of their features (eg, shape, color, smell, and texture). In addition, if cooking skills are developed, self-efficacy and attitudes toward cooking will be improved, which might help to build stronger self-confidence in children.[12] Therefore, these hands-on (HO) activities might be relevant for shaping children's dietary behaviors.[13] Moreover, purchasing ingredients has also been found to favor the decision to choose vegetables, at least in an experimental context,[14] whereas generally providing children with choices has been shown to increase their vegetable intake.[15] Thus, it is relevant to explore the extent to which using a combination of these 2 approaches could have an impact on children's food choices.

The primary objective of the present work was to determine if involving children in the different steps of meal preparation (choosing a recipe, purchasing the ingredients, and cooking) effectively reduces food neophobia in the short-term and medium-term, comparing it to a standard nutritional education (NE) program. The variables studied were: food neophobia, choice, and intake, willingness to try new foods, vegetable preferences, diet quality, and cooking attitude and self-efficacy. It was hypothesized that (1) children in the intervention group (participating in the HO workshops) would show less neophobia and greater self-efficacy and cooking attitudes than the comparison group (a group attending the NE program). In addition, it was expected that (2) the HO group would choose the new food targeted during the workshops, showing a greater intake of this food, compared with the NE group. Moreover, it was anticipated that (3) children in both groups would change their preferences for vegetables and hence the quality of their diet, with such improvements being more marked for the HO group than the NE group.

METHODS

Participants

Children in the third grade of primary school (aged 8–9 years) from 2 different schools around Bilbao (Basque Country, Spain) were included in the study. Once both schools had been contacted, an informative letter was sent to the children's parents or legal guardians, inviting them to participate in the study. A total of 202 children participated in the study (43% girls and 57% boys). Both schools were randomly allocated into one of the following conditions by picking numbers from a hat[16]: the NE group (99 participants) or the HO group (103 participants). However, the parents of 7 of the children did not answer the baseline questionnaire, and so these data are missing.

Design

The *EgizuSUK!* Project was a quasi-experimental trial carried out in 2 schools. Each group (NE or HO) received a different intervention. Both consisted of 3 workshops, each of which lasted for around an hour and was scheduled once per week during school hours (for a total of 3 weeks, consecutively). The workshops were run in the students' classrooms, except for the last workshop of the HO group, which was completed in the school canteen.

Procedure

All workshops were carried out and supervised by researchers from the *EgizuSUK!* Project that belongs to the BCCInnovation (Basque Culinary Center). Figure 1 presents a brief overview of the experimental setup. This procedure was carried out twice (each time for a different group of students), and 2 rounds were performed (1 for each target vegetable, broccoli or spinach) to facilitate the working process. Thus, in total, there were 4 groups of students: broccoli HO, broccoli NE, spinach HO, and spinach NE.

Hands-on group. Three workshops were carried out for the HO group, with the aim of increasing the children's willingness to accept an unappealing vegetable (broccoli or spinach). These foods were selected because they have been shown to be 2 of the least appealing vegetables for children,[17] which was also supported by the results of a preference questionnaire completed before the intervention.

The first workshop consisted of choosing the recipe. Using a PowerPoint (Microsoft Corporation, 2007) presentation, the children were shown 3 different options and had to choose one of these, keeping their characteristics in mind (eg, cooking techniques, fat quantity, palatability, or cooking difficulty). The options were: steamed broccoli with garlic sauté, broccoli pie, and broccoli empanadilla for one of the target foods (broccoli); and spinach salad, spinach pie, and spinach spring rolls for the other target food (spinach).

In the second workshop, the children shopped for the ingredients online, as in a previous study.[14] They followed the instructions of the researchers through the shopping process. To conclude with this second workshop, children were handed real ingredients so that they could see and feel them in person.

Finally, in the third workshop, the children used the recipe to cook their chosen option. The school's canteen was adapted to place students in several spots in a U shape, facing a stand where 2 cookers were located, used for the boiling process (supervised by the researchers). There were 2–3 students located in each spot, equipped with the necessary tools and ingredients, such as chopping boards, knives, bowls, cups, spinach/broccoli, milk, bacon, cheese, and liquid eggs. The children had to wash and cut the vegetables and mix them with the other ingredients. Furthermore, customized cooking aprons and hats were provided for use during the cooking procedure and then gifted to them by way of thanks for their participation. In addition, children received the recipe of the broccoli/

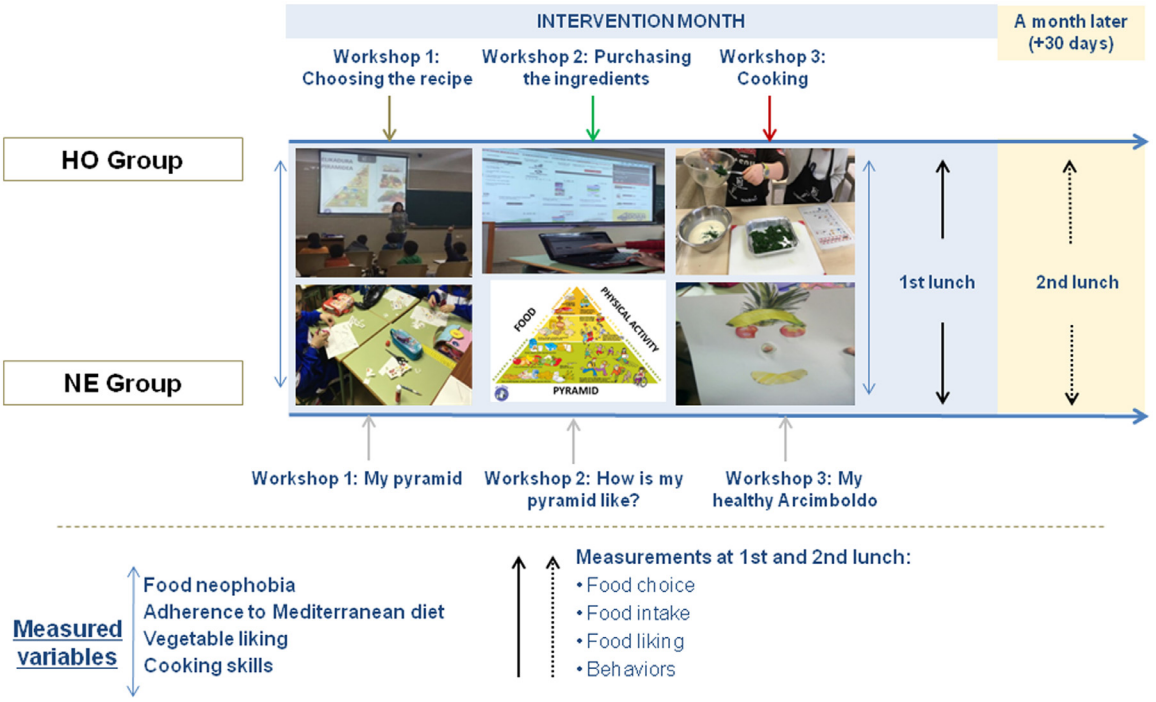

Figure 1. Study diagram for the *EgizuSUK!* Project. HO indicates hands-on; NE, nutritional education.

spinach pie after their first experimental lunch so that they could transfer the behavioral changes and skills that they had learned to their home environment.

Nutritional education group. The NE group was involved in a nutrition education program comprising 3 workshops that aimed to promote healthier habits in children. In the first workshop, students had to create their own food and physical activity pyramid, taking into account their eating and physical activity habits, positioning the most frequently consumed foods at the base of the pyramid and the less frequently consumed foods at the top.

In the second workshop, children learned about the Spanish food pyramid.[18] Then, they identified the aspects that they could improve from their own pyramids. They also completed some exercises to test what they learned.

Finally, the third workshop consisted of making a collage in the shape of a face using images of food that should be consumed most frequently. By way of illustration, researchers showed portraits of the artist Arcimboldo, following a previous study.[10] At the end of the third workshop, students had to list 10 recommendations they were willing to follow, and each one received an apron and a cooking hat to thank them for their participation. After their first experimental lunch, they received the recipe for the broccoli/spinach pie to facilitate the transfer of behavioral changes and learned skills to their home environment.

Postintervention experimental lunch. In the fourth week, once each of the groups had completed the 3 workshops, they had an experimental lunch in the school canteen to assess the effects of the intervention. The students had to choose between rice with vegetables, spinach/broccoli pie (recipe worked on in the HO groups), or a mixed option (half rice with vegetables, half spinach/broccoli pie). They were not aware of the options until they reached the serving line. To avoid any distractions or conditioning and ensure that the choice was made without pressure and on an individual basis, each child entered the canteen one by one. The second dish (roti with sauce) and dessert (yogurt) were the same for everyone. One month after this first experimental lunch, with the goal of checking whether or not behavioral changes were maintained, students had a second experimental (follow-up) lunch, which was exactly the same as the first. Furthermore, following the second lunch, the students completed a short questionnaire to verify whether they had cooked at home the broccoli or spinach pie.

Measurements and Variables

Before beginning with the intervention, the children and their parents were asked to complete certain questionnaires. The parents provided information about: (1) their child (eg, age, weight); (2) their child's food neophobia, using the Spanish Food Neophobia Scale[19]; and (3) their eating habits, through PREDIMED test.[20] The children completed the following questionnaires at baseline (before the intervention) and also immediately before the first experimental lunch, with the aim of evaluating any changes that appeared as a result of the intervention: (1) an *ad hoc* questionnaire to measure vegetable preferences; (2) KidMed[21] to evaluate adherence to the Mediterranean diet; (3) Spanish Child Food Neophobia Scale[22] to measure food

neophobia; and, (4) cooking self-efficacy and attitude toward cooking.[23]

Food selection and intake. In the experimental lunches, researchers weighted the first dish (chosen by each student) at the beginning and the end of the lunch using a cooking scale to calculate the ingested food (ingested food [grams] = initial weight – final weight). Moreover, they also registered the choices made by rice with vegetables, spinach/broccoli pie, or the mixed option. Students could ask for more food if they wished, and researchers registered, measured, and took this into account in the subsequent analyses. Furthermore, 2 pictures of each tray (1 before and 1 after the lunch) were taken to have visual records of the chosen meal (Figure 2).

Spanish Food Neophobia Scale. Not only the children,[22] but also their parents or legal guardians (modified version)[19] completed this questionnaire. The children's version of the questionnaire includes 8 items with responses on a 5-point Likert scale (from 1 = never to 5 = always), whereas the adaptation for parents has 10 items on a 7-point Likert scale (from 1 = strongly disagree to 7 = strongly agree, except for the reversed questions, rated in the opposite order). The sum of the scores of each item gives each child's neophobia score.

Cooking attitude and self-efficacy. A questionnaire developed by Lohse et al[23] evaluated attitude and self-efficacy toward cooking. Eight items compose the self-efficacy scale, with 5 possible answers: YES!, Yes, No, NO!, and Not Sure. Each response scored differently (1, 2, 4, 5, and 3, following the previously mentioned order of options), and the total score ranges from 8 to 40. The attitudes toward cooking scale consists of 6 items with 5 response options (1 = really like, 2 = kind of like, 4 = don't like, 5 = really don't like, 3 = not sure). The sum of each answer equals the total score, which ranges from 6 to 30. In both cases, the lower the score, the greater the degree of self-efficacy and positive attitude toward cooking.

KidMed index. This questionnaire[21] evaluates the quality of the Mediterranean diet in children. It is composed of 16 self-reported items with a true or false response. Responses positively related to the Mediterranean diet score +1 point, whereas negative responses score −1. The sum of the score of each item makes the total score (range, −4 to 12 points). There are 3 cutoffs for results classification: ≥8 for optimal, 4–7 average, and ≤3 for poor Mediterranean diet quality.

Vegetable preferences. A self-reported questionnaire composed a list of several vegetables (23 items) evaluated these preferences, based on a validated questionnaire.[23] Students had to rate using a 5-point Likert scale (from 1 = I hate it to 4 = I love it, and 0 = I haven't tried it before). A face with a different expression accompanied and represented each written answer (based on[24]): a broad smile for extremely liked, a slight smile for liked, a slight frown for disliked, a large frown for extremely disliked, and a neutral face for didn't taste it. The total score (range, 0–92) resulted from the sum of the score of each item.

Statistical Analysis

The researchers conducted statistical analyses using SPSS software (version 24.0, IBM Corp, 2016). Contingency table analyses assessed the differences between the 2 groups in terms of qualitative baseline variables (ie, gender, frequency of eating at the school canteen, cooking involvement, frequency of vegetables/fruits intake, and liking for spinach/broccoli parent-reported). Cramér's V assessed the magnitude of associations between variables (0.10 was considered small, 0.30 moderate, and 0.50 large).[25] In addition, the chi-square test of independence analyzed adjusted residuals (AR), considering $AR < -1.96$ or $AR > 1.96$ to be statistically significant.[26] The *t* tests evaluated the quantitative baseline variables (ie, age, body mass index [BMI], liking for broccoli/spinach children reported, food neophobia, KidMed score, cooking self-efficacy, cooking attitude, and PREDIMED score), considering $P < 0.05$ to be statistically significant.

With regard to the intake during both lunches, ANCOVAs compared differences between the 2 groups.

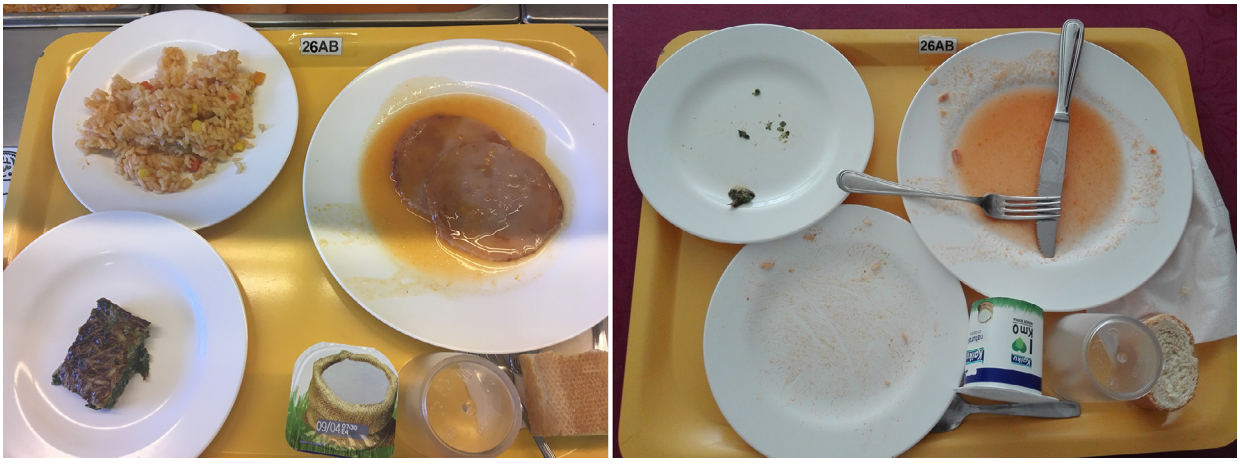

Figure 2. Before (left) and after (right) lunch pictures of a student's tray.

The index of overall effect size used was η^2, which values were interpreted following Kirks's guidelines[27]: $\eta^2 \leq 0.010$ for small, $\eta^2 \geq 0.059$ for medium, and $\eta^2 \geq 0.138$ for large effect size. Contingency tables and chi-square statistics analyzed differences between the 2 groups for selection variable during both lunches.

Paired sample t test intragroup analyses for broccoli liking children reported, spinach liking children reported, cooking self-efficacy, cooking attitude, KidMed score, and food neophobia compared preintervention and postintervention results. Moreover, the same analyses, but between groups, for those variables and the recipe preparation times variable compared postintervention results between the groups. Analyses for broccoli liking children reported and spinach liking children reported only included those students that worked with each vegetable (n = 100 for broccoli, and n = 96 for spinach). Cohen's d assessed effect size for statistically significant variables taken into consideration in t tests (considering 0.20 to be small, 0.50 moderate, and 0.80 large[28]).

Ethical Aspects

Before collecting any data, all parents or legal guardians provided a signed informed consent form. The study complied with the Second Declaration of Helsinki and received the approval of the Ethical Commission of Basque Culinary Center-Mondragon Unibertsitatea (005/2014). A G*power *a priori* analysis with a significance level of 0.05 and power of

Table 1. Observed Frequency (f_o), Adjusted Residuals (AR), Chi-Square Test for Independence, and *P* Values in Baseline Variables of Participants in HO and NE Groups

Variables (n HO, n NE)	HO Group f_o (AR)	NE Group f_o (AR)	χ^2	*P*
Gender (98, 98)				
Male	63 (2.2)	48 (−2.2)	4.674	0.03[a]
Female	35 (−2.2)	50 (2.2)		
Frequency of eating at the school canteen (95, 93)				
Never	36 (0.7)	31 (−0.7)	10.240	0.04[a]
1 or 2 times/mo	2 (−1.2)	5 (1.2)		
1 or 2 times/wk	4 (0.0)	4 (0.0)		
3 or 4 times/wk	22 (−2.5)	37 (2.5)		
Each school day	31 (2.4)	16 (−2.4)		
Cooking involvement (95, 94)				
≤1 time/mo	59 (2.8)	39 (−2.8)	8.889	0.03[a]
2 or 3 times/mo	12 (−1.8)	21 (1.8)		
1 time/wk	13 (−1.7)	22 (1.7)		
>1 time/wk	11 (−0.2)	12 (0.2)		
Frequency of vegetable intake (94, 94)				
<1 time/wk	3 (−0.4)	4 (0.4)	2.168	0.71
1–3 times/wk	49 (0.0)	49 (0.0)		
4–6 times/wk	22 (−0.5)	25 (0.5)		
1 time/d	15 (1.3)	9 (−1.3)		
>1 time/d	5 (−0.6)	7 (0.6)		
Frequency of fruit intake (95, 94)				
<1 time/wk	3 (1.7)	0 (−1.7)	7.876	0.10
1–3 times/wk	16 (0.4)	14 (−0.4)		
4–6 times/wk	28 (1.8)	17 (−1.8)		
1 time/d	19 (−1.2)	26 (1.2)		
>1 time/d	29 (−1.3)	37 (1.3)		
Liking spinach parent-reported (98, 98)				
Hates it	20 (−1.9)	32 (1.9)	6.725	0.15
Does not like it	9 (−0.9)	13 (0.9)		
Likes it	16 (0.2)	15 (−0.2)		
Likes it very much	15 (0.2)	14 (−0.2)		
Never tasted/do not know	38 (2.2)	24 (−2.2)		
Liking broccoli parent-reported (98, 98)				
Hates it	28 (0.5)	25 (−0.5)	4.129	0.39
Does not like it	9 (−0.2)	10 (0.2)		
Likes it	17 (1.7)	9 (−1.7)		
Likes it very much	20 (−0.2)	21 (0.2)		
Never tasted/do not know	24 (−1.4)	33 (1.4)		

HO indicates hands-on; NE, nutritional education.
[a]Statistically significant results ($P < 0.05$).

Table 2. Mean Scores, SDs, *t* Values and *P* Values for Baseline Characteristics in HO and NE Groups

Variables (n HO, n NE)	HO Group	NE Group	*t*	*P*
Age, y (98, 98)	8.71 (0.29)	8.68 (0.31)	−0.881	0.38
BMI (87, 91)	17.50 (2.71)	17.32 (2.38)	−0.467	0.64
Broccoli liking children reported (50, 50)	−0.20 (1.33)	0.14 (1.47)	1.214	0.23
Spinach liking children reported (48, 48)	0.06 (1.38)	−0.65 (1.45)	−2.455	0.02[a]
Food neophobia (98, 98)	22.56 (6.00)	20.35 (5.77)	−2.634	0.01[a]
KidMed score (97, 98)	4.99 (2.40)	5.35 (2.29)	1.063	0.29
Cooking self-efficacy (98, 96)	23.30 (6.49)	23.80 (6.87)	0.527	0.60
Cooking attitude (98, 98)	17.94 (4.76)	17.61 (5.08)	−0.465	0.64
PREDIMED score (92, 92)	6.70 (1.88)	6.82 (1.94)	0.425	0.67
Vegetable preference (98, 98)	1.68 (16.31)	0.87 (20.23)	−0.311	0.76

BMI indicates body mass index; HO, hands-on; NE, nutritional education.
[a]Significant results ($P < 0.05$).
Note: Values are mean (SD).

80% indicated that to detect a moderate effect size (0.25) in the food neophobia variable, a sample of 64 participants in each condition was necessary.[29]

RESULTS

A total of 196 children participated in the study. Table 1 shows descriptive qualitative data related to participants' characteristics at baseline. There were no differences between the 2 groups for most of the measures. However, there were significant differences between the HO group and NE group concerning gender distribution (χ^2 [1] = 4.674, $P = 0.03$), although Cramér's V (0.154) indicated a weak association. With regard to frequency of eating at the school canteen, significantly more children in the NE group ate at the school canteen 3 or 4 times per week, whereas significantly more children in the HO group ate at the school canteen on each school day. Moreover, significantly more children from the HO group participated in cooking once or less per month compared with the NE group. Table 2 displays quantitative date from baseline. With regard to spinach liking children reported, children in the HO group showed a significantly higher score compared with children in the NE group, presenting a medium effect size (Cohen's d = 0.497). Children from the HO group appeared to show significantly higher levels of neophobia at baseline than those from the NE group, with a medium effect size (Cohen's d = 0.374).

Food Selection and Intake During Lunches

The results in Table 3 reveal that for the first lunch, significantly more children in the HO group chose spinach/broccoli or the mixed option compared with the NE group: χ^2 (2) = 23.437, $P < 0.001$, in which Cramér's V (0.352) indicated a moderate association. By comparison, significantly more children in the NE group chose rice. With regard to the second lunch results, significantly more children in the HO group chose spinach/broccoli, χ^2 (2) = 6.364, $P = 0.04$, showing a weak association (Cramér's V = 0.184).

With regard to the participants' intake during lunches, Table 4 shows the results of the ANCOVA analysis, in which variables that appeared to differ significantly at baseline were taken as covariables. Inspection of the results for the first lunch indicates that children in the HO group ate significantly more spinach/broccoli than children in the NE group, with a small effect size ($\eta^2 = 0.033$); whereas the children's intake of rice was significantly higher in the NE group than in the

Table 3. Observed Frequency (f_o), Adjusted Residuals (AR), Chi-Square Test For Independence, and *P* for Election During Lunches According to the Condition

Variables (n HO, n NE)	HO Group f_o (AR)	NE Group f_o (AR)	χ^2	*P*
Election first lunch (94, 95)				
Spinach/broccoli	33 (3.6)	12 (−3.6)	23.44	<0.001[a]
Rice	41 (−4.8)	74 (4.8)		
Mix option	20 (2.3)	9 (−2.3)		
Election second lunch (93, 96)				
Spinach/broccoli	21 (2.5)	9 (−2.5)	6.364	0.04[a]
Rice	63 (−1.4)	74 (1.4)		
Mix option	9 (−0.8)	13 (0.8)		

HO indicates hands-on; NE, nutritional education.
[a]Significant results ($P < 0.05$).

Table 4. ANCOVA Analyses of Food Intake (g) According to the Condition

Variables (n HO, n NE)	HO Group	NE Group	*F*	*P*	η^2
Intake first lunch (94, 95)					
Spinach/broccoli	16.49 (28.87)	8.75 (20.94)	5.994	0.02	0.033[a]
Rice	59.92 (66.47)	88.4 (58.45)	10.910	0.001	0.058[a]
Intake second lunch (98, 98)					
Spinach/broccoli	14.34 (29.58)	11.02 (27.64)	1.032	0.31	0.006
Rice	50.50 (57.52)	64.98 (56.89)	3.126	0.08	0.018

F indicates F-test; HO, hands-on; NE, nutritional education.
[a]Significant results ($P < 0.05$).
Note: Values are mean (SD). Results adjusted by gender, food neophobia, baseline vegetable liking, and frequency of eating at the school canteen.

HO group, with a medium effect size ($\eta^2 = 0.058$). There were no significant differences for intake on the second lunch.

Preintervention and Postintervention Intragroup Comparison

Table 5 shows the results of the comparison between participants within the same group for preintervention and postintervention. Cooking self-efficacy and KidMed scores showed statistically significant differences for both groups (HO and NE). In particular, both groups had an increase in cooking self-efficacy following the intervention, with a small effect size (Cohen's d = 0.233 and 0.276, for HO and NE group, respectively). The same patterns of results emerged for the KidMed scores, indicating an improvement in the quality of the children's Mediterranean diet, with a small effect size (Cohen's d = 0.267 and 0.325, for HO and NE group, respectively). Moreover, for the HO group, food neophobia scores decreased significantly, and spinach liking children reported increased significantly after the intervention, although the effect size appeared small (Cohen's d = 0.181) and medium (Cohen's d = 0.42), respectively.

Between-Group Comparison Following the Intervention

Table 6 presents postintervention results for the comparison between HO and NE group. There was a significant difference between them for spinach liking children reported, with the HO group showing a greater liking than the NE group, although the effect size was medium (Cohen's d = 0.729).

Table 5. Preintervention and Postintervention Intragroup Paired *t* Test Analyses

Variables	Preintervention	Postintervention	*t*	*P*
Broccoli liking children reported				
HO group (n = 50)	−0.20 (1.33)	0.08 (1.41)	−1.309	0.20
NE group (n = 50)	0.14 (1.47)	0.16 (1.46)	−0.123	0.90
Spinach liking children reported				
HO group (n = 48)	0.06 (1.38)	0.63 (1.28)	−2.421	0.02[a]
NE group (n = 48)	−0.65 (1.45)	−0.33 (1.32)	−1.770	0.08
Cooking self-efficacy				
HO group (n = 96)	23.21 (6.53)	24.79 (6.96)	−3.002	0.003[a]
NE group (n = 94)	23.67 (6.86)	25.56 (6.80)	−3.857	<0.001[a]
Cooking attitude				
HO group (n = 96)	17.93 (4.78)	17.64 (5.84)	0.665	0.51
NE group (n = 95)	17.53 (5.09)	17.44 (5.29)	0.232	0.82
KidMed score				
HO group (n = 92)	5.02 (2.44)	5.72 (2.77)	−3.234	0.002[a]
NE group (n = 94)	5.33 (2.29)	6.14 (2.65)	−3.320	0.001[a]
Food neophobia				
HO group (n = 96)	22.49 (6.04)	21.35 (6.48)	2.359	0.02[a]
NE group (n = 95)	20.29 (5.77)	19.65 (6.13)	1.321	0.19
Vegetable preference				
HO group (n = 98)	1.68 (16.30)	3.14 (17.23)	−1.467	0.15
NE group (n = 98)	0.86 (20.23)	3.19 (19.19)	−1.670	0.10

HO indicates hands-on; NE, nutritional education.
[a]Significant results ($P < 0.05$).
Note: Values are mean (SD).

Table 6. Postintervention Between Groups Paired *t* Test Analyses

Variables (n HO, n NE)	HO Group	NE Group	*t*	*P*
Broccoli liking children reported (50, 50)	0.08 (1.41)	0.16 (1.46)	0.278	0.78
Spinach liking children reported (48, 48)	0.63 (1.28)	−0.33 (1.32)	−3.599	0.001[a]
Cooking self-efficacy (96, 95)	24.76 (6.96)	25.54 (6.77)	0.750	0.45
Cooking attitude (96, 95)	17.64 (5.84)	17.44 (5.29)	−0.240	0.81
KidMed score (93, 94)	5.72 (2.76)	6.14 (2.65)	1.056	0.29
Food neophobia (96, 95)	21.35 (6.48)	19.65 (6.13)	−1.865	0.06
Recipe elaboration times (97, 97)	0.33 (0.80)	0.19 (0.53)	−1.484	0.14
Vegetable preference (98, 98)	3.14 (17.23)	3.19 (19.19)	0.020	0.98

HO indicates hands-on; NE, nutritional education.
[a]Significant results ($P < 0.05$).
Note: Values are mean (SD).

DISCUSSION

Children's fruit and vegetable consumption in Spain remains low, despite governmental efforts to increase consumption by supporting multiple healthy eating campaigns.[30] The objective of the present work was to determine if child involvement in the feeding process (ie, choosing a recipe, purchasing ingredients, and cooking) in a nonexperimental setup decreases child food neophobia. The primary findings from the present work were that interventions effectively enhanced children's diet quality, although only the HO group decreased food neophobia levels. The evidence shows that when activities are cooking-related,[10,31–33] or even shopping-related,[14] or when real foods are involved,[34] they are effective in modifying choices for novel fruits and vegetables.

The school-based study conducted by Hyland et al[33] found that (at least partially) children aged between 12 and 13 years showed an increased willingness to try new foods after the intervention (20 cooking sessions). Even though tools used to measure children's neophobia or willingness to try new foods have been diverse, including interviews,[32–34] questionnaires[34] or registering meal choices,[10,14] it appears that these types of HO activities could be a useful strategy for encouraging children to try new fruits and vegetables.

Children in the HO group reported higher spinach liking. This result is in line with numerous studies showing that allowing children to participate in meal preparation influences their preferences toward fruits and vegetables.[9,35,36] Furthermore, children who more frequently helped with cooking at home showed higher preferences for fruits and vegetables.[11] In a similar vein, there is a positive association between preferences for fruits and vegetables and exposure to those foods.[37] For this reason, even if activities are not based on cooking but still entail exposure to fruits and vegetables such as gardening and/or NE,[31,34,38,39] improvements in preferences can occur. Therefore, the conclusion could be that the intervention employed in the present study did not provide the children with sufficient exposure to vegetables to influence their preferences in general (only for spinach). Moreover, broccoli and spinach are the types of vegetables most disliked by children because they belong to the categories of cruciferous and leafy green vegetables, respectively.[40] However, Spanish children's liking for spinach is slightly higher than for cauliflower,[17] which could possibly explain why there was a difference in the liking for spinach but not for broccoli.

In the present study, although the short-term results for choice and consumption are positive, in the mid-term, they appear to become weaker. In previous studies,[10,14] there were no differences regarding choice or intake, although their willingness to taste new foods was high. Hence, children might make safer choices instead of taking a risk by trying new food. However, despite seeing behavioral changes in school, it could be difficult to demonstrate these quantitative results at home.[32] In the present study, even if participants received the recipe and cooking accessories (apron and cooking hat), the number of occasions on which they prepared the recipe appeared to be almost nonexistent.

Nevertheless, many studies have reported an increase in intake after the intervention, whether they involve cooking,[33,41–43] gardening,[31] both,[38,44] or NE activities.[34,39] Moreover, as mentioned previously, studies vary considerably with regard to the number of sessions, length of the intervention, and measuring instruments, all of which make it difficult to draw any firm conclusions at this stage. The social environment is a recognized determinant of children's behavior.[37] Parents, siblings, and teachers are also salient members of children's social environment and collectively influence the development of dietary behaviors in young children.[45,46] Therefore, peer intake might have affected the intake of the children in this study, and explain why the results appeared to be significant for choice and not for intake. In general, the involvement of children in cooking could be beneficial for guiding them toward making healthy food choices, considering that maintenance of those behavioral changes could depend on having the opportunity to continue these habits in both the school and home environment.

Contrary to expectations, the pre-post comparison regarding cooking self-efficacy revealed significant changes in both groups (intragroup), though the difference between them (intergroup) was not significant. As this variable also increased in the NE group, it could suggest that this may

have occurred by chance, but it could also be plausible to think that the recipe and cooking accessories gifted to the children might have influenced cooking self-efficacy. Nonetheless, there is extensive literature supporting the evidence that culinary interventions for children improve their cooking self-efficacy or confidence,[9,33,36,42,43,47–49] although those interventions lasted for longer periods. Although the current study did not produce the latter results, previous studies have also observed significant changes in cooking attitudes.[9,36] Moreover, a recent review[48] had revealed that when interventions included additional components (NE, gardening, or physical activity) together with culinary interventions, significant improvements occur for self-efficacy as well as attitudes. Taken together, these findings support the conclusion that cooking interventions could improve cooking self-efficacy in school-aged children when children have the opportunity to cook at home, which is of great importance because cooking is an essential life skill that helps an individual to feed themselves well.[47]

Finally, results regarding diet quality indicate that both strategies (HO and NE) had an impact on children's healthy eating habits. Many studies in the literature have reported that improved diet quality is a consequence of the positive experiences that arise from involving children in cooking.[13,44,48,50,51] Nonetheless, NE interventions could also have a positive impact on the dietary habits of children,[52] although this was less efficient than HO strategies (ie, cooking and gardening).[53] Furthermore, a recently published systematic review protocol assessing the impact of involving children in healthy cooking on nutrition-related outcomes[54] shows promise for shedding more light on those issues and provides indications for the course for future studies.

Limitations of the present study include the variation of the recipe preparation between both schools and lunch days. For instance, it is possible that some of the dishes were not cooked in exactly the same way in both school canteens, which could have had an impact on the results.

Moreover, tasks were age-appropriate, so students did not fully complete the recipes on their own because a researcher supervised the boiling process. This limitation might have reduced the effectiveness of the HO intervention.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Neophobia remains a widespread barrier to follow a healthy diet, which could seemingly be addressed in childhood through environmental interventions. The present work identified a reduction in food neophobia, which suggests that those HO, participatory, and positive experiences, and the resulting exposure increment, might be useful for improving children's diet quality by increasing their willingness to try new foods, fruit and vegetable preference, and consequently their consumption. Future research should control the exposure of children to identical meals to maintain greater comparability. In the home environment, although sometimes parents are reluctant or have limited time to involve children in preparing meals,[55,56] cooking and eating together has positive outcomes. Furthermore, it would be preferable that children complete all the phases of the cooking process because perceived competence could be a stronger motivator for performing the behavior.[57]

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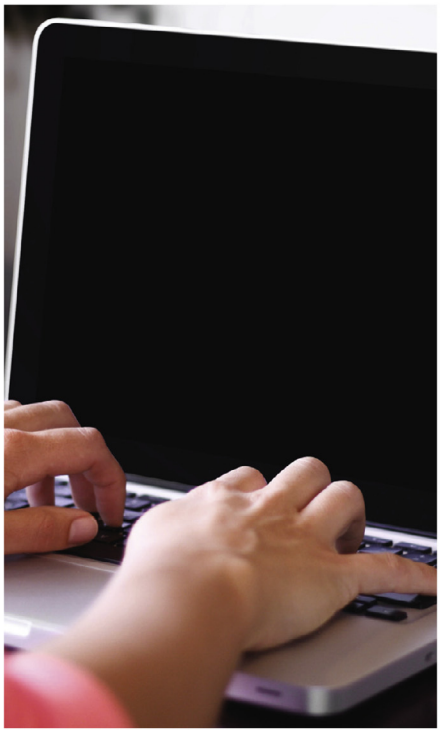

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