

USE OF WHOLE FOODS: EDUCATIONAL ACTION FOR SCHOOL-AGE CHILDREN

APROVEITAMENTO INTEGRAL DE ALIMENTOS: AÇÃO EDUCATIVA PARA CRIANÇAS EM IDADE ESCOLAR

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Abstract: The objective was to evaluate the effect of educational actions on the consumption and knowledge related to the utilization of whole foods in school-age children. Also, to evaluate the physicochemical composition of the products. School-aged children (32) answered a questionnaire on consumption and knowledge about whole food utilization (Pre-Intervention). Then, they participated in theoretical-practical educational actions on the subject (Intervention), which included the preparation of food products with radish residues in cooking workshops. In the Post-Intervention, the children answered the same questionnaire as in the Pre-Intervention. The food products were evaluated in relation to the physicochemical composition. In general, the intervention improved children's consumption and knowledge about the use of whole foods. The products with radish residue additive, prepared in the cooking workshops, presented high acceptability indices, above 80%. In addition, they were classified with a nutritional profile favorable for human consumption, especially relating to minerals and fiber. It is concluded that educational interventions are effective strategies to improve children's learning on topics related

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to the whole utilization of food. Furthermore, food products made with radish residue in cooking workshops show good sensory acceptability among children, besides having a good nutritional profile.

Keyword: Sensory Analysis; Physicochemical Composition; Radish Residues.

Resumo: Objetivou-se avaliar o efeito de ações educativas sobre o consumo e o conhecimento sobre a utilização de alimentos integrais em escolares. Além disso, avaliar a composição físico-química dos produtos. Crianças em idade escolar (32) responderam um questionário sobre consumo e conhecimento sobre a utilização de alimentos integrais (Pré-Intervenção). Em seguida, participaram de ações educativas teórico-práticas sobre o tema (Intervenção), que incluíram o preparo de produtos alimentícios com resíduos de rabanete em oficinas de culinária. Na Etapa Pós-Intervenção, as crianças responderam ao mesmo questionário da Pré-Intervenção. Os produtos alimentícios foram avaliados quanto à composição físico-química. Em geral, a intervenção melhorou o consumo e o conhecimento das crianças sobre o uso de alimentos integrais. Os produtos com aditivo de resíduo de rabanete, elaborados nas oficinas de culinária, apresentaram altos índices de aceitabilidade, acima de 80%. Além disso, foram classificados com perfil nutricional favorável ao consumo humano, principalmente em relação aos minerais e fibras. Conclui-se que as intervenções educativas são estratégias eficazes para melhorar o aprendizado das crianças sobre temas relacionados ao aproveitamento integral dos alimentos. Além disso, alimentos elaborados com resíduo de rabanete em oficinas de culinária apresentam boa aceitabilidade sensorial entre as crianças, além de apresentarem bom perfil nutricional.

Palavras-chave: Análise Sensorial; Composição Físico-Química; Resíduos de Rabanete.

INTRODUCTION

The parts of food for non-conventional consumption are called by-products. The peels, seeds, stalks, bagasse, husks, and leaves are examples of these residues related to vegetables and fruits (Coman *et al.*, 2020). Worldwide, the food processing industry generates approximately half a billion tons of fruit and vegetable residue every year (Banerjee *et al.*, 2017). A high rate of food waste is observed during the production chain, approximately 54% in harvest, post-harvest, and storage, and 46% in processing, distribution, and consumption (Freire Junior; Soares, 2020). In households, waste disposal may reach 569 million tons per year (UNEP, 2021). This occurs due to a lack of planning in the purchase, inadequate storage (Bravi *et al.*, 2018), and low consumer knowledge about the reuse of by-products (Porpino, 2016). These factors can trigger economic and nutritional losses (Massow *et al.*, 2019), as well as harm the environment by the accumulation of organic waste (Vilariño *et al.*, 2017). In regard to children, it has already been found that there is a high rate of food waste, yet children report disapproving of this behavior (Sorokowska *et al.*, 2020). Thus, childhood is an opportune stage of life to carry out actions aimed at changing this scenario.

The population's eating pattern has been changing over time. Generally, children have a greater preference for foods high in fat, sugar, and sodium, such as fast foods and ultra-processed foods (Cosmi *et al.*, 2017). Frequent consumption of these foods can trigger non-communicable chronic diseases, such as obesity (Canhada *et al.*, 2019), diabetes (Srouf *et al.*, 2019), and hypertension (Mendonça *et al.*, 2017). In addition, ultra-processed products may have chemical additives such as flavorings, colorings, emulsifiers, thickeners (Monteiro *et al.*, 2019), which can also cause allergies (Valluzzi *et al.*, 2019) and other health problems.

Food choices in childhood can be influenced by several factors, such as family food consumption habits, cultural and social aspects, good availability, family income (Scaglioni *et al.*, 2018), and the media (Naderer *et al.*, 2018). In addition, children may develop a condition known as food neophobia, characterized by an aversion to trying new foods (Rioux, 2019), which reduces dietary diversity and nutrient intake (Kral, 2018). This effect is verified mainly in relation to the consumption of fruits and vegetables since many families do not have the habit of eating them. Thus, these factors can significantly influence children's eating behavior, reducing the acceptability of some dishes (Scaglioni *et al.*, 2018).

The recommended daily intake of vegetables and fruits for children is around 400 g (5 servings) (WHO, 2020). However, Scaglioni *et al.* (2018) found that the actual consumption of these foods is much lower, at 2 to 3 servings per day. In general, this is because fruits and vegetables have substances known as phytonutrients, for example glucosinolates (Bell *et al.*, 2018) and solanines (Moore-Gough; Gough, 2016), which are responsible for the bitter taste (Moore-Gough; Gough, 2016; Bell *et al.*, 2018). Tannins, on the other hand, promote a feeling of astringency (Lamy *et al.*, 2016), which also reduces acceptability. Fruits and vegetables also have a more fibrous and hard texture (Poelman *et al.*, 2017), similar to what is observed in by-products such as peels, seeds, stalks, leaves, and bagasse, which further hampers consumption. However, these residues contain polyphenols and carotenoids, which have antioxidant and anti-inflammatory action (Coman *et al.*, 2020), acting beneficially in the body. In this aspect, the addition of by-products in foods can contribute to intestinal health (Chaouch; Benvenuti, 2020), cholesterol lowering, and glycemic level control (Vu *et al.*, 2018).

The technological feasibility of adding vegetable by-products in food products is already consistent in the literature. The addition of radish leaves and roots in hamburgers (Ahn *et al.*, 2018), broccoli leaves and stalks in bread (Lafarga *et al.*, 2018), and beet leaves in cookies (Asadi; Khan, 2020) had good acceptability compared to the standard products. Moreover, higher contents of ash, protein, and moisture (Ahn *et al.*, 2018; Asadi; Khan, 2020), dietary fiber (Asadi; Khan, 2020), phenolic compounds, and higher antioxidant activity (Lafarga *et al.*, 2018; Asadi; Khan, 2020) have been observed. However, the use of high residue levels promoted a detriment in texture (Ahn *et al.*, 2018; Lafarga *et al.*, 2018), aroma, flavor, and color (Asadi; Khan, 2020).

Interventions in childhood food and nutrition education are important to promote healthy eating behaviors throughout life, reduce food neophobia (Allirot *et al.*, 2016; Kim; Park, 2020), and the risk of non-communicable chronic diseases (Price *et al.*, 2017). In this context, the school is an ideal environment for the implementation of these actions since children remain

in this place for a long period of the day (Coulthard; Sealy, 2017). This allows for greater contact and interaction between teachers, colleagues, and other professionals (Poelman *et al.*, 2019), ensuring greater efficiency of activities.

Repeated exposure to food, sensory play, school gardens, and cooking workshops are some examples of interventions that can be used with children. Specifically, research using cooking workshops has shown that children interact directly with the preparations. Additionally, increased contact and handling of ingredients has been observed (Allirot *et al.*, 2016), increased vegetable consumption (Maiz *et al.*, 2018), as well as the promotion of knowledge (Poelman *et al.*, 2019) and self-confidence (Zahr; Sibeko, 2017). In this aspect, the objective of the study was to evaluate the effect of educational actions on consumption and assess knowledge related to the whole utilization of food in school-age children. Also, to evaluate the physicochemical composition of the products.

MATERIALS AND METHODS

TARGET AUDIENCE

Thirty-two children participated in the research, aged between 7 and 10 years, of both sexes, enrolled in elementary school, conveniently selected and located in the city of Guarapuava, Paraná, Brazil. Parents or guardians of the children received an Free and Informed Consent Form (FICF), which should be signed authorizing participation in the activities.

STUDY DESIGN

The research was divided into three Stages: Pre-Intervention, Intervention, and Post-Intervention. In the Pre-Intervention, children answered a questionnaire about consumption and knowledge related to the whole utilization of food. In the Intervention Stage, the children participated in theoretical-practical educational actions related to the whole utilization of food, and; practical activities of cooking workshops, in which they prepared and sensorially evaluated three food products with added radish waste. In the Post-Intervention, they answered the same questionnaire on whole use of food as in the Pre-Intervention. The food products were also evaluated for physicochemical composition.

PREPARATION OF FOOD PRODUCTS

For this study, three food products (kibe, pizza and pie) containing radish residue – leaves and stalks (Frame 1), which is one of the vegetables less accepted by children (Ciborska *et al.*, 2018; Moreno-Black; Stockard, 2018) were prepared. All ingredients were purchased in

the local trade of Guarapuava, Paraná, Brazil. The addition percentages of the ingredients were defined through preliminary sensory tests performed with the products. The preparations were sensorially evaluated by the children in the Intervention Stage.

Frame 1 – Products with radish residue additive evaluated in the Intervention Stage.

Product	Ingredients	Main recipe steps
 <p><i>Kibe</i></p>	<p>Cooked radish residue (stems and leaves) (30.6%), hot water (31.5%), wheat grain (15.8%), carrot (8.8%), onion (3.5%), lemon juice (3.1%), soybean oil (1.8%), spring onion (1.8%), parsley (1.6%), salt (1%), and garlic (0.7%).</p>	<p>Hydrate the wheat grains in hot water (50°C) for 20 minutes and drain. Cook the residues and carrot in boiling water (100°C) for 10 and 15 minutes, respectively. Blend the residues, carrot, onion, garlic, lemon juice, parsley, spring onion, salt, and oil until homogenized. Mix the hydrated wheat with the blended dough and distribute in a non-stick form. Bake in a preheated oven (180°C) for 40 minutes.</p>
 <p>Pizza</p>	<p>Dough: wheat flour (38.8%), warm water (17%), cooked and chopped radish residues (leaves and stalks) (9.5%), soybean oil (3.8%), dry biological yeast (0.9%), and salt (0.5%). Filling: cooked and chopped radish residues (leaves and stalks) (8.5%), tomato sauce (6.6%)*, tomato (3.8%), mozzarella cheese (3.3%), and oregano (0.6%). *Tomato sauce made with: tomato (4.7%), onion (0.9%), garlic (0.5%), and soybean oil (0.5%).</p>	<p>Dough: mix the water, yeast, flour, residues, oil, and salt until homogenized. Leave aside for 40 minutes. Open the dough with a rolling pin and distribute on a non-stick baking sheet. Filling: cook the residues in boiling water (100°C) for 10 minutes. *For the preparation of the sauce, distribute the seedless tomatoes, onion, garlic, and oil in a baking dish and cook in a preheated oven (220°C) for 45 minutes. Blend the sauce ingredients until homogenized and spread over the dough, add the cheese, residue, tomato, and oregano. Bake the dough in a preheated oven (180°C) for 25 minutes.</p>
 <p>Pie</p>	<p>Dough: whole milk (24.3%), cooked radish residue (leaves and stalks) (12.1%), wheat flour (10.9%), egg (6.1%), oat flour (3.6%), soybean oil (3.0%), and salt (0.6%). Filling: chopped radish residues (12.1%), grated carrot (7.3%), tomato (5.5%), onion (3.6%), spring onion (3.6%), parsley (2.9%), soybean oil (1.8%), garlic (0.8%), and salt (0.4%).</p>	<p>Dough: cook the residues in boiling water (100°C) for 10 minutes. Blend the residues, milk, egg, oil, flours, and salt until homogenized. Leave aside. Filling: sauté the garlic and onion with the oil, add the residues, carrot, tomato, parsley, spring onion, and salt. Distribute half of the liquefied dough on a baking sheet, add the filling, and the rest of the dough. Bake in a preheated oven (180°C) for 35 minutes.</p>

The vegetables were sanitized in running water and sanitized in sodium hypochlorite solution (250 ppm) for 10 minutes; **Source:** survey data (2024).

PRE-INTERVENTION STAGE

The children answered a questionnaire on the whole use of food, adapted from the literature (Mercini; Chaves, 2015; Gomes; Teixeira, 2017). The instrument was composed of 12 multiple choice questions (Q): Q1. “Have you ever heard about whole food utilization?”; Q2. “Have you ever consumed any recipes that use the peels, stalks, leaves, seeds of foods?”; Q3. “If you checked yes in Q2, what did you think of the recipe?”; Q4. “If you marked yes in Q2, where did you eat?”; Q5. “If someone offered you some food that had peels, stalks, leaves,

seeds, would you eat it?"; Q6. "Do you think there are nutrients in the peels, stems, and seeds of foods that are good for health?"; Q7. "Do you think that eating food in a whole form has any benefits?"; Q8. "If you checked yes in Q7, what would those benefits be?"; Q9. "In your home, what is done with the peels, stalks, leaves, and seeds of food?"; Q10. "Do you think it is important to wash food, such as fruit and vegetables, before eating?"; Q11. "If you marked yes in Q10, why is it important to wash food, such as fruits and vegetables?"; Q12. "If you checked yes in Q10, how should these foods (fruits and vegetables) be washed?".

The answers for Q1-Q2, Q5-Q7, and Q10 were "yes", "no", and "don't know", and the child was to mark an "x" in only one of the alternatives. In Q3, the child should also mark only one of the alternatives: "hated", "didn't like", "neither liked nor disliked", "liked", and "loved". In questions Q4, Q8, Q9, and Q11, children could mark an "x" in more than one answer: Q4, "at home", "at school", "another place", and "don't know"; Q8, "avoid food waste", "help the environment", "spend less money", "consume more nutrients", and "other"; Q9, "thrown in the trash", "used in other recipes (cake, cookies, etc.)", "given to domestic animals (cat, dog, etc.)", "it is made like fertilizer", and "don't know"; Q11, "remove dirt", "remove microorganisms", "not getting sick", and "other". For Q12, the child should mark only one of the following alternatives: "wash with clean water, sponge/brush, and soap", "soak in a disinfectant such as bleach", "wash, soak in bleach for 10 minutes and rinse with clean water", and "don't know how they should be washed".

For Q1-Q7 and Q10 there were no right or wrong answers. In questions Q8 and Q11, all answers were correct, while for Q9, the alternatives: "used in other recipes", "given to domestic animals" and "it is made like fertilizer" were considered correct. In Q12, the only correct alternative was "wash, soak in bleach for 10 minutes and rinse with clean water". The questionnaire scores for Q1-Q7, and Q10 were recorded by means of frequency (%) for each of the alternatives presented. To analyze the results of Q1, Q2, Q5-Q7 and Q10, the alternatives "no" and "don't know" were grouped together. Likewise for Q3, in which "hated", "didn't like", "neither liked nor disliked" were combined and considered responses of negative acceptability, while "liked", and "loved" were combined and considered responses of positive acceptability. The classification of the answers of Q8 and Q11 were organized as follows: when the child marked 1 correct alternative, it was considered to have "low knowledge", when marked 2 correct alternatives, it had "good knowledge", and when marked 3 or 4 correct alternatives, it had "great knowledge". Questions Q9 and Q12 were evaluated in relation to the frequency of errors and correct answers (%).

INTERVENTION STAGE

Two educational actions were carried out: theoretical-practical activities on the whole use of food and; practical activities using the cooking workshop methodology. The actions were carried out in schools every 15 days for a period of 4 months. Playful, theoretical-practical actions with the use of figures, paintings, food, and games were used as learning methodologies. The following topics were addressed: a) whole use of food (fruits and vegetables), covering the concept, benefits, nutritional value, and possible culinary dishes with vegetable residue additives; b) sanitization of fruits and vegetables, explaining the importance and correct form of sanitization. Children could interact freely during the activities. In total, five meetings were held, with intervals of 15 days.

The cooking workshops were held during the last three meetings of the Intervention Stage, at intervals of 15 days. Three different products containing radish residues were prepared in the workshops (Frame 1), on different days, with an average duration of one hour each. The products were prepared in the school kitchen by small groups of students (15 individuals). At the beginning of the activity, a dynamic educational intervention was applied to the children in order to remind them of the nutritional importance of the consumption and use of the vegetable residues utilized in the workshop. The children individually assisted in some of the steps of preparing the products, such as peeling, cutting, chopping, weighing, adding, and mixing the ingredients. The researchers provided verbal instructions during the workshop, aiming to increase the child's understanding at each stage of the recipe development.

The acceptability of food products containing radish residue was evaluated after the completion of each cooking workshop. The following sensory attributes were analyzed: appearance, aroma, taste, texture, and color, by means of a 7-point mixed face structured hedonic scale ranging from 1 ("super bad") to 7 ("super good"), adapted from Resurreccion (1998). In addition, a global acceptance test was applied, using a 5-point mixed face structured hedonic scale 1 ("hated") to 5 ("loved") (Brasil, 2017). Each child was taken to an organized place with an urn-like booth so that they could carry out the evaluation of the product. At this time, a portion of the sample (approximately 15 g) was delivered in a white disposable container in a sequential monadic manner.

The Acceptability Index (AI) was evaluated according to the formula: $AI (\%) = A \times 100/B$ (A = average score obtained for the product; B = maximum score given to the product) (Teixeira *et al.*, 1987). The AI was also analyzed according to Brasil (2017), so that the preparation could be considered in future studies for inclusion in regional school meals.

POST-INTERVENTION STAGE

The questionnaire applied in the Pre-Intervention Stage was reapplied in this phase to assess the learning obtained during the educational actions (Intervention Stage).

ANALYSIS OF THE PHYSICOCHEMICAL COMPOSITION OF THE PRODUCTS

The following evaluations were carried out on the radish residues and on the products made in the cooking workshops (in triplicate): Moisture: determined in an oven at 105 °C until constant weight (AOAC, 2011); Ash: analyzed in a muffle furnace (550 °C) (AOAC, 2011); Lipid: the cold extraction method was used (Bligh; Dyer, 1959); Protein: evaluated through the total nitrogen content of the sample, by the Kjeldahl method determined at the semi-micro level (AOAC, 2011); Dietary Fiber: measured by theoretical calculation (TACO, 2011; USDA, 2020); Carbohydrate: evaluation by theoretical calculation (by difference), according to the formula: % Carbohydrate = 100 - (% moisture + % protein + % lipid + % ash + % dietary fiber); Total caloric value (kcal): the calculation was theoretical using the factors of Atwater and Woods (1896) for lipid (9 kcal g⁻¹), protein (4 kcal g⁻¹) and carbohydrate (4 kcal g⁻¹).

STATISTICAL ANALYSIS

The data were analyzed with the Software R version 3.6.1 through the McNemar's Test and analysis of variance (ANOVA). Means were compared using the dependent Student's t and Tukey's mean tests, with a 5% significance level.

ETHICAL ISSUES

This work was approved by the Research Ethics Committee of UNICENTRO, opinion number 3,089,447/2018.

RESULTS AND DISCUSSION

Tables 1 to 4 show the results of the participants' consumption and knowledge about the whole use of food in the Pre and Post-Intervention Stages.

Table 1 – Children's answers to questions 1 (Q1), 2 (Q2), 5 (Q5), 7 (Q7) and 10 (Q10) of the questionnaire applied in the Pre and Post-Intervention Stages.

Question	Pre-Intervention				Post-Intervention				p
	No/Don't know		Yes		No/Don't know		Yes		
	n	%	n	%	n	%	n	%	
Q1. Have you ever heard about whole food utilization?	21	65.6	11	34.4	8	25.0	24	75.0	0.002
Q2. Have you ever consumed any recipes that use the peels, stalks, leaves, seeds of foods?	21	65.6	11	34.4	4	12.5	28	87.5	0.001
Q5. If someone offered you some food that had peels, stalks, leaves, seeds, would you eat it?	13	40.6	19	59.4	2	6.3	30	93.8	0.001
Q6. Do you think there are nutrients in the peels, stems, and seeds of foods that are good for health?	8	25	24	75	3	9.4	29	90.6	0.063
Q7. Do you think that eating food in a whole form has any benefits?	14	43.8	18	56.3	4	12.5	28	87.5	0.002
Q10. Do you think it is important to wash food, such as fruit and vegetables, before eating?	2	6.3	30	93.8	0	0	32	100	0.001

n = 32; McNemar's Test, considering $p < 0.05$ significant; **Source:** survey data (2024).

Table 2 – Children's answers to question 3 (Q3) of the questionnaire applied in the Pre and Post-Intervention Stages.

Question	Pre-Intervention				Post-Intervention				p
	Hated/ Didn't like/ Neither liked nor disliked		Liked/ Loved		Hated/ Didn't like/ Neither liked nor disliked		Liked/ Loved		
	n	%	n	%	n	%	n	%	
Q3. If you checked yes in question 2 (Q2)*, what did you think of the recipe?	15	46.9	14	43.8	3	9.4	29	90.6	0.001

n = 32; *Q2. Have you ever consumed any recipes that use the peels, stalks, leaves, seeds of foods?; McNemar's Test, considering $p < 0.05$ significant; **Source:** survey data (2024).

Table 3 – Children's answers to questions 8 (Q8) and 11 (Q11) of the questionnaire applied in the Pre and Post-Intervention Stages.

Question	Pre-Intervention				Post-Intervention				p
	Low knowledge		Good/Great knowledge		Low knowledge		Good/Great knowledge		
	n	%	n	%	n	%	n	%	
Q8. If you checked yes in question 7 (Q7)*, what would those benefits be?	21	65.6	11	34.4	6	18.8	26	81.3	0.001
Q11. If you marked yes in question 10 (Q10)**, why is it important to wash food, such as fruits and vegetables?	15	46.9	17	53.1	6	18.8	26	81.3	0.004

n = 32; *Q7. Do you think that eating food in a whole form has any benefits?; **Q10. Do you think it is important to wash food, such as fruit and vegetables, before eating?; McNemar's Test, considering $p < 0.05$ significant; **Source:** survey data (2024).

In general, the intervention improved children's consumption and knowledge about whole food utilization ($p < 0.05$). This effectiveness can also be demonstrated in relation to the increased percentage of positive responses, being: 118% (Q1), 154% (Q2), 106% (Q3), 58%

(Q5), 56% (Q7), 136% (Q8), 150% (Q9), 7% (Q10), 53% (Q11) and 1,200% (Q12). Other studies have found similar results assessing responses from children (Antón-Peset *et al.*, 2021) and adolescents (Kowalewska *et al.*, 2018). Among the questions in this research, it is worth noting that few children had knowledge of the correct way to clean and disinfect fruits and vegetables before the intervention (n=2), learning increasing significantly after the educational action (n=26) (Table 4). Thus, the inclusion of this topic in the elementary school curriculum is suggested, given its importance for health and for presenting positive results regarding children's knowledge (Schmitt *et al.*, 2018; Ibrahim *et al.*, 2020; Asakura *et al.*, 2021).

Despite the beneficial effects of training, there was no significant difference for Q6, which deals with the nutritional content of the by-products. This effect occurred because the number of children who already had knowledge about the topic before the intervention was high. Thus, there was little variability in the data obtained after the intervention.

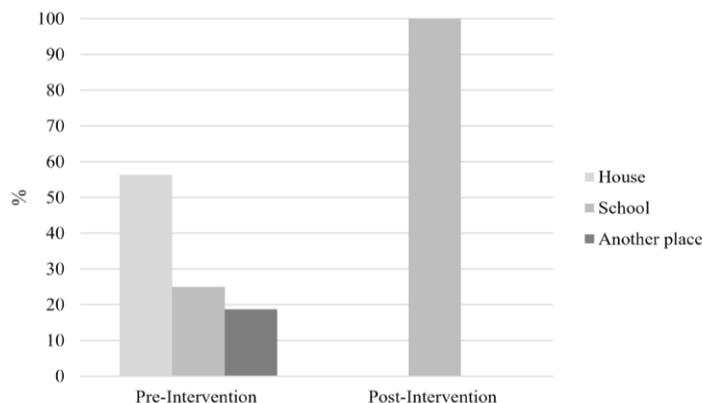
The educational intervention influenced the children's responses regarding the place of consumption of food by-products. Before the intervention, some children responded that they had already consumed preparations with fruit and vegetable residues at home, at school, or elsewhere. However, after the intervention 100% of them marked that they had consumed at school, as can be seen in Figure 1. These results demonstrate that possibly the children did not have a clear understanding of what a food preparation with added by-products was before the intervention. In this aspect, it is verifiable that there was learning of the target audience through the educational action. Knowing this, it is essential that this topic be addressed emphatically in children's school curriculum (Boulet *et al.*, 2022; Santos *et al.*, 2022). The results of the sensory analysis of the products made in the cooking workshops (Intervention Stage) are expressed in Table 5.

Table 4 – Children's answers to questions 9 (Q9) and 12 (Q12) of the questionnaire applied in the Pre and Post-Intervention Stages.

Question	Pre-Intervention				Post-Intervention				p
	Wrong		Correct		Wrong		Correct		
	n	%	n	%	n	%	n	%	
Q9. In your home, what is done with the peels, stalks, leaves, and seeds of food?	24	75.0	8	25.0	12	37.5	20	62.5	0.008
Q12. If you checked yes in question 10 (Q10)*, how should these foods (fruits and vegetables) be washed?	30	93.8	2	6.3	6	18.8	26	81.3	0.001

n = 32; *Q10. Do you think it is important to wash food, such as fruit and vegetables, before eating?; McNemar's Test, considering $p < 0.05$ significant; **Source:** survey data (2024).

Figure 1 – Frequency of children's responses to question 4 (Q4) (referring to question 2 (Q2)). have you ever consumed any recipes that use the peels, stalks, leaves, seeds of foods?) in the Pre and Post-Intervention Stages.



n = 32; No child marked the answer “don’t know”; **Source:** survey data (2024).

Table 5 – Mean sensory scores (\pm standard deviation) and Acceptability Index (AI) (%) of the products with added radish residues (leaves and stalks) elaborated in the cooking workshops (Intervention Stage).

Parameter	Kibe	Pizza	Pie
Appearance	5.0 \pm 1.56 ^c	6.2 \pm 1.31 ^a	5.4 \pm 1.64 ^b
Aroma	5.0 \pm 1.45 ^b	5.8 \pm 1.63 ^a	5.7 \pm 1.82 ^a
Taste	5.7 \pm 1.62 ^b	6.1 \pm 1.63 ^a	6.2 \pm 1.64 ^a
Texture	5.1 \pm 1.79 ^b	5.8 \pm 1.46 ^a	5.9 \pm 1.43 ^a
Color	5.0 \pm 1.55 ^b	6.2 \pm 1.42 ^a	5.0 \pm 1.92 ^b
Global acceptance	4.1 \pm 1.18 ^b	4.5 \pm 0.92 ^a	4.4 \pm 1.08 ^a
AI ¹	82.5 ^b	89.4 ^a	88.8 ^a
AI ²	81.3 ^b	87.5 ^a	90.6 ^a

n = 32; Distinct letters in the row indicate significant difference between products by Tukey's Test ($p < 0.05$); ¹AI: Acceptability Index referring to global acceptance (¹Teixeira *et al.* (1987); ²Brasil (2017)); Hedonic scale for attributes: 7 points: 1 ("super bad") to 7 ("super good"); Hedonic scale for global acceptance: 5 points: 1 ("hated") to 5 ("love"); **Source:** survey data (2024).

Pizza and pie had the highest acceptance scores for all attributes except appearance and color which were lower for pie when compared to pizza ($p < 0.05$). In general, the kibe showed the lowest acceptability by the children. Despite this, the products presented high average scores for the attributes (≥ 5) and for overall acceptance (≥ 4.1). Similar results were verified in other research, which sensorially evaluated the addition of beetroot, broccoli, and cauliflower leaves and stalks in savory pie (Garcia *et al.*, 2015) and kale in farofa (Luiz *et al.*, 2019) with school age children.

The evaluated AI's values, according to Teixeira *et al.* (1987) showed a percentage above 70%, demonstrating good sensory acceptance by children. In addition, with the exception of kibe, the other preparations can be included as options in the school meals menu since the AI's were higher than 85% (Brasil, 2017).

PHYSICOCHEMICAL COMPOSITION

The results of the physicochemical composition of the products containing radish residues (stalks and leaves) are shown in Table 6.

Table 6 – Mean physicochemical composition (\pm standard deviation) of products with radish residues additive (stalks and leaves).

Parameter	Radish residues	Kibe	Pizza	Pie
Moisture (g 100 g ⁻¹)	94.05 \pm 0.08	70.11 \pm 0.08 ^a	52.80 \pm 0.06 ^c	68.66 \pm 0.05 ^b
Ash (g 100 g ⁻¹)	1.01 \pm 0.05	1.97 \pm 0.07 ^a	1.12 \pm 0.05 ^c	1.85 \pm 0.04 ^b
Protein (g 100 g ⁻¹)	1.70 \pm 0.07	4.04 \pm 0.09 ^a	3.83 \pm 0.08 ^b	2.36 \pm 0.10 ^c
Lipid (g 100 g ⁻¹)	0.29 \pm 0.04	2.65 \pm 0.08 ^c	4.55 \pm 0.05 ^b	6.56 \pm 0.04 ^a
Carbohydrate (g 100 g ⁻¹)	2.96 \pm 0.21	21.23 \pm 0.25 ^b	37.70 \pm 0.18 ^a	20.58 \pm 0.21 ^b
Total caloric value (kcal 100 g ⁻¹)	21.18 \pm 0.68	124.91 \pm 0.74 ^c	207.08 \pm 0.52 ^a	150.77 \pm 0.89 ^b
Dietary fiber (g 100 g ⁻¹)	1.87 \pm 0.34	2.73 ^{β}	1.41 ^{μ}	1.63 ^{μ}

Distinct letters in the row indicate significant difference between products by Tukey's Test ($p < 0.05$); Values calculated on a wet basis; ^{β} Theoretical calculation: TACO (2011) and USDA (2020); ^{μ} Theoretical calculation: TACO (2011); Portion of products: 100 g; **Source:** survey data (2024).

The kibe had higher contents of moisture, ash, and protein and lower contents of lipid and energy, while the pizza had higher contents of carbohydrate and energy and low contents of moisture and ash ($p < 0.05$). The pie was the product with the highest amount of lipid and the lowest amount of protein. Lower carbohydrate contents were found in kibe and pie, with no statistical difference between them ($p > 0.05$). These results occurred due to the different ingredients contained in the preparations. The higher moisture content in the kibe can be explained due to the high amount of water used for the hydration of the wheat grain (31.5%). In the case of ash, kibe is the food with the highest content of radish residues (30.6%), which contains a high concentration of minerals such as calcium (752.64 mg 100 g⁻¹), potassium (495.31 mg 100 g⁻¹), sodium (298.58 mg 100 g⁻¹), and magnesium (57.04 mg 100 g⁻¹) (Goyeneche *et al.*, 2015). In addition, wheat grain also consists of high mineral content such as potassium (410 mg 100 g⁻¹), phosphorus (300 mg 100 g⁻¹), magnesium (164 mg 100 g⁻¹), and calcium (35 mg 100 g⁻¹) (Philippi, 2017). The higher amounts of soybean oil and whole milk in the pie justify the higher lipid content in this product. The higher content of carbohydrates in pizza can be explained by the higher amount of wheat flour present in the preparation, which contains a high content of this nutrient (75.09 g 100 g⁻¹) (TACO, 2011).

Kibe was the product with the highest dietary fiber content, followed by pie and pizza. When compared to traditional products without added vegetables, preparations with radish residue additive had lower calorie and lipid contents and higher fiber contents (USDA, 2019). According to Brazilian legislation, only kibe can be classified as a source of fiber, as it contains a content of $\geq 2.5\%$ of this compound per serving (Brasil, 2020).

FINAL REMARKS

Educational interventions improve children's consumption and knowledge about the whole use of food. The products with radish residue additive and prepared in the cooking workshops present high rates of sensory acceptability, higher than 80%. In addition, they contain a nutritional profile favorable to human consumption, especially in relation to minerals and fiber, and can be offered to school age children.

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