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FOOD EDUCATION IN SCHOOL: EFFECTS OF NEOPHOBIA, HEALTHINESS, SENSORIAL ACCEPTANCE AND PURCHASE OF ESCAROLE PRODUCTS

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ABSTRACT

Food neophobia in childhood can hinder vegetable consumption and compromise healthier choices. In this sense, school interventions can be considered promising strategies to increase acceptance and intention to purchase foods containing vegetables. The objective of the research was to evaluate the effect of educational activities on children's level of neophobia towards vegetables, as well as their perception of healthiness and sensory aspects and purchase of food products containing escarole. A total of 260 children participated, organized into four groups: G1, control; G2, theoretical and practical educational activities; G3, cooking workshops; and G4, school garden. The actions reduced the degree of neophobia and increased the perception of healthiness, acceptability, and purchase intention for G3 and G4. G2 also showed a positive, albeit modest, effect on these parameters for bread after the intervention. Educational activities carried out at school are effective in reducing neophobia towards vegetables, especially when cooking workshops and vegetable gardens are used. In addition, they increase the perception of healthiness, acceptance, and purchase intention. Theoretical-practical educational activities also promote beneficial effects, but to a lesser extent.

Keywords: Product development. Educational interventions. Infancy.



EDUCAÇÃO ALIMENTAR NA ESCOLA: EFEITOS NA NEOFOBIA, SAUDABILIDADE, ACEITAÇÃO SENSORIAL E COMPRA DE PRODUTOS COM ESCAROLA

RESUMO

A neofobia alimentar na infância pode dificultar o consumo de hortaliças e comprometer escolhas mais saudáveis. Nesse sentido, intervenções escolares podem ser consideradas estratégias promissoras para ampliar a aceitação e a intenção de compra de alimentos com hortaliças. O objetivo da pesquisa foi avaliar o efeito de ações educativas sobre o nível de neofobia de crianças frente às hortaliças, além da percepção de saudabilidade e aspectos sensoriais e de compra de produtos alimentícios com escarola. Participaram 260 crianças organizadas em 4 grupos: G1, controle; G2, ações educativas teórico-práticas; G3, oficinas de culinária; e G4, horta escolar. As ações reduziram o grau de neofobia e aumentaram a percepção de saudabilidade, aceitabilidade e intenção de compra para G3 e G4. O G2 também apresentou um efeito positivo, porém discreto, nesses parâmetros para o pão, pós-intervenção. As ações educativas realizadas na escola são eficientes para reduzir a neofobia frente às hortaliças, especialmente quando se utiliza as técnicas de oficinas de culinária e horta. Além disso, aumentam a percepção de saudabilidade, aceitação e intenção de compra. Ações educativas teórico-práticas também promovem efeitos benéficos, porém em menor grau.

Palavras-chave: Desenvolvimento de produtos. Intervenções educativas. Infância.



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1 INTRODUCTION

Changes in eating habits in recent years are the main causes of obesity and other chronic diseases, which often begin in childhood. This process is marked by an increase in the consumption of ultra-processed products, as they are more palatable, easy to prepare and consume, and inexpensive (Martini *et al.*, 2021; Torres; Gomes; Mattos, 2021). However, these foods are high in calories, sugar, sodium, and fat (United States Department of Agriculture, 2024), which can impair child growth and development (Awuchi; Igwe; Amagwula, 2020). Other factors also contribute to children's choice of ultra-processed foods, especially a sedentary lifestyle, excessive use of electronic devices (Beni *et al.*, 2022), as well as conditions known as neophobia (Torres; Gomes; Mattos, 2021) and food selectivity (Martini *et al.*, 2021).

Neophobia and food selectivity are common processes in childhood and affect school-age children. In the first case, children refuse to eat new foods (Dovey *et al.*, 2008), while food selectivity is characterized by an aversion to certain flavors, colors, brands, and types of food, resulting in dietary restriction (Van Dijk; Buruma; Blijd-Hoogewys, 2021). These conditions can occur due to biological, individual, psychological, cultural, socioeconomic, and demographic factors, in addition to being directly influenced by the food consumption of family members and/or guardians (Torres; Gomes; Mattos, 2021). It should be noted that excessive consumption of ultra-processed foods can also aggravate cases of neophobia and food selectivity (Martini *et al.*, 2021). In addition, boys may exhibit a higher degree of neophobia and selectivity than girls (Harris *et al.*, 2021).

Both neophobia and food selectivity in children are directly related to inadequate consumption of fresh foods, such as fruits and vegetables. Children's intake of these foods is well below the recommended 400 g/day (National Health Service, 2022), ranging from 220 to 345 g/day (Lynch *et al.*, 2014). In Brazil, only 37.7% of schoolchildren consume an adequate amount of vegetables (Instituto Brasileiro de Geografia e Estatística, 2019). Generally, the low preference for fruits and vegetables is due to the presence of volatile aromatic substances in these foods (Xu *et al.*, 2022). Dark green vegetables, such as escarole, may be even more rejected by children (Gomes *et al.*, 2023). This is because they have high amounts of phenolic compounds and terpenoids,



such as sesquiterpene lactones, which promote a bitter taste (Perović *et al.*, 2021). Despite being a highly rejected food, escarole contains considerable amounts of minerals (1.4 g 100 g⁻¹) and dietary fiber (3.1 g 100 g⁻¹) (United States Department of Agriculture, 2019), which are important for child growth and development. In this context, actions are needed to increase the consumption and acceptability of this type of vegetable by children.

One strategy that helps promote the intake and acceptance of vegetables in childhood is to add them as ingredients in food preparations. In addition, this practice can improve the nutritional composition of the food (Castagnoli *et al.*, 2017). However, the use of vegetables in high levels or in apparent formats can reduce acceptability, as they accentuate the flavor and modify the appearance of the preparation (Werthmann *et al.*, 2015). Another factor that interferes with acceptance is the type of vegetable used in the preparation (Castagnoli *et al.*, 2017), since some may be more rejected by children (Gomes *et al.*, 2023).

Educational activities carried out in the school environment that use playful methodologies such as the implementation of vegetable gardens (Wells *et al.*, 2023) and cooking workshops (Maiz *et al.*, 2021; Veneruso *et al.*, 2022) can help to improve children's food choices (Maiz *et al.*, 2021). In the case of vegetable gardens, children participate in the entire process, from creating the beds to harvesting, which can help promote sustainability, environmental preservation, and vegetable consumption (Davis *et al.*, 2021). In cooking workshops, children assist in the different stages of food preparation. This can positively influence their willingness to try and accept the product, as well as generate a sense of ownership and pride for having helped in its preparation (Allirot *et al.*, 2016). Interdisciplinary theoretical-practical educational activities, such as games, dynamics, lectures, among others, can also be used in schools as child learning techniques to help improve eating habits (Moitra; Madan; Verma, 2021). In this context, the objective of the research was to evaluate the effect of different educational activities on the level of neophobia in children towards vegetables, as well as their perception of healthiness and sensory aspects and purchase of food products with added escarole.



2 MATERIAL AND METHODOS

2.1 Target Population

A total of 260 children aged between 6 and 10 years, enrolled in grades 1 to 5 at three public schools in the urban area of Guarapuava, Paraná, Brazil, participated in the study. Sampling was based on convenience.

2.2 Ethical Issues

The study was approved by the Research Ethics Committee Involving Human Subjects of UNICENTRO, opinion No. 4,872,901/2021. The inclusion criteria considered students in the study age group from participating in schools; signing of the Free and Informed Consent Form (FICF) by legal guardians; signing of the Free and Informed Assent Form (FIAF) by children; absence of food allergies or known diseases; and participation of the child in all stages of the research. Individuals who did not meet these criteria were excluded from the study.

2.3 Study Design

The children were randomly divided into four groups, each containing 65 participants: Group 1 (G1), control, without participating in any educational activities; Group 2 (G2), application of theoretical-practical educational activities; Group 3 (G3), participation in practical educational activities in a cooking workshop, with the preparation of two food products containing escarole; Group 4 (G4), participation in a practical activity involving the planting of an escarole garden at school.

The study was developed in three stages: 1) Pre-Intervention, children from all groups answered two questionnaires: a) Questionnaire A (QA), on the level of neophobia about vegetables; b) Questionnaire B (QB), assessing the perception of healthiness, sensory acceptance, and purchase intention of two food preparations with added escarole; 2) Intervention: after four weeks, educational activities were carried out for groups G2, G3, and G4. These activities were conducted over a total period of two months, with regular intervals of 15 days; and 3) Post-Intervention: all children completed the same questionnaire used in the Pre-Intervention stage.

2.4 Pre-Intervention

Questionnaire A (QA) – Children's level of neophobia regarding vegetables


The instrument was adapted from Laureati *et al.* (2015) and consists of eight questions, four neophilic and four neophobic, regarding vegetable consumption: I eat new and different vegetables almost every day (QA1), I don't trust new vegetables (QA2), If a vegetable is new, I don't try it (QA3), I like to try strange flavors and vegetables that are not common and come from other places (QA4), When I am at a friend's house, I like to try new vegetables (QA5), I am afraid to eat vegetables I have never eaten before (QA6), I am very picky when it comes to vegetables (QA7), and I really eat all kinds of vegetables (QA8).


The answers were presented on a mixed facial scale, ranging from 1 to 5 points, respectively: very false to very true. The child should mark an “x” on only one of the alternatives. The assessment was based on three groups, according to the sum of the questionnaire scores: low neophobia (scores ≤ 17), medium neophobia (scores between ≥ 18 and ≤ 24), and high neophobia (scores ≥ 25). For the purposes of presenting the results, the medium and high neophobia levels were combined.

2.5 Product Development

Two food products (coxinha and bread) were developed with the addition of escarole (Byczkovski; Costa; Novello, 2025), as described in Frame 1.

Frame 1. Endive products added and evaluated by children.

Products	Ingredients	Main steps of the recipe
<p>Coxinha</p> 	<p>Dough: cassava (27.5%), whole wheat flour (27.4%), water (10.9%), chicken cooking water (0.2%), butter (0.1%), salt (0.1%).</p> <p>Filling: shredded chicken breast (16.3%), escarole (7.0%), bell pepper (5.0%), onion (4.0%), garlic (0.5%), parsley (0.4%), chives (0.4%), saffron (0.1%), salt</p>	<p>Dough: Cook the cassava in water under pressure, over high heat (220°C), for 30 minutes. Drain and set aside the water. Repeat the same procedure for the chicken. Mash the cassava and add the water used to cook the cassava and chicken, butter, and salt, and cook for 30 minutes (220°C). Gradually add the flour and cook for another 30 minutes (200°C). Set aside.</p> <p>Filling: Shred the chicken and sauté with chopped garlic, onion, escarole, and bell pepper for 15 minutes (180°C). Mix in salt,</p>

	(0.1%).	saffron, parsley, and chives. To assemble the product, use 50 g of dough, add 10 g of filling in the center, and shape into a coxinha. Bake in a preheated medium oven (120°C) for 30 minutes.
	<p>Dough: refined wheat flour (30.3%), whole wheat flour (13.0%), water (6.5%), skim milk (4.4%), egg (4.3%), refined sugar (2.0%), biological yeast (1.3%), salt (1.3%), olive oil (0.5%).</p> <p>Filling: escarole (20.0%), bell pepper (10.0%), onion (4.5%), garlic (0.5%), parsley (0.5%), chives (0.5%), olive oil (0.2%), salt (0.2%).</p>	<p>Dough: Add warm milk (30°C) and yeast to a bowl, then add the egg, olive oil, sugar, flour, and salt. Mix and gradually add water, kneading the dough by hand for 15 minutes. Cover the dough for 40 minutes until it doubles in size.</p> <p>Filling: Chop the ingredients into medium cubes (5 cm), sauté with olive oil for 20 minutes (100°C) and set aside. Roll out a portion of the dough (20 g) with a rolling pin until it is 2 mm thick. Add 10 g of the filling to half of the dough, covering the filling with the other half. Leave the covered dough to rest for 20 minutes until it doubles in size. Bake in a preheated conventional oven (180°C) for 30 minutes.</p>

The vegetables were washed in running water and sanitized in a sodium hypochlorite solution (250 ppm) for 10 minutes; formulations based on Byczkovski, Costa, and Novello (2025). Source: The Authors.

Questionnaire B (QB) – Assessment of perceived healthiness, sensory acceptance, and purchase intention of food products

One week after the children answered the QA, they evaluated the perceived healthiness, sensory acceptance, and purchase intention of two food products using QB. The questionnaire consisted of the following questions: QB1. “How healthy do you think this product is?” QB2. “Overall, how much did you like this product?”, QB3. “How much did you like or dislike the product considering the attributes below? (appearance, aroma, flavor, texture, and color)”, QB4. “If you could buy this product, what would you do?”.

The answers to QB1 and QB3 were given using facial emojis, through a mixed structured 7-point facial scale, respectively (1, not healthy/very bad to 7, totally healthy/very good), adapted from Resurreccion (1998). For the evaluation of QB2 and QB4, a mixed structured 5-point facial hedonic scale was used (1, hated it/would definitely not buy it to 5, loved it/would definitely buy it), adapted from Brasil (2017), Kroll (1990), and Resurreccion (1998). The Acceptability Index (AI) of the preparations was evaluated according to Teixeira, Meinert, and Barbetta (1987).



Prior to the evaluation of the products, the researchers informed the children in all groups that escarole and other vegetables had been added to the coxinha and bread. Each child was taken to a place equipped with a booth-like cabin so that they could evaluate the preparations. At that moment, a portion of each sample (approximately 15 g) was delivered in a white disposable container, along with a glass of water to cleanse the palate. The samples were delivered in a balanced, monadic, and sequential manner.

2.6 Intervention Stage

Only children in G2, G3, and G4 participated in the intervention stage. For G2, theoretical-practical educational activities related to study topics were implemented, as described in Table 1. Children in G3 participated in two cooking workshops, preparing coxinha and bread with added escarole (Frame 1). Group 4 collaborated in the implementation and cultivation of an escarole garden.

The theoretical-practical educational activities for G2 were carried out in the school classroom and were based on the methodology of Byczkowski, Costa, and Novello (2025). The purpose was to promote knowledge about the importance of healthy eating and nutrition and about planting vegetables. The activities lasted eight weeks, with biweekly meetings. Each intervention lasted a total of 30 minutes and was organized in two stages: the first 10 minutes were devoted to theoretical explanations of the topics, followed by 20 minutes of practical activities. One week after the activities were completed, the children evaluated the food products sensorially and filled out the QB, following the procedures described above.

Table 1. Theoretical-practical educational activities developed for children in Group 2 (G2)

Week	Action		Goal
	Theoretical	Practical	
1	Getting to know vegetables ^a	Painting vegetables ^b	Understand the difference between vegetables and subdivisions.
2	Recognizing the vitamins and minerals in vegetables ^c	Nutritional classification of vegetables by color ^c	Conceptualize the vitamins and minerals present in vegetables and their health benefits.
3	Types of	Growing vegetables	Learn about the types of



	vegetables ^d	in plastic bottles ^d	vegetable gardens and how to grow vegetables at home.
4	Environmental preservation ^e	Compost bins and organic gardens ^e	Ways to care for the environment and use food as fertilizer.

^aPhillippi (2019); ^bBernier *et al.* (2022); ^cBrasil (2014); ^dLucivânio and Silva (2019); ^eGuenther *et al.* (2020); actions based on Byczkovski, Costa, and Novello (2025). Source: The Authors.

For the cooking workshops, which were held individually for each product, the G3 children were organized into subgroups of approximately 30 individuals. Each workshop lasted an average of 30 minutes and was held in a classroom during school hours, with a 30-day interval between them. At the beginning of the activity, the researchers showed the children fresh escarole. They then received brief information about the vegetable and their importance, which covered the following initial questions: “Do you know escarole?”; “Do you like escarole?”; and “Do you know why it is important to eat escarole?” The participants individually assisted in some of the stages of product preparation, such as peeling, cutting, chopping, weighing, adding, and mixing the ingredients. The researchers also provided verbal instructions during the workshop to increase understanding at each stage of recipe preparation. At the end of each workshop, the children answered QB, following the procedures described above.

Group 4 individuals participated in the implementation of a school garden for a period of two months, with biweekly meetings lasting 30 minutes. The children were organized into subgroups of approximately 20 members to carry out the activity. The garden was cultivated exclusively with escarole during the summer and early fall, in tires with an average size of 112.8 mm x 205.0 mm wide and a radius of 406.4 mm. Initially, the environment was cleaned and organized by researchers. In the first week, vegetable seedlings were planted in holes with an average depth of 6 cm and spacing of 10 cm, with the sides covered with soil. In the following weeks, the children were assisted by the researchers during watering and maintenance of the garden.

The seedlings were watered every 15 days by the children with a manual watering can. At the same time, the beds were maintained, removing any weeds and dirt from the site. After 60 days, at the end of the intervention, the children helped harvest the vegetables and clean the garden. Throughout the educational process, the children received general information about escarole, its cultivation, and the



importance of consumption, in addition to being able to freely interact with other questions. One week after the completion of the vegetable garden implementation, the children evaluated the food products sensorially and completed the QB instrument, following the procedures described above.

2.7 Post-Intervention Stage

Both questionnaires, QA and QB, were reassessed in the Post-Intervention period. QA was reapplied two weeks after the end of the intervention period for all groups. In the case of QB, the control group (G1) underwent the assessment again after the end of the intervention period carried out only for G2, G3, and G4. The children in G2, G3, and G4 reassessed QB, according to the methodology described above.

2.8 Statistical Analysis

The effect of the educational intervention on the level of neophobia was assessed using the McNemar test. The comparison of sensory acceptance means was performed using Student's t-tests and ANOVA with Tukey's post-hoc test. All analyses were evaluated at a 5% significance level using R software version 4.4.1.

3 RESULTS AND DISCUSSION

A total of 260 children participated in the study, 50.8% (132) boys and 49.2% (128) girls, of which: 46.2% (30) boys and 53.8% (35) girls were in G1; 53.8% (35) boys and 46.2% (30) girls in G2; and 44.6% (29) boys and 55.4% (36) girls in G3; 58.5% (38) boys and 41.5% (27) girls in G4. The average age for children overall was 7.7 ± 1.04 years, 7.5 ± 0.53 years for G1, 8.0 ± 0.66 years for G2, 6.7 ± 0.59 years for G3, and 8.7 ± 1.1 years for G4.

Most children were classified as having a high degree of neophobia (medium/high) in the Pre and Post-Intervention stages in all groups, respectively: G1, 86.2% (n=56) and 83% (n=54); G2, 87.7% (n=57) and 76.9% (n=50); G3, 87.7% (n=57) and 66.1% (n=43); G4, 84.6% (n=55) and 61.5% (n=40). Similar results were found in other studies conducted with children from different countries (Maiz *et al.*, 2021; Torres; Gomes; Mattos, 2021). Table 2 describes the effect of the intervention on children's level

of neophobia towards vegetables.

Table 2. Effect of the intervention on children's level of neophobia towards vegetables

Pre-Intervention	Post-Intervention		Total % (n)	p*
	Medium/High neophobia % (n)	Low neophobia % (n)		
<i>Grupo 1</i>				
Medium/High	72.3 (47)	13.8 (9)	86.2 (56)	0.804
Low	10.8 (7)	3.1 (2)	13.8 (9)	
Total	83.1 (54)	16.9 (11)	100.0 (65)	
<i>Grupo 2</i>				
Medium/High	70.8 (46)	16.9 (11)	87.7 (57)	0.118
Low	6.2 (4)	6.2 (4)	12.3 (8)	
Total	76.9 (50)	23.1 (15)	100.0 (65)	
<i>Grupo 3</i>				
Medium/High	60.0 (39)	27.7 (18)	87.7 (57)	0.004
Low	6.2 (4)	6.2(4)	12.3 (8)	
Total	66.2 (43)	33.8 (22)	100.0 (65)	
<i>Grupo 4</i>				
Medium/High	50.8 (33)	33.8 (22)	84.6 (55)	0.008
Low	10.8 (7)	4.6 (3)	15.4 (10)	
Total	61.5 (40)	38.5 (25)	100.0 (65)	

n = 260 children (132 boys and 128 girls); *McNemar test, considering $p \leq 0.05$ significant; G1: control; G2: theoretical-practical educational activities; G3: cooking workshops; G4: school garden. Source: The Authors.

The control groups (G1) and those participating in theoretical-practical educational activities (G2) showed no change ($p > 0.05$) in the neophobia index after the intervention period. However, the workshop (G3) and vegetable garden (G4) significantly reduced ($p < 0.05$) the level of neophobia, as observed in similar studies (Maiz *et al.*, 2021; Wells *et al.*, 2023). Studies indicate that classroom interventions are more effective in changing children's behavior when associated with participatory ones (Moitra; Madan; Verma, 2021; Veneruso *et al.*, 2022).

Techniques that promote children's involvement in practical activities, such as cooking workshops, develop a sense of ownership and pride due to their collaboration in food preparation (Allirot *et al.*, 2016). In addition, acquiring knowledge about food production and healthy eating habits can be a trigger for increasing taste perception and food experience (Kim *et al.*, 2021). In the case of vegetable gardens, children's participation in the production process contributes to healthier food consumption,



reducing neophobia towards vegetables. It also contributes to raising awareness about sustainability and environmental preservation (Davis *et al.*, 2021). Exposing children to green areas promotes better cognitive assessment, which improves their level of knowledge, increasing understanding and learning (Reuben *et al.*, 2019).

The effect of educational actions on the scores of perceived healthiness, sensory acceptance, and purchase intention of the food products evaluated by the children is shown in Table 3. In the Pre-Intervention period, there was no significant difference ($p>0.05$) between the groups in the children's perception of the healthiness of the escarole coxinha. However, higher scores ($p<0.05$) for appearance were found for G3 compared to G1 and G2, and G4 also had higher scores than G2. Children in groups G1, G3, and G4 reported higher scores for the aroma of this product compared to those in G2. Greater acceptability for the taste of the coxinha was found for participants in G4 compared to G1 and G2, with G3 also reporting higher scores than G2. Higher scores for texture, color, overall acceptance, and AI of the preparation were found in G3 and G4 compared to the others. Purchase intention was higher for children in groups G3 and G4 than in G2.

The escarole bread also showed a difference ($p<0.05$) in sensory acceptance between the groups, except for color ($p>0.05$), in the Pre-Intervention period. The perception of healthiness and purchase intentions were higher for children in G4 compared to those in G2. Appearance, aroma, texture, overall acceptance, and AI had higher scores in G1, G3, and G4, while G4 judges reported higher scores for flavor than the other groups. In general, in the Pre-Intervention period, children in G3 and G4 had higher sensory acceptance for both products. However, participants in the control group also reported statistically higher scores than G2 for most bread attributes. Children in groups G3 and G4, in the Post-Intervention period, had higher scores ($p<0.05$) than those in G1 and G2 for all parameters, both for the coxinha and for the bread. However, the purchase intention of G1 was significantly higher than G2 for the chicken nuggets, while for the bread, the same result was found for overall acceptance, AI, and purchase intention.

The intervention significantly increased the G3 and G4 scores for the products in all parameters. There was no difference ($p>0.05$) between the evaluations (Pre and Post) of the coxinha in G1 and G2 in terms of perceived healthiness, sensory attributes, overall



acceptance, and acceptability index. However, greater purchase intention ($p < 0.05$) was observed for this product in G1 after the intervention period. In the case of bread, the scores for perceived healthiness, appearance, aroma, flavor, texture, overall acceptance, and AI for G1 were not affected by the intervention period, while color and purchase intention were rated higher in the Post-Intervention stage. Group G2 had higher ratings for perceived healthiness, aroma, and color after the educational activities. Similar results have been observed in the literature, with improved acceptance of vegetables such as spinach (Decosta *et al.*, 2017) and broccoli (Maiz *et al.*, 2021) following the implementation of school gardens and cooking workshops.

The AI of the preparations for G1 and G2 was less than 70%. On the other hand, a result higher than this index after the intervention was found for G3 and G4, indicating good sensory acceptance (Teixeira; Meinert; Barbetta, 1987). This demonstrates that practical activities are more effective in improving the sensory evaluation of food products (Shi; Feng, 2022), as observed in a pie with added broccoli and spinach (Maiz *et al.*, 2021).

It has been demonstrated that educational interventions using playful methodologies such as the implementation of vegetable gardens and cooking workshops have contributed to improving children's perception of healthiness and sensory acceptance (Maiz *et al.*, 2021; Veneruso *et al.*, 2022) and intention to purchase food products (Wells *et al.*, 2023). Taste perception is closely associated with psychophysical cognitive factors such as language, learning, memory, and thinking (Kim *et al.*, 2021). Thus, pre-existing knowledge about food, together with that acquired in educational activities, contributes to individual taste perception. Also, encouraging children to adopt healthy eating habits increases their intention to purchase fruits and vegetables (Guichard *et al.*, 2021), which was confirmed in the present study. It should be noted that outdoor and sequential educational activities, with a beginning, middle, and end, are more effective in promoting cognitive efficiency in children, especially in information processing and problem solving (Shi; Feng, 2022).



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Table 3. Effect of educational actions on children's perception of healthiness, sensory acceptance, and purchase intention of evaluated food products

Parameter	G1	G1	G2	G2	G3	G3	G4	G4
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
<i>Coxinha</i>								
Healthiness	4.6±2.11 ^{aA}	4.7±2.10 ^{aB}	4.1±2.04 ^{aA}	4.7±2.09 ^{aB}	4.6±2.43 ^{bA}	6.7±0.53 ^{aA}	4.9±2.02 ^{bA}	6.6±0.86 ^{aA}
Appearance	4.9±2.15 ^{aCB}	4.8±2.14 ^{aB}	4.2±2.31 ^{aC}	4.1±2.14 ^{aB}	5.8±1.75 ^{bA}	6.9±0.36 ^{aA}	5.4±1.72 ^{bAB}	6.9±0.41 ^{aA}
Aroma	4.8±2.18 ^{aA}	4.8±2.14 ^{aB}	3.5±2.24 ^{aB}	4.2±2.31 ^{aB}	4.7±2.36 ^{bA}	6.7±0.95 ^{aA}	5.4±2.03 ^{bA}	6.7±0.71 ^{aA}
Flavor	4.3±2.34 ^{aCB}	4.3±2.31 ^{aB}	3.7±2.27 ^{aC}	4.3±2.30 ^{aB}	5.1±2.38 ^{bAB}	6.8±0.44 ^{aA}	5.6±1.92 ^{bA}	6.8±0.54 ^{aA}
Texture	4.1±2.13 ^{aB}	4.1±2.05 ^{aB}	3.7±2.20 ^{aB}	4.1±2.08 ^{aB}	5.1±2.18 ^{bA}	6.6±0.69 ^{aA}	5.4±1.88 ^{bA}	6.7±0.65 ^{aA}
Color	4.0±1.88 ^{aB}	4.2±1.89 ^{aB}	3.6±2.14 ^{aB}	3.8±2.10 ^{aB}	5.2±2.10 ^{bA}	6.9±0.43 ^{aA}	5.4±1.66 ^{bA}	6.8±0.46 ^{aA}
Overall acceptance	3.3±1.41 ^{aB}	3.4±1.43 ^{aB}	3.1±1.47 ^{aB}	3.3±1.49 ^{aB}	4.0±1.42 ^{bA}	4.8±0.44 ^{aA}	4.0±1.35 ^{bA}	4.8±0.51 ^{aA}
Acceptability index (%)	66.0 ^{aB}	68.0 ^{aB}	62.0 ^{aB}	66.0 ^{aB}	80.0 ^{bA}	96.0 ^{aA}	80.0 ^{bA}	96.0 ^{aA}
Purchase intention	3.6±1.51 ^{bAB}	3.8±1.37 ^{aB}	3.0±1.62 ^{aB}	3.3±1.55 ^{aC}	3.8±1.63 ^{bA}	4.9±0.39 ^{aA}	4.2±1.10 ^{bA}	4.9±0.27 ^{aA}
<i>Bread</i>								
Healthiness	4.9±2.10 ^{aAB}	4.9±2.04 ^{aB}	4.2±2.09 ^{bB}	5.1±2.15 ^{aB}	4.8±2.31 ^{bAB}	6.7±0.86 ^{aA}	5.5±1.78 ^{bA}	6.8±0.57 ^{aA}
Appearance	4.7±2.13 ^{aA}	4.7±2.19 ^{aB}	3.7±2.28 ^{aB}	4.2±2.24 ^{aB}	5.1±2.20 ^{bA}	6.5±0.92 ^{aA}	5.2±1.82 ^{bA}	6.9±0.31 ^{aA}
Aroma	4.3±2.19 ^{aA}	4.3±2.24 ^{aB}	3.1±2.14 ^{bB}	4.0±2.31 ^{aB}	4.3±2.25 ^{bA}	6.3±1.34 ^{aA}	5.0±1.75 ^{bA}	6.8±0.59 ^{aA}
Flavor	4.2±2.27 ^{aB}	4.2±2.26 ^{aB}	3.4±2.16 ^{aB}	4.0±2.33 ^{aB}	4.0±2.58 ^{bB}	6.4±1.48 ^{aA}	5.3±1.93 ^{bA}	6.9±0.38 ^{aA}
Texture	4.4±2.08 ^{aA}	4.4±2.05 ^{aB}	3.3±2.12 ^{aB}	3.9±2.27 ^{aB}	4.5±2.19 ^{bA}	6.5±0.95 ^{aA}	5.0±1.86 ^{bA}	6.9±0.43 ^{aA}
Color	4.8±1.87 ^{bA}	4.9±1.84 ^{aB}	4.2±1.95 ^{bA}	4.9±1.98 ^{aB}	4.8±2.29 ^{bA}	6.7±0.79 ^{aA}	4.9±1.88 ^{bA}	6.8±0.49 ^{aA}
Overall acceptance	3.4±1.51 ^{aA}	3.6±1.47 ^{aB}	2.7±1.37 ^{aB}	2.9±1.58 ^{aC}	3.5±1.62 ^{bA}	4.4±0.92 ^{aA}	3.8±1.24 ^{bA}	4.9±0.34 ^{aA}
Acceptability index (%)	68.0 ^{aA}	72.0 ^{aB}	54.0 ^{aB}	58.0 ^{aC}	70.0 ^{bA}	88.0 ^{aA}	76.0 ^{bA}	98.0 ^{aA}
Purchase intention	3.4±1.49 ^{bAB}	3.7±1.27 ^{aB}	2.8±1.47 ^{aB}	2.8±1.68 ^{aC}	3.2±1.69 ^{bAB}	4.5±1.00 ^{aA}	3.8±1.40 ^{bA}	5.0±0.17 ^{aA}

n = 260; Distinct lowercase letters in the row indicate a significant difference according to the paired Student's t-test (p<0.05) considering the pre- and post-intervention stages between the same parameter and group; Distinct uppercase letters in the row indicate a significant difference according to Tukey's test (p<0.05) between the different groups and the same intervention stage; SD: Standard Deviation; G1: control; G2: theoretical-practical educational actions; G3: cooking workshops; G4: school garden; Hedonic scale for perception of healthiness: 7 points: 1 (not healthy at all) to 7 (totally healthy); Hedonic scale for attributes: 7 points: 1 (very bad) to 7 (very good); Hedonic scale for overall acceptance: 5 points: 1 (hated it) to 5 (loved it); Hedonic scale for purchase intention: 5 points: 1 (would definitely not buy) to 5 (would definitely buy).



4 CONCLUSION

School-aged children show a high degree of neophobia towards vegetables. However, cooking workshops and school gardens are effective in reducing this condition. These actions also increase the perception of healthiness, sensory acceptability, and purchase intention for products such as coxinha and bread with added escarole. Theoretical-practical educational interventions also increase the perception of healthiness and acceptance of bread in specific attributes, such as aroma and color. Food products with added escarole are healthier options for children's consumption due to their nutritional profile. Thus, it is suggested that educational interventions on food be continuously applied to children in the school environment to promote a change in eating habits and, consequently, a better quality of life.

Among the limitations of this research, we can mention the restricted and contextual sample, which, despite being representative, is limited to a specific context (school and regional), which may limit the generalization of the results to other populations or age groups. The short duration of the intervention may be another limiting factor, since longer actions may present different and even more effective responses. Also, there was no explicit control of external factors, such as eating habits at home or previous exposure to vegetables, which may have influenced the children's responses. The research evaluations are specifically related to coxinha and escarole bread. Thus, expanding the variety of food products could provide a more comprehensive view of the effects of interventions.

It is recommended that future studies explore the points presented as limitations in a broader and more diverse manner. In addition, it would be interesting to compare different teaching approaches to identify which methodologies are most effective for specific populations.

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