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The Role of Schools in Popularizing Unconventional Food Plants: An Overview of Consumption in School Meals and Local Cuisine in Municipalities of Serra Negra da Mantiqueira, Minas Gerais, Brazil

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ABSTRACT

This exploratory-descriptive study aimed to investigate the potential of Unconventional Food Plants (PANC) in the Serra Negra da Mantiqueira region, specifically in the municipalities of Olaria, Lima Duarte, and Bom Jardim de Minas. The research identified several species of local PANC and evaluated their feasibility for integration into school and gastronomic menus aimed at rural tourism. Using structured questionnaires, information was collected from students, school cooks, nutritionists, and restaurant owners, revealing significant knowledge and varied acceptance of PANC. The results highlight the potential of these plants not only as nutritional sources but also as promoters of sustainable food and regional agricultural practices, highlighting the need for educational and market policies that encourage their use and cultivation in the region.

Keywords: food education; sustainable agriculture; popularization of local cuisine.

ABSTRACT

This exploratory-descriptive study aimed to investigate the potential of Non-Conventional Edible Plants in the Serra Negra da Mantiqueira region, specifically in the municipalities of Olaria, Lima Duarte, and Bom Jardim de Minas. The research identified various local Non-Conventional Edible Plants species and assessed their viability for integration into school and gastronomic menus focused on rural tourism. Structured questionnaires were used to collect information from students, cafeteria workers, nutritionists, and restaurant owners, revealing significant knowledge and varied acceptance of Non-Conventional Edible Plants. The results highlight the potential of these plants not only as nutritional sources but also as promoters of sustainable eating habits and regional agricultural practices, underscoring the need for educational and market policies that encourage their use and cultivation in the region.

Keywords: food education; sustainable agriculture; popularization of local gastronomy.



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Introduction

Non-Conventional Edible Plants (PANC) are native or exotic wild plants, spontaneous or cultivated, of great rusticity, with ecological importance, often being part of the cultural tradition of some regions, peoples, or ethnic groups (Garcia et al. 2020).

In general, PANC are recognized as healthy foods, sometimes with high nutraceutical value, and are welcomed as part of the diet of the Brazilian population as a whole (Kinupp and Lorenzi 2021). However, these plants are not yet recognized in the more conventional food market, even though they are still present in traditional cultures, ensuring food sovereignty for the population (Julião 2021). Due to their hardiness, these vegetables adapt to more extreme climates and are resistant to diseases common to other vegetables. They are suitable for cultivation in spaces of any size, being ornamental, medicinal, tasty, and nutritious, and knowledge and use of these plants and their various uses can contribute to the health of the social environment (Kristjansson et al. 2007).

Due to all the characteristics mentioned above, PANC are an important means of expanding the school menu without the need for specific cultivation (A. B. Santos and Moreira 2020). PANC also have high phytotherapeutic importance, performing a functional nutritional role, particularly in the case of those that contain minerals, antioxidants, fiber, and essential vitamins in their composition (Garcia et al. 2020).

Brito et al. (2020) highlight the importance of school meals today and point out that approximately 169 countries provide at least one meal per day in their schools. Brazil is the second country with the most students benefiting from this food. Ensuring food in public educational institutions is a mechanism for keeping students in school, since Brazil has improved school meals, which are prescribed by a nutritionist in charge of organizing the menu. Thus, PANC are healthy food alternatives that can be grown within school spaces.

PANC can also contribute to the development of tourism, given that gastronomy and tourism are deeply linked, with food being a relevant attraction for tourists. In this way, tourism is an economic activity that is constantly growing, attracting the attention of various private and public sectors due to its capacity to generate income. Over the last 60 years, it has expanded progressively to become one of the main sectors of the global economy (Pereira, Maia, and Brito 2020).

Gastronomy, on the other hand, has emerged as an alternative way to showcase a place, create its identity, and attract visitors. This area has become a branding element capable of promoting local cultural values. The appeal of gastronomy lies in its ability to allow tourists/consumers to learn about the cultural aspects of a place and try the local food. It is a cultural experience through which tourists can observe, participate in, and experience regional flavors, as dishes and culinary rituals have become important elements of the journey (Lavandoski 2018).

PANC are plants of great relevance, being very nutritious, so that their use rescues values of a culture in relation to increasingly responsible and conscious consumption, exhibiting high nutritional richness with zero productive expenditure. They grow spontaneously and rapidly in different regions and climatic situations, without the use of pesticides (Brito et al. 2020).

In view of the above, this research was developed in the Mantiqueira region, involving cities near the Serra Negra da Mantiqueira State Park: Lima Duarte, Bom Jardim de Minas, and Olaria, where the study of unconventional food plants shows promise for promoting healthy eating in schools and rural tourism focused on agroecology. The objectives were to identify and the PANC existing in the above-mentioned municipalities, verifying the potential of these species in school menus and in gastronomy focused on local tourism.



Materials and Methods

Research location

The project was carried out in the Mantiqueira region, which covers the municipalities of Olaria, Lima Duarte, and Bom Jardim de Minas, which have 1,945, 17,221, and 6,783 inhabitants, respectively, according to the 2022 demographic census (IBGE 2023a; 2023b; 2023c). The region has strong potential for rural tourism. The activities that generate income in these three municipalities are represented by agriculture and small-scale commerce, with dairy and beef cattle farming being the main activity in these cities. Tourism is an activity that has been explored in these cities, as they have relevant characteristics such as attractive landscapes and rich local cuisine, attracting tourists.

The climate of these municipalities is very similar, as they are close to each other and have many landscapes. The climate is Cwb, mesothermal humid, with dry, cold winters and mild, humid summers. The temperature in this region is around 20.1 °C in winter, while the hottest months, January and February, reach a temperature of 27 °C. In July, the temperature is much lower, as it is the coldest period in this region, reaching 10.5 °C.

In terms of public schools, Lima Duarte has eight, Olaria has two, and Bom Jardim de Minas has three. As for restaurants, based on companies registered on the web, there are more than 10 registered restaurants in Lima Duarte, four in Olaria, and eight in Bom Jardim de Minas.

Identification of PANC species consumed by local school students and their families

In this stage of the research, the PANC consumed in the region was identified based on the perceptions of students and their families. The survey was conducted by applying questionnaires to students from six public schools in the municipality of Lima Duarte, encompassing four institutions in urban areas and two in rural areas (60% of all existing schools). In Bom Jardim de Minas, the questionnaires were administered in three public schools, distributed between two urban areas and one rural area (100% of all existing schools). In the municipality of Olaria, interviews were conducted in two schools, one located in a rural area and the other in an urban area (100% of all existing schools). The interviews focused on the traditional plants present in their diets, methods of obtaining them for consumption, nutritional perceptions, and traditional dishes prepared with the identified plants.

A total of 180 students were interviewed. The age range of the interviewees was 6 to 16 years old, belonging to grades 1 to 9 of elementary school.

Assessment of the potential of PANC species in school and restaurant menus

To assess the incorporation of PANC in school and restaurant menus, interviews were conducted with 12 school cooks in Lima Duarte, with the participation of two representatives from each institution. In Bom Jardim de Minas, two cooks from each school in the urban area and one from the rural area participated. In Olaria, two cooks from an urban school and one cook from a rural school participated. The interviews consisted of understanding the potential and limitations of PANC in school meals, as well as investigating these professionals' knowledge of these plants.

To evaluate PANC in the composition of school menus, a survey was conducted with school nutritionists in each municipality. Simultaneously, restaurant owners were interviewed to evaluate PANC in gastronomy, with 12 establishments in Lima Duarte (45% of all existing restaurants), six in Bom Jardim de Minas (66% of all existing restaurants), and three in Olaria (50% of all existing restaurants), with the aim of understanding the potential and challenges associated with the use of PANC in local cuisine.



Data analysis and interpretation

The methodological approach adopted in this study is qualitative in nature, more specifically, exploratory-descriptive. As explained by Richardson (2017), qualitative research seeks an in-depth understanding of the meanings and specific characteristics presented by research participants, in contrast to the generation of quantitative measures of characteristics or behaviors.

Therefore, this study qualifies as exploratory, as it sought greater familiarity with the problem in question, systematically collecting and recording data related to the theme chosen as the object of study (2019). In addition, it is also classified as descriptive, since it is based on the observation and analysis of data and facts collected from reality itself, with the aim of providing a detailed description of the participants immersed in that reality (Trivinos 1987).

This methodological choice was motivated by the need for a thorough interpretation of the processes that give rise to the reality of the individuals involved in the research. All research complied with Resolution No. 466 (Brazil 2012) regarding the confidentiality and anonymity of research respondents. Considering that research in the humanities and social sciences requires respect for and guarantee of the full exercise of participants' rights, in accordance with Resolution No. 510 (Brazil 2016), it was designed, evaluated, and conducted in such a way as to anticipate and avoid possible harm to participants. In this sense, all parents of students, school cooks, nutritionists, and restaurant owners read and signed the Free and Informed Consent Form (FICF), both in duplicate, one for the participant and the other for the researcher's file, as provided for in Resolution No. 466 (Brazil 2012).

The instrument used to collect data from respondents consisted of a structured questionnaire specific to each group: students, school cooks, nutritionists, and restaurant owners. Regarding the use of questionnaires, Silva and Buss (2019) highlight several advantages associated with this method, such as obtaining more agile and accurate responses, granting greater freedom to respondents due to anonymity, reducing possible distortions resulting from the researcher's influence, and promoting flexible schedules for answering questions. The questionnaires used are presented below.

The questionnaire administered to students requested the following information: (1) gender (male or female), (2) age, and (3) grade level in elementary school. Next, respondents were asked (4) if they knew what Unconventional Food Plants (PANC) were, with the response options "Yes" or "No." If they had any type of PANC at home, respondents were asked to (5) indicate which ones. They were also asked (6) if they knew that PANC are rich in nutrients, and (7) if they agreed that the school should offer dishes made with PANC, with "Yes" or "No" options for both questions. The questionnaire also asked (8) if there was a vegetable garden at the respondent's home and, if so, (9) if this garden had PANC, asking them to specify which ones. In addition, respondents were asked (10) if they had ever eaten any PANC at school, included as a leaf or salad in dishes, with "Yes" or "No" options. Finally, it asked (11) if, given what they had learned about PANC, the respondent had more questions about these plants, with space to share observations.

The questionnaire administered to school cooks requested the following information: (1) gender (male or female) and (2) length of service at the school. Next, they were asked (3) if the school has a vegetable garden, with options "Yes" or "No," and (4) how diverse the vegetables are. It also asked (5) if there are PANC at the school, and (6) if they are used in the school lunch menu, both with options "Yes" or "No." The questionnaire also asked (7) if the cook agreed (or thought it was a good idea) to include PANC in school lunches, with options "Yes" or "No." Next, it asked (8) what nutritional benefits of PANC the cook knows and (9) what dishes are made with PANC, if they are used in the school food menu. The questionnaire also investigated (10) whether students liked dishes made with PANC, and (11) whether the cook had difficulties using PANC in school meals, with options "Yes" or "No" for both questions.



The questionnaire administered to nutritionists included the following information: (1) gender (male or female), (2) how long they had been working at the school, and (3) how long they had been working as a school nutritionist. Next, they were asked (4) if, during their academic training, the nutritionist had any courses or studies focused on Unconventional Food Plants (PANC), with options “Yes” or “No,” and if the answer was “Yes,” they should indicate which ones. They were also asked (5) if they considered it important to include PANC in the school menu, with options “Yes” or “No,” and if the answer was “Yes,” they were asked to explain why. The questionnaire also asked (6) how PANC should be included in the school menu so that students would accept these plants in their diet. It was also asked (7) whether, in addition to their nutritional properties, PANC could be recommended for other purposes in the school context, with options “Yes” or “No,” and if the answer was “Yes,” it was necessary to specify which ones. The questionnaire continues by asking (8) whether the nutritionist considers that PANC may be healthier than the traditional plants provided at school, since they do not require pesticides to be grown, and (9) whether they believe that PANC can contribute to the educational development of students, both with options “Yes” or “No.” Next, it asked (10) if there are appropriate ways to consume PANC in the dishes offered at school, with options “Yes” or “No,” and if the answer was “Yes,” they should indicate which ones. The questionnaire also asked (11) the nutritionist to indicate which properties considered most important in PANC should be included in the school food menu, offering the options “Vitamins and minerals,” “Fiber and protein,” “Carbohydrates and lipids,” or “All of the above.” Finally, it asked (12) whether the nutritionist considers it important for the school to start producing PANC within its own space to teach students what PANC are and how they can be grown, with options “Yes” or “No.”

The questionnaire administered to restaurant owners requested the following information: (1) gender (male or female) and (2) how long they have owned the restaurant. Next, they were asked (3) if the owner was familiar with Unconventional Edible Plants (PANC), with options “Yes” or “No.” The questionnaire also asked (4) if any PANC are used in the restaurant’s menu, with options “Yes” or “No,” and if the answer was “Yes,” it was necessary to indicate which ones. It also asked (5) if there are customers who seek foods with PANC, and (6) if customers approve of dishes made with PANC, both with options “Yes” or “No.” The questionnaire continued by asking (7) whether the owner was considering adding PANC to the restaurant menu, with options “Yes” or “No,” and if the answer was “Yes,” they should indicate which PANC they intend to use.

The data were collected and organized according to the responses obtained in the questionnaires. Data tabulation, analysis, and graphing were performed using Microsoft Excel and Atlas.ti (2022) *software*.

Results and Discussion

Students' perceptions of PANC

The survey was conducted with a total of 180 students, 28 (15.59%) from the municipality of Olaria-MG, 106 from Lima Duarte-MG (58.89%), and 46 from Bom Jardim de Minas-MG (25.14%). In the three municipalities surveyed, more than 70% of students are familiar with PANC, and at least half of them reported having PANC at home. Students are knowledgeable about the nutrients provided by PANC, ranging from 64% to 82% among the municipalities studied. In the city of Olaria-MG, 100% of students agree that the school should offer PANC on the menu, while in the other municipalities, this intention ranged from 79 to 83%. Regarding home gardens, more than 50% have them, and the percentage of students who have PANC at home ranged from 43 to 50%. Regarding the consumption of PANC at school, the percentage in each municipality ranged from 29 to 39%. Below, as presented in Table 1, there is information about the species listed by the

students, as well as word clouds by municipality (Figure 1) of the PANC that were most highlighted by students from public schools in Olaria-MG, Lima Duarte-MG, and Bom Jardim de Minas-MG.

Regarding curiosity about PANC, students from the municipalities of Olaria-MG, Lima Duarte-MG, and Bom Jardim de Minas-MG showed a marked interest in PANC, albeit with different focuses. In Olaria-MG, there is a motivation to explore the variety and culinary and health applications of PANC, as well as a concern with the safe identification of these plants, especially those similar to poisonous species. In Lima Duarte-MG, students focus on the nutritional benefits of PANC compared to conventional plants, as well as wanting to discover new species and learn about the cultivation and culinary preparation of these plants. In Bom Jardim de Minas-MG, interest is focused on the nutritional properties of PANC, the diversity of available species, and research into their potential medicinal use, while also considering production costs and possible health risks. These aspects reflect a common search for knowledge about healthy eating and sustainability among students in these municipalities.

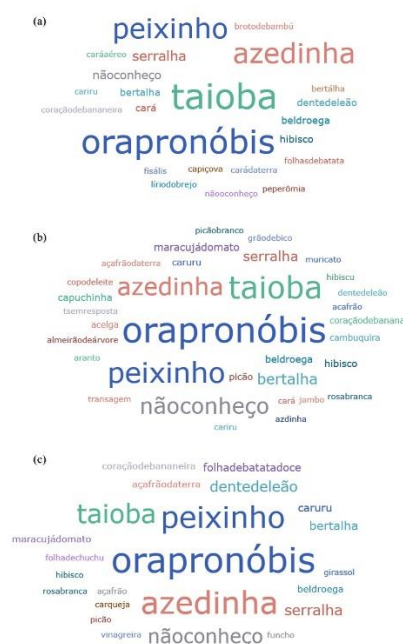


Figure 1. Word clouds with the PANC most cited by public school students in the municipalities of Olaria-MG (a), Lima Duarte-MG (b), and Bom Jardim de Minas-MG (c). Source: prepared by the authors

Table1 . List of PANC mentioned by public school students in the three municipalities of Minas Gerais surveyed: Olaria, Lima Duarte, and Bom Jardim de Minas



Common name	Scientific name	Municipalities in the Mantiqueira Region-MG		
		Lima Duarte	Bom Jardim de Minas	Olaria
Turmeric	<i>Curcuma longa</i>	X	X	
Aranto	<i>Kalanchoe daigremontiana</i>	X		
Wood sorrel	<i>Rumex acetosa</i>	X	X	X
Bertalha	<i>Heartleaf bindweed</i>	X	X	X
Purslane	<i>Purslane</i>	X	X	X
Bamboo shoots	<i>Bambusa spp.</i>			X
Cambuquira	<i>Muskmelon</i>	X		
Capiçova	<i>Apteryx australis</i>			X
Nasturtium	<i>Tropaeolum majus</i>	X		
Air car	<i>Dioscorea bulbifera</i>			X
Ground yam	<i>Dioscorea alata</i>	X		X
Carqueja	<i>Baccharis trimera</i>		X	
Caruru	<i>Green amaranth</i>	X	X	X
Calla lily	<i>Zantedeschia aethiopica</i>	X		
Banana heart	<i>Musa spp.</i>	X	X	X
Dandelion	<i>Taraxacum officinale</i>		X	X
Physalis	<i>Physalis spp.</i>			X
Sweet potato leaf	<i>Ipomoea batatas</i>			
Chayote leaf	<i>Sechium edule</i>		X	
Muricato leaf	<i>Priva cordifolia</i>			
Potato leaves	<i>Solanum tuberosum</i>		X	X
Fennel	<i>Foeniculum vulgare</i>		X	
Sunflower	<i>Helianthus annuus</i>		X	
Chickpea	<i>Cicer arietinum</i>			
Hibiscus	<i>Hibiscus spp.</i>	X	X	X
Jambo	<i>Syzygium spp.</i>	X		
Swamp lily	<i>Hedychium coronarium</i>			X
Wild passion fruit	<i>Passiflora cincinnata</i>	X	X	
Ora-pro-nobis	<i>Pereskia aculeata</i>	X	X	X
Peixinho	<i>Stachys byzantina</i>	X	X	X
Picão	<i>Bidens pilosa</i>	X	X	
White rose	<i>Plumeria alba</i>	X	X	
Milk thistle	<i>Sonchus oleraceus</i>	X	X	X
Taioba	<i>Xanthosoma spp.</i>	X	X	X
Transagem	<i>Plantago spp.</i>	X		
Sorrel	<i>Hibiscus sabdariffa</i>		X	

Source: Prepared by the authors



Perceptions of school cooks about PANC

The survey conducted with school cooks in the city of Olaria-MG reveals perceptions and practices related to the use of PANC in two schools. In this municipality, all interviewees work in schools with vegetable gardens, with lengths of service ranging from 9 months to 15 years. The gardens have a considerable diversity of vegetables. One of the schools stands out for having greens, leaves, legumes, teas, and fruits. The other school has a variety of vegetables such as tomatoes, peppers, zucchini, kale, lettuce, chayote, and beets.

Of the three school cooks interviewed, only one reported the presence of PANC in the school garden and on the school menu. She highlighted the inclusion of various PANC in dishes such as salads and pies, and mentioned that students enjoy these preparations. The other two participants stated that they do not have PANC in the garden or on the school menu, but agreed with the inclusion of these plants in school meals.

The school cook who uses PANC knows their benefits, mentioning their various vitamins and reporting that students like dishes prepared with PANC. In contrast, the cooks at the other school are unaware of the benefits of PANC, indicating a need for greater awareness and education about the nutritional and sustainable advantages of these plants. None of the participants mentioned significant difficulties in using PANC, suggesting that, with adequate knowledge and support, the implementation of these plants can be carried out efficiently.

In the municipality of Lima Duarte-MG, participants have been working for periods ranging from 8 months to 16 years. Most schools (4 out of 6) have gardens with a significant diversity of vegetables, including kale, lettuce, taioba, zucchini, parsley, chives, jiló, tomatoes, spinach, carrots, broccoli, medicinal plants, chayote, pumpkin, chicory, spinach, peixinho, and cabbage. However, two schools do not have vegetable gardens.

Of the 12 participants, eight reported the existence of PANC in their school gardens, and six stated that they already use PANC in the school menu. The PANC mentioned include taro, peixinho, and other medicinal plants. Dishes prepared with PANC range from salads to sautéed leaves and omelets. Most participants (11 out of 12) agree with the inclusion of PANC in the school menu. They recognize several benefits of PANC, such as strengthening the immune system and providing vitamins, minerals, iron, proteins, and antioxidants. Only one participant did not explicitly mention the benefits of PANC.

All participants who use PANC report that students like the dishes prepared with these plants. None of the participants mentioned significant difficulties in using PANC, indicating that, with adequate knowledge and support, the implementation of these plants in school meals can be carried out efficiently.

As for the cooks in the municipality of Bom Jardim de Minas-MG, the participants have been working for between 8 and 30 years. Only two of the three schools have vegetable gardens, where various vegetables are grown: lettuce, kale, parsley, chives, carrots, onions, spinach, beets, and chicory. One school does not have a vegetable garden, indicating a limitation in its own food production.

Among the schools surveyed, only one reported having PANC in their garden, but none of the schools use PANC in their school menu. Despite this, all participants agree with the inclusion of PANC in the menu, recognizing the nutritional benefits of these plants, such as their richness in vitamins, minerals, and potential for health treatment, they point out.

Student acceptance is a concern mentioned by school cooks, but there is no concrete data on student taste preferences, as PANC are not yet used. The main difficulty pointed out is the lack of practical experience with these plants, reflected in the absence of dishes with PANC on school menus. Another point to be highlighted is that students may have difficulty adapting. Furthermore, with regard to cultivating PANC, many schools do



not have vegetable gardens, and the National School Feeding Program (PNAE) does not offer PANC to schools, which hinders the dissemination of PANC in schools.

In general, there is positive receptivity to the inclusion of PANC in school menus, although some schools do not yet use these plants. The high level of recognition of the nutritional and health benefits of PANC reflects a potential for expanding their use in school meals, provided there is adequate support and training to overcome the practical barriers identified.

Nutritionists' perceptions of PANC

The survey conducted with a nutritionist from the city of Olaria-MG reveals a positive perception of the importance of PANC in school meals, despite the lack of specific training on the subject. The nutritionist, who has been working at the school for three years, points out that the inclusion of PANC in the school menu can be promoted through playful activities and information about the benefits of these plants, in addition to encouraging students to grow them. She believes that the introduction of these plants can contribute significantly to the educational development of students, teaching them about agriculture, nutrition, and sustainability.

The careful presentation and preparation of food are seen as essential to improving the acceptance of PANC among students, considering their rich nutritional properties, including vitamins, minerals, fiber, proteins, and carbohydrates. The production of PANC at the school is supported by the nutritionist, who sees this practice not only as a source of fresh and healthy food, but also as an important educational tool. She suggests that the cultivation and management of school and home gardens can help familiarize students with these plants and encourage their consumption, promoting a more direct connection with the food they eat.

The nutritionist from Lima Duarte-MG, who has been working at the school for six months, participated in a mini-course on PANC and highlights the importance of including these plants in school meals to promote nutritional gains among students. She notes that PANC can be included in the menu in various ways, such as in pie fillings, soups, salads, and meats, especially for students already accustomed to these foods. The introduction of PANC is seen as an effective means of food education and is associated with school garden projects, which encourage the cultivation and consumption of these plants. The nutritionist believes that familiarization with the wide variety of PANC available contributes positively to the educational development of students, improving school performance and increasing knowledge about the importance of these plants in the diet.

The production of PANC at school is considered essential by the nutritionist, who sees this practice as a valuable tool for food and nutrition education. PANC are valued for their nutritional properties, including vitamins, minerals, fiber, carbohydrates, and lipids, which can be served appropriately as salads or cooked. She emphasizes that care in the presentation and preparation of food is crucial to increase the acceptance of these plants among students. The inclusion of PANC in the school menu, in addition to enriching the diet with essential nutrients, promotes more conscious and sustainable eating, encouraging students to value food diversity and adopt healthy eating habits from an early age.

The nutritionist from Bom Jardim de Minas-MG, with 17 years of experience in schools, has no specific training in PANC, but recognizes the importance of including these plants in the school menu to increase the nutritional value of school meals. She suggests that PANC can be included in various preparations, such as sauces, salads, and meats, to diversify students' diets. In addition, the introduction of these plants is in line with environmental education, providing an opportunity to teach students about sustainability and the importance of healthy eating. Although she does not have in-depth knowledge about PANC, the nutritionist believes that the inclusion of these plants can enrich students' diets with vitamins, minerals, fiber, and protein.



However, the production of PANC at the school faces limitations due to the availability of labor, which makes it difficult to cultivate and manage these plants. The nutritionist sees the potential of PANC to contribute to the educational development of students, but points out that the lack of adequate human resources may restrict this initiative. The introduction of PANC into the school menu can not only improve students' nutrition, but also promote environmental and food awareness, encouraging sustainable and healthy practices from an early age. To maximize the benefits of PANC, it would be necessary to invest in training and infrastructure, ensuring that schools can grow and use these plants efficiently and educationally.

Perceptions of restaurant owners in Olaria, Lima Duarte, and Bom Jardim de Minas about PANC

A survey on the perceptions of three restaurant owners in Olaria-MG about PANC revealed that two of the three interviewees are familiar with PANC. However, none of them currently use these plants on their restaurant menus. This may indicate a barrier to the adoption of PANC, even among those who are knowledgeable about the topic.

Among those interviewed, only one reported that her customers seek out PANC, such as chicken dishes with ora-pro-nobis, azedinha salad, and taioba with angu, for example. This suggests that the demand for these plants may be limited or unknown to many consumers. This data may indicate that awareness and promotion of PANC still need to be intensified to generate greater public interest.

Regarding the intention to include PANC on the menu, there is a division. Two of the three interviewees intend to include these plants in the future. One of them, who is already familiar with PANC and recognizes customer demand, plans to use ora-pro-nobis with chicken. The other, who was initially unfamiliar with PANC, shows interest in incorporating taioba, yams, and ora-pro-nobis into her dishes. This demonstrates a growing potential for the acceptance and use of PANC as more information and positive experiences are disseminated. However, one of the interviewees has no plans to introduce PANC to the menu. This attitude may reflect concerns related to customer acceptance, additional costs, or the adaptation of recipes and suppliers.

In the municipality of Lima Duarte, most participants (10 out of 12) are familiar with PANC, which demonstrates widespread awareness of them. Among those who are familiar with them, half already use PANC in their restaurant menus, indicating a relatively high adoption of these plants among owners. The most commonly mentioned PANC include peixinho, taioba, ora-pro-nobis, serralha, azedinha, salva, and capuchinha. Six participants reported that their customers seek out PANC, suggesting that there is a growing demand for these foods in the municipality. This perceived demand may positively influence owners' decisions to incorporate or expand the use of PANC in their menus.

Most respondents (8 out of 12) expressed an intention to include PANC on their menus, including those who already use some of these plants. The PANC they intend to use in the future include purslane, purslane, peixinho, sage, taioba, and sorrel, among others. This interest demonstrates significant potential for increasing the diversity of PANC on the menus of restaurants in Lima Duarte. Although overall interest is high, some participants do not intend to use PANC in the future. The reasons may vary, including perceived lack of demand, limited familiarity with PANC, or perceived logistical and supply difficulties.

In the city of Bom Jardim de Minas, of the six participants, three are familiar with PANC and three are not. Among those who are familiar with them, two already use PANC in their menus, while the third, , has not yet incorporated them, despite being familiar with them. The PANC used include azedinha, ora-pro-nóbis, and peixinho. It is important to note that none of the participants who use PANC mentioned that their customers specifically seek out these plants. This suggests that, in the context of Bom Jardim de Minas, customer demand for PANC may be low or not yet perceived by restaurant owners.



Half of the participants (3 out of 6) expressed their intention to include PANC on the menu in the future. These participants are interested in using purslane, bertalha, ora-pro-nóbis, peixinho, and sorrel. This willingness indicates potential for growth in the use of PANC, especially among those who already have some knowledge or experience with these plants.

Conversely, the other half of the participants do not intend to use PANC in the future, including those who are currently unfamiliar with or do not use these plants. The reasons for their lack of interest are not specified, but may include a perceived lack of demand, unfamiliarity with the benefits of PANC, or logistical challenges related to incorporating these plants into menus.

PANC and prospects for the Serra Negra da Mantiqueira region

Analysis of the data collected reveals a comprehensive overview of the knowledge, use, acceptance, nutritional benefits, and obstacles related to PANC in the communities studied. Regarding knowledge about PANC, participants showed considerable interest in these plants, reflected in the frequent use of the term "PANC" in their responses. This interest suggests a growing awareness of the importance of PANC as valuable food resources and highlights a movement toward diversification of food options.

In addition, the discussion on the nutritional benefits of PANC is widely addressed. Participants recognize the potential health benefits associated with consuming these plants, as evidenced by frequent mentions of "benefits," "nutritional," "vitamins," "minerals," and "nutrients." This awareness highlights the role of PANC in promoting a balanced and nutritious diet.

However, despite the interest and recognition of the advantages of PANC, the data also reveal significant obstacles and challenges. The words "challenges," "knowledge," "preparation," "acceptance," and "availability" reflect common concerns faced by participants, such as lack of knowledge about PANC, difficulty in preparation, and limited availability of these plants. These challenges highlight the need for comprehensive approaches and effective policies to overcome barriers to the adoption of PANC in everyday and school meals.

Based on the data collected and the objective of promoting tourist gastronomy through PANC, a promising scenario can be observed in the municipalities studied. Most respondents demonstrate significant knowledge about PANC, which is crucial for their integration into local cuisine, as pointed out by Ferreira et al. (2024), who highlighted the importance of awareness in valuing these plants in cooking and nutrition. However, despite this knowledge, the effective use of PANC in local gastronomy is still limited, suggesting the need to develop innovative recipes that highlight their culinary characteristics, as indicated by Watson and Preedy (2016).

The development of new gastronomic approaches is crucial to explore the nutritional and gastronomic potential of PANC. The data also show moderate interest on the part of customers in PANC, as well as considerable willingness on the part of establishments to include them in their menus. This alignment with consumer demand and chef interest is fundamental, as highlighted by Bezerra et al. (2018), driving the inclusion of unconventional ingredients in gastronomy.

Furthermore, as Santos et al. (2018) highlight in their study on the importance of food education in schools, "the inclusion of foods such as PANC in the school diet can be an effective strategy to promote healthy and sustainable eating habits among students." This quote highlights the relevance of the graph's results not only for understanding the local context but also for formulating more inclusive and healthy food policies in schools and communities.

The introduction of Unconventional Food Plants (PANC) into the daily diet can promote both food diversification and the appreciation of local biodiversity. It is also important to implement strategies in schools that reduce food neophobia, facilitating the inclusion of PANC in meals and thus contributing to healthier,



more sustainable eating habits, which in turn will strengthen and develop family farming (Ferreira et al. 2024; Torres 2020).

Final Considerations

The research reveals that, although there are variations between municipalities, all demonstrate a considerable level of knowledge, presence, and acceptance of PANC both at home and at school. These data indicate an interest and willingness on the part of communities to promote the consumption and cultivation of these plants, highlighting the importance of more inclusive and healthy food policies in schools and communities.

As for restaurants, diversifying menus with PANC can bring benefits to both restaurant owners and consumers, promoting a more sustainable and nutrient-rich diet. In addition, increasing the supply of PANC can encourage local production of these plants, strengthening the regional economy and environmental sustainability.

Furthermore, to increase the adoption of PANC by restaurant owners and schools that do not yet have or use PANC in general in the three municipalities studied, it may be necessary to implement awareness and education strategies for both restaurant owners and consumers.

These strategies may include *workshops*, *marketing* campaigns, and partnerships with local PANC producers. In addition, the inclusion of PANC on menus can offer a competitive advantage to restaurants, differentiating them in the market and attracting consumers interested in more diverse and sustainable food options.

References

- ATLAS.ti. 2022. "ATLAS.ti | The Qualitative Data Analysis & Research Software." Windows. Nova Scotia-CA: Scientific Software Development GmbH. <https://atlasti.com/pt>.
- Bezerra, Cinthia, Vanessa Penha, Daniele Moura, and Igor Pompeu. 2018. "You are what you eat." *Observatorio de la Economía Latinoamericana*, no. March. <https://www.eumed.net/rev/oel/2018/03/analise-perfil-consumidor.html>.
- Brazil. 2012. *Resolution No 466, of December 12, 2012*. Brasília-DF. <https://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf>.
- . 2016. *Resolution No. 510, dated April 7, 2016*. Brasília-DF. <https://conselho.saude.gov.br/resolucoes/2016/Reso510.pdf>.
- Brito, Tayrine Parreira, Luiz Carlos Dias Da Rocha, Aloísia Rodrigues Hirata, Rogério Robs Fanti Raimundo, and Livia Oliveira Galvão. 2020. "valorização da sociobiodiversidade na alimentação escolar" [valuing socio-biodiversity in school meals]. *Food and Nutritional Security* 27 (December):e020030. <https://doi.org/10.20396/san.v27i0.8659632>.
- Ferreira, Renata De Souza, Juliana Rodrigues De Souza Cruz, Elisa De Paula Reis Lima, Valéria Paula Rodrigues Minim, and Márcia Cristina Teixeira Ribeiro Vidigal. 2024. "Can food neophobia affect the consumption of foods enriched with unconventional edible plants (PANC) by elementary school students?" *Revista Ponto de Vista* 13 (1): 01–14. <https://doi.org/10.47328/rpv.v13i1.17493>.



Garcia, Ramon De Marchi, Luis Eduardo Pontes Stefanelli, João Lucas Sauer, Lucas Campos Ferreira, Tarcísio Marcos Macedo Mota Filho, and Eduardo dos Santos Rossi. 2020. "The importance of PANC in nutrition." In *IX JORNACITEC - Scientific and Technological Conference*, 1–6. Botucatu-SP: Fatec Botucatu. <http://www.jornacitec.fatecbt.edu.br/index.php/IXJTC/IXJTC/paper/view/2228>.

GIL, A. C. 2019. *Social research methods and techniques*. 7thed. São Paulo, SP: Atlas.

IBGE. 2023a. "IBGE | Cities@ | Minas Gerais | Bom Jardim de Minas | Overview." Brazilian Institute of Geography and Statistics. 2023. <https://cidades.ibge.gov.br/brasil/mg/bom-jardim-de-minas/panorama>.

———. 2023b. "IBGE | Cities | Minas Gerais | Lima Duarte | Overview." Brazilian Institute of Geography and Statistics. 2023. <https://cidades.ibge.gov.br/brasil/mg/lima-duarte/panorama>.

———. 2023c. "IBGE | Cities | Minas Gerais | Olaria | Overview." Brazilian Institute of Geography and Statistics. 2023. <https://cidades.ibge.gov.br/brasil/mg/olaria/panorama>.

Julião, N. R. 2021. "Food and Nutritional Security in the Municipality of Belo Horizonte, Minas Gerais: Perspectives and Challenges." Dissertation (Master's Degree in Sustainability and Environmental Technology), Bambuí, MG: Federal Institute of Education, Science, and Technology.

Kinupp, Valdely Ferreira, and Harri Lorenzi. 2021. *Unconventional Food Plants (PANC) in Brazil*. 2nd ed. Nova Odessa, SP, Brazil: Plantarum.

Kristjansson, E. A., V. Robinson, M. Petticrew, B. MacDonald, J. Krasevec, L. Janzen, T. Greenhalgh, et al. 2007. "School Feeding for Improving the Physical and Psychosocial Health of Disadvantaged Elementary School Children." *The Cochrane Database of Systematic Reviews*, no. 1 (January), CD004676. <https://doi.org/10.1002/14651858.CD004676.pub2>.

Lavandoski, Joice. 2018. *Food and tourism: creativity, experience, cultural heritage*. João Pessoa, PB: CCTA Publishing House.

Pereira, Joyce Kimarce do Carmo, Nayane Suelen Maia, and Thalita Regina de Souza Brito. 2020. "Gastronomy as a strategy for promoting tourism in Minas Gerais." *RITUR - Revista Iberoamericana de Turismo* 10 (1): 68–84. <https://www.seer.ufal.br/index.php/ritur/article/view/9422>.

Richardson, R. J. 2017. *Social research: methods and techniques*. São Paulo: Atlas. https://edisciplinas.usp.br/pluginfile.php/3034822/mod_resource/content/1/Texto%20-%20Pesquisa%20social.pdf.

Santos, A. B., and A. B. L. S. Moreira. 2020. "Panc at school: a proposal for a school menu." In *Proceedings*. Campina Grande, PB: Realize Editora. <https://editorarealize.com.br/artigo/visualizar/69243>.

Santos, Beatriz, Clara Silva, and Elisabete Pinto. 2018. "The importance of school in food education for children in the first cycle of basic education – how to be more effective." *Acta Portuguesa de Nutrição* 2018, 14, 18–23 14 (November):18–23. <https://doi.org/10.21011/apn.2018.1404>.



Silva, Beatriz Mendez, and Cristiano Silva Buss. 2019. "Prior Organizers for Teaching Physics: an application for the study of Mechanical Waves." *Revista Educar Mais* 3 (1): 3–14. <https://doi.org/10.15536/reducarmais.3.2019.3-14.1375>.

Torres, Catarina Domingues Saleiro. 2020. "Analysis of the sustainability of school meals: application of the EATS tool to a menu plan for the municipality of Esposende." Dissertation (Master's in Nutrition and Food), Porto, Portugal: University of Porto.

Trivinos, Augusto Nivaldo Silva. 1987. *Introduction to Social Science Research: Qualitative Research in Education*. 1st edition. São Paulo-SP: Atlas.

Watson, Ronald Ross, and Victor R. Preedy. 2016. *Fruits, Vegetables, and Herbs: Bioactive Foods in Health Promotion*. Academic Press.