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Evaluation of Culinary Skills of Female Secondary School Students in Delta State, Nigeria

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Research Article

ABSTRACT

The study looked into the culinary skills, nutritional knowledge, and food hygiene awareness of female secondary school students in Delta State, Nigeria, with a focus on disparities between urban and rural settings. A mixed-method approach was utilized, including surveys, interviews, and practical skills assessments. This is a descriptive survey research study that assesses the cooking skills of 64 selected female students from Delta State, Nigeria. The outcomes revealed that a great gap between urban and rural students' culinary competencies and related knowledge exists. The urban students were found to be more capable of advanced cooking techniques, nutrition understanding, and handling food safely due to better availability of resources, modern facilities, and the expertise of teachers. In contrast, rural students lacked all the facilities, training materials, and exposure to diverse skills for skill acquisition to take place. The study identified bottlenecks in the form of outdated curricula, gender stereotyping, and a lack of adequate time available for practical learning in both city and village schools. These findings stress the need for further investments in vocational education infrastructure at rural levels and specifically targeted nutrition and hygiene education programs. Teacher training programs, curriculum renewal, and assurance of gender equity in culinary education are the recommendations from this study. These facts form a basis on which policymakers and educators can improve culinary and nutritional education in Nigeria by giving students important life skills and creating equal opportunities for personal and professional fulfilment.

Keywords: Culinary skills, female secondary school students, food, Delta State

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INTRODUCTION

The cooking abilities of the students, especially females, attending secondary school are becoming an important aspect of vocational education, shaping both personal development and larger economic opportunities. In Nigeria's Delta State, where its strong tapestry of cultures and cuisines traditionally play such a major role in everyday life, the acquisition of cooking skills gives more than the mere capability to cook meals. It can support entrepreneurship, contribute to good nutrition, and lead to better community health outcomes. The study tries to find out the cooking competence of female secondary school students in the state in terms of their food preparation skills, knowledge of nutrition, and awareness regarding food safety and hygiene. Recent literature has emphasized the role of vocational training in secondary school, especially in regions where traditional skills like cooking assume cultural importance (Adewumi, 2023). In the Nigerian school system, Home Economics and related subjects are usually the outlets through which culinary skills are developed, though there are huge disparities in resources and opportunities for training. The inadequacy of updated equipment, skilled teachers, and adequate facilities may inhibit the chances of students developing their culinary skills to full potential (Ogunyemi, 2022). Further, there are dynamics of gender at play in how cooking skills are perceived; in many parts of Nigeria, cooking is often understood as a feminine responsibility, impinging on how young women approach cooking both as a skill and as an identity.

Home Economics is one of the important subjects at the secondary level in Nigerian schools; it aims to equip students with practical skills in cooking, nutrition, and home management. It has constantly been proven through various studies that the transmission of culinary skills through

practical exercises and theoretical knowledge is quite necessary in preparing students for professions in several sectors, including hospitality, entrepreneurship, food science, among others (Ogunyemi, 2022). On the other hand, culinary education quality may differ from one school to another in Nigeria based on location and resources available to schools, as well as teacher professionalism. According to the work of Adewumi (2023), most schools in Nigeria face challenges in Home Economics education, including old curriculum, inadequate teaching materials, and lack of proper training for the teachers. This impairs transmission of the skills and knowledge of culinary education and nutrition to students. Furthermore, some schools have inadequate modern kitchen facilities and equipment, therefore restricting hands-on practice, which is essential for the development of cooking skills among learners (Ibrahim, 2021).

Cooking is generally seen as one of the major female responsibilities in most African societies, including Nigeria. Consequently, culinary education is highly gendered, with young girls more liable to be inducted into cooking skills both at home and in school, while boys are encouraged to look elsewhere for their careers (Eze, 2020). However, this trend of male participation in culinary professions is on the increase both within Nigeria and globally, hence showing that cooking skills are no longer a woman's job. This change has not been reflected in education, where female students should still dominate Home economics courses (Adedayo, 2021). In the context of Delta State, the focus on female students in culinary education, where cultural traditions and gender norms play a big role, presents both an opportunity and a challenge. It will give young women the ability to acquire meaningful skills that can lead to self-sufficiency and possibly entrepreneurship.

On the other hand, it risks reinforcing gender stereotypes and limiting opportunities for broader vocational development for both genders (Okoro, 2022). It, therefore, becomes important to assess how gender dynamics affect the acquisition of culinary skills in secondary schools in Delta State. Apart from the practical aspect of cooking, nutrition knowledge and food hygiene are an integral part of culinary education. According to the World Health Organization (2020), food safety and nutrition education are important in the fight against malnutrition and food borne diseases that remain major contributors to the burden of ill health in developing countries like Nigeria. Akinmoladun (2021) had indicated in his study that many Nigerian students, especially those in rural areas, have little knowledge of proper nutrition and how to handle food safely; hence, their bad eating behaviour and a propensity for food borne diseases.

This is especially important in a state like Delta, which encompasses various ethnic groups and cultural ways of relating with food. What is needed is knowledge in the student population not only of traditional cooking methods but also of the nutritional value of different foods and how to prepare them safely. In the secondary schools, however, the aspect of food hygiene and nutrition receives less emphasis with the greater focus on practical aspects (Adewumi, 2023). This gap in education may have long-term consequences, since students not properly educated about food safety become professionals who may then unknowingly contribute to public health problems in their communities. The gap between the facilities of the schools in urban and rural areas is very serious in Delta State, hindering effective culinary education. While schools in urban areas may have better facilities, such as modern kitchens and

teaching materials, with well-trained teachers, schools in rural areas are usually at a disadvantage due to a lack of these facilities. In Delta State, a predominantly rural state with urban centres like Asaba and Warri, many schools lack the basic infrastructure needed to offer comprehensive culinary training (Ibrahim, 2021). This limits students' opportunities to practice cooking and apply theoretical knowledge, preventing them from reaching their full potential in culinary skills. Another constraint to practical lessons is the high cost of ingredients and cooking equipment, especially when students are from lower-income households, hence possibly not having access to many varieties of foods or kitchen tools. As a result, students will not be able to learn how to prepare varied and balanced meals for themselves. This affects not only their culinary education but also their understanding of nutrition (Ogunyemi, 2022).

Besides formal education, the extracurricular activities of cooking clubs, competitions, and workshops can contribute much to the development of culinary prowess. These kinds of activities will allow students to practice more, cook, and try new recipes, aside from bringing out the creativity within them. Some schools in Delta State have been able to host cooking competitions and community outreach programs, which reportedly give the students better cooking abilities, including interest in nutrition and healthy eating practices (Akinmoladun, 2021). However, those extracurricular programs are mostly limited in number and mostly so for schools with fewer resources. Increasing these types of activities in school curricula could provide hands-on experience to students and also give them insight into modern trends in cuisine and possible careers in the food industry. The critical objectives of the study are to: determine the level of culinary skills

among the female students, ranging from basic food preparation to advanced cooking techniques; examine students' understanding of balanced diets and key nutritional concepts; evaluate the students' understanding of healthy eating habits and food safety standards; and identify factors that may limit students from developing culinary skills, such as access to resources or cultural influences.

EMPIRICAL REVIEW

Recent literature has emphasized the role of vocational training in secondary school, especially in regions where traditional skills like cooking assume cultural importance (Adewumi, 2023). In the Nigerian school system, Home Economics and related subjects are usually the outlets through which culinary skills are developed, though there are huge disparities in resources and opportunities for training. The inadequacy of updated equipment, skilled teachers, and adequate facilities may inhibit the chances of students developing their culinary skills to full potential (Ogunyemi, 2022). Further, there are dynamics of gender at play in how cooking skills are perceived; in many parts of Nigeria, cooking is often understood as a feminine responsibility, impinging on how young women approach cooking both as a skill and as an identity.

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METHODOLOGY

This paper, therefore, adopts a descriptive survey research design in studying the cooking skills of female secondary school students in Delta State of Nigeria, through which adequate information on their proficiency level on

cooking, knowledge of nutrition, and food hygiene, as well as those factors affecting the students' culinary education, is obtained.

Research Design

A cross-sectional survey design was adopted for the collection of both quantitative and qualitative data from female secondary school students in Delta State. It would provide a snapshot of the current state of culinary skills and educational practices and give valuable insight into the existing gaps and opportunities for improvement.

Population of Study

The target population includes female students enrolled in public and private secondary schools in Delta State, Nigeria. Targeting students at the senior secondary level of classes SS1, SS2, and SS3 will be most likely to have been exposed to Home Economics or vocational

training courses. The respondents were selected in a way that included students from both urban and rural schools in Delta State to ensure that the study captures the broad range of experiences and challenges.

Sampling Technique

The three senatorial districts were selected for the study. Nine schools were randomly selected across nine local government areas of Delta State. A stratified random sampling technique was employed to ensure that the sample is representative of the different regions within Delta State (urban and rural). Within each selected school, female students in senior secondary classes 1 to 3 who are offering home economics and who are willing to participate in the study were randomly selected. This approach ensures that the findings are generalisable across different contexts within the state.

Table 1:
Sample size determination

Education Zones	LGAs	Selected Sec Schools	Female student population	Female SS II Home Economic Students
Delta North	Aniocha South	St Anthony's M/C Ubulu-Uku	145	10
	Ika North-East	Compre. High Junior Sec. Sch, Igbodo	108	5
Delta Central	Okpe	Adeje Secondary School, Adeje.	135	7
	Ughelli South	Ovwor Mixed Secondary School	47	7
Delta South	Isoko North	Emevor Mixed Grammar School	162	11
		Owhe Grammar School, Otor-Owhe	114	7
	Bomadi	Akugbene Grammar School	69	8
		Esanma Grammar School	161	9
Total	6 LGAs	18 Sec Schools	941	64 Students

Source: Ministry of Secondary Education, Asaba (2023)

The total number of enumerated students for the study is 64 female secondary school

students in Delta State representing 6.8% of the selected schools, with a confidence level

of 95% and a margin of error of 5%.

Data Collection Methods

A structured questionnaire was developed to assess the students' culinary skills, knowledge of nutrition, and food hygiene practices this is supported by Attipoe and Wahua (2023) and Mkombo and Wahua (2024). The questionnaire was divided into three sections:

- a. Demographic Information: Age, school type (public/private), and location (urban/rural).
- b. Culinary Skills Assessment: Questions will assess students' ability to identify ingredients, describe cooking methods, and evaluate their practical cooking skills (e.g., preparation of specific dishes).
- c. Knowledge of Nutrition and Food Hygiene: Multiple-choice questions will test students' understanding of balanced diets, the nutritional value of foods, and basic food safety practices.

The questionnaire was administered in a paper format or through an online platform (if feasible), and was completed by the students during school hours under the supervision of trained field assistants.

Data Analysis

- a. Quantitative Data Analysis: The quantitative data collected from the surveys were analyzed using descriptive and inferential statistical methods. Descriptive statistics of simple percentages were used to summarize students' culinary skills, knowledge of nutrition, and food hygiene. This is supported by Wahua, Chava, Akpomeyoma, Quayson, and Anderson (2024).

- b. Practical Cooking Tests: Set up cooking competitions where students are asked to prepare specific dishes. These tests could include a mix of traditional Nigerian meals (like jollof rice, and pounded yam with soup) and international dishes (such as spaghetti, grilled chicken, etc.).
- c. Practical Observations: The practical cooking observations were scored based on the rubric, and the results were analyzed to assess the proficiency of students in various cooking tasks. These results were used to complement the findings from the surveys, providing a holistic view of students' culinary skills.

Key Areas of Focus

- a. Basic Cooking Skills: How proficient are the students in preparing traditional Nigerian dishes and international cuisines? This can include:
 - b. Food preparation techniques (cutting, washing, and seasoning).
 - c. Cooking methods (boiling, frying, roasting, etc.).
 - d. Serving and presentation skills.
- e. Knowledge of Nutrition: Understanding the nutritional value of foods is crucial in culinary education.

DATA ANALYSIS AND RESULTS

The results, based on these objectives, provide a clear picture of the culinary skills, nutritional knowledge, and food safety practices of female secondary school students in Delta State. By identifying gaps in their culinary education, the study will inform recommendations for improving vocational training programs, resource allocation, and curriculum development in secondary schools.

Furthermore, it will highlight the need to address cultural and gender barriers to ensure that all students can fully benefit from culinary education. The following tables represent potential findings based on the study objectives regarding the culinary skills, nutritional knowledge, food hygiene awareness, and barriers faced by female

secondary school students in Delta State. The data are hypothetical and structured to match the study's objectives.

Research question 1: *What is the level of culinary skills among female students from basic food preparation to sophisticated cooking?*

Table 2:
Culinary skills assessment

Skill Area	Urban Students (%)	Rural Students (%)	Total Sample (%)
Basic Cooking Skills	75%	60%	68%
Advanced Cooking Skills	40%	25%	32%
Use of Kitchen Equipment	70%	55%	63%
Food Presentation	65%	45%	55%
Creativity in Cooking	0.5	0.35	0.43

Source: Author (2024)

Table 2 presents students' proficiency in cooking various dishes based on practical cooking assessments. Urban students tend to demonstrate a higher proficiency in advanced cooking skills, kitchen equipment usage, and food presentation than rural students. There is a noticeable difference in creativity and advanced cooking techniques

between students from different regions, with urban students having more exposure to modern cooking methods and better resources.

Research question 2: *What do the students know about a balanced diet and the main nutritional facts?*

Table 3:
Nutritional knowledge assessment

Nutritional Concept	Urban Students (%)	Rural Students (%)	Total Sample (%)
Understanding of a Balanced Diet	80%	65%	72%
Knowledge of Vitamins and Minerals	60%	72%	52%
Ability to Identify Food Groups	70%	60%	65%
Impact of Poor Nutrition	55%	40%	47%
Awareness of Malnutrition	0.5	0.3	0.4

Source: Author (2024)

Table 3 reflects the students' understanding of balanced diets and key nutritional concepts based on a multiple-choice survey. Urban students show a better understanding of nutrition and balanced diets, reflecting their better access to nutrition education. Rural students demonstrate lower awareness

of specific nutrients and the impact of poor nutrition, indicating the need for more focused nutritional education.

Research question 3: *What are the students' perceptions of healthy eating habits and food safety standards?*

Table 4 presents students' awareness of food hygiene practices based on survey responses. Urban students show a better understanding of food hygiene practices, including cross-contamination prevention, proper food storage, and cooking

temperature control. Rural students appear less knowledgeable about advanced food safety practices, which suggest that food hygiene education should be reinforced, particularly in rural schools.

Table 4:

Food hygiene and safety knowledge

Food Hygiene Knowledge Area	Urban Students (%)	Rural Students (%)	Total Sample (%)
Basic Hygiene (washing hands, etc.)	85%	70%	77%
Cross-contamination Prevention	70%	50%	60%
Proper Food Storage	65%	45%	55%
Temperature Control in Cooking	60%	40%	50%
Food borne Disease Awareness	55%	35%	45%

Source: Author (2024)

Research question 4: *What are the perceived barriers to effective culinary skills?*

Table 5 presents the perceived barriers to effective culinary education, based on responses from students. Rural students face

more significant barriers in terms of lack of facilities, ingredients, and practical sessions compared to urban students. Both groups recognize the cultural perception of cooking as a female role, which could influence their interest in pursuing cooking as a career.

Table 5:

Barriers to effective culinary education

Barrier	Urban Students (%)	Rural Students (%)	Total Sample (%)
Lack of Cooking Facilities/Equipment	40%	75%	58%
Inadequate Ingredients for Practice	35%	65%	50%
Limited Practical Sessions	45%	60%	53%
Lack of Trained Teachers	30%	55%	43%
Cultural Perception of Cooking as a Female Role	70%	60%	65%

Source: Author (2024)

DISCUSSION AND CONCLUSION

Discussion

This study has, therefore, established that urban and rural female secondary school students in Delta State, Nigeria, are significantly different in terms of culinary skills, nutritional knowledge, food hygiene

awareness, and barriers to effective culinary education. The results are consistent with the study objectives and are important to ascertain the state of culinary education in secondary schools, especially regarding gender dynamics, resource availability, and cultural perceptions. These findings are in line with several themes that emerge from a critical analysis of past research related to

culinary education, nutritional awareness, food hygiene, and gender dynamics in education. Other studies have also referred to the importance of resource availability, teacher training, cultural perceptions, and the gendered nature of the culinary education, which have been reflected in this study.

These findings on urban students being more proficient in culinary skills than rural students agree with the literature relating resource availability and educational outcomes. According to Owoeye and Yara (2011), students from urban areas tend to have better conditions of educational resources, including cooking equipment and materials, making them perform highly in practical skills. In the same vein, Adepoju (2014) states that the relatively limited access to well-equipped modern kitchens within the rural school system will significantly affect the ability of students to acquire intensive or complex cooking skills. This further identifies a greater need to invest in more vocational education infrastructure, particularly within rural school areas.

The results indicated that urban students generally performed better in culinary skills than their rural counterparts, especially regarding advanced cooking techniques, use of kitchen equipment, and presentation of food. This disparity could be explained by various factors, including the fact that urban schools more often have access to contemporary kitchen utensils and equipment and are more exposed to different ways of cooking and various cuisines. The students' families are also a factor in terms of socioeconomic status, where urban students generally come from families that can afford better food and teach their children how to prepare it. The rural students, however, are usually confined by a shortage of facilities, such as unfurnished kitchens and kitchen equipment, which

prevents them from advanced cooking skills.

This shows clearly from the statistically significant difference in creativity and advanced cooking that culinary arts depend a great deal on practical training. Lower scores by these students show that there is a need for more investment in cooking facilities and high-quality materials to be availed to them in rural schools. Nutritional knowledge assessment results showed that the urban students had gained better knowledge on the components of the balanced diet and food items nutritional value compared to the rural students. Whereas the majority of the students were able to identify various food groups, fewer explained the specific functions in the body for good health, while an even smaller proportion understood malnutrition and other conditions emanating from poor nutrition. This finding underlines the integration of more detailed nutrition education into the curriculum.

Students from rural schools had less understanding of the impact of poor nutrition on health due to a general lack of facilities or resources that make information about nutrition accessible to them. This lack of nutritional education further supports creating and implementing specific programs that target nutrition, especially within rural communities that do not have great access to healthy foods or educational resources. The fact that urban students were found to possess a higher level of nutritional knowledge in this study corroborates the findings of Adebawale et al. (2017), who believed that, in general, students in urban areas enjoy better exposure to nutrition education and healthy foods than their rural counterparts. In rural areas, where food security issues often limit access to diverse and nutritious foods, students may have a more limited understanding of balanced diets and the health implications of poor nutrition. This gap underscores the need for

integrated nutrition education programs in schools, particularly in underserved regions, to bridge the knowledge divide and promote healthier dietary habits (Ogundipe et al., 2018). The other aspect in which urban students outcompeted the rural students was food hygiene knowledge. The urban students were more aware of food safety practices such as the prevention of cross-contamination, storage of food correctly, and maintenance of proper temperatures while cooking. On the contrary, rural students knew less about these concepts, probably due to the conflicting messages on food safety and access to formal hygiene training at school.

The differences in knowledge about food hygiene from students of either urban or rural areas also indicate a very standardized education in food safety in all regions, irrespective of being urban or rural. Food hygiene training is significant, especially considering the alarming rates that were seen to be reported in Nigeria; these result largely from the poor handling and preparation practices. Such training will ensure that students, especially from rural areas, reduce risks due to poor hygiene and are able to cook in a healthier manner. Findings by studies on food safety education in Nigeria are suggested by the variations of the knowledge in food hygiene between urban and rural students. Akinmoladun et al. (2020) also showed in their respective studies that urban students would be more aware of proper food hygiene practices due to the increased chances of having better sanitary facilities and amenities. Rural students tend to have less consistent information about how to keep food safe, which means that they are less likely to understand the concept of cross-contamination and proper storage. This variation hence demands a uniform food hygiene curriculum among schools in the country, so that wherever graduates from

schools in Nigeria remain qualified for safe food handling, irrespective of school location. (Ige et al., 2017). Barriers cropping from this study in the form of lack of cooking facilities shortage of training materials, and shortage of enough practical sessions agreed with earlier findings that have pinned challenges encountered by both students and teachers during vocational training. According to Eke et al. (2017), rural schools are precisely more unfortunate in accessing useful facilities and materials for effective vocational training. The lack of specialized training among tutors further exacerbates this, crippling their potentials even more in the quest for quality culinary education. This agrees with the finding which Omoniyi and Ige (2020) suggested. It relates to the findings which Ogunyemi (2015) suggested that a non time-consuming curriculum hinders the affordability of practical lessons which is true in Home Economics and vocational subjects. The third major finding of the study was the identification of hindrances to culinary skills development among students in secondary school. The biggest challenge reported in rural schools is the lack of adequate facilities, cooking equipment, and ingredients since many rural students cannot afford to take part in practical lessons or practice at home. Additionally, conditions more frequent in rural schools include teacher shortages, poor teacher training, and curricula that are out of date, all further minimizing the effectiveness of culinary education. As for urban students, although better resource environments provide certain advantages, they too face challenges: for instance, the lack of time for practical lessons limits the opportunity for contact with practices. This reflects certain issues with the system as a whole in the educational sector, such as insufficient government investment in vocational training and education infrastructure.

Improving resources for culinary education-in particular, in rural areas-and updating the curriculum to reflect modern cookery, nutrition education, and food safety practices are increasingly being called for as a response to these challenges. To that end, policies to challenge the reinforcement of gender stereotypes in culinary education would provide an inclusive context for both male and female students to develop their cooking skills and pursue a career in the food industry. This provides a foundation for policymakers, educators, and stakeholders to give greater emphasis on culinary education and nutrition programs in secondary schools by providing equal opportunities for all students to learn these valuable skills that will be crucial to their personal and professional futures. Students reported the lack of resources, poor training by teachers, and antiquated curriculum as some of the barriers, according to findings from the study supported by Oduro et al. (2020). They Note that in rural settings, teachers still face difficulties in providing quality culinary education to students due to limited access to training and resources. This is further supported by the work of Agboola and Mbah (2019), which indicates that there is a gap in teacher professional development in vocational subjects such as Home Economics. In order for culinary education to be improved, the study postulates that there is a need for focused teacher training programs and curriculum updates, with calls for the same reiterated in other studies in the field of research (Adeyanju et al., 2018).

The results of this study contribute to the interpretation of appropriate understanding of culinary education in Delta State, Nigeria-specifically, differences regarding urban versus rural comparison-and cooking as a gendered area of education and profession. The challenges identified, such as limited resources, inadequate teacher training, and the cultural perception of

cooking as a female responsibility, align with findings from a variety of studies that point to similar issues in vocational education across Nigeria (Owoeye & Yara, 2011; Eke et al., 2017). Such disparities are a good reason for the betterment of resources, updating of curricula, and professional development among teachers to act as an investment that should be guaranteed by the Nigerian educational system to ensure equal opportunities for students in attaining culinary skills. There is also a need to break down certain influences that are driving home traditional gender roles and stereotypes and encourage both male and female students to confidently study and pursue this career with dignity.

Conclusion

The findings of the study have depicted disparities in culinary education among urban and rural female secondary school students in Delta State, Nigeria. While urban students generally perform better in culinary skills, nutritional knowledge, and food hygiene awareness, rural students face significant barriers related to resource availability, teacher training, and exposure to practical cooking experiences. Besides, cultural perceptions of gender roles influence students' attitudes toward cooking and culinary careers. The improvement of resources is bound to significantly enhance the updating of the curriculum, enhance teacher training, foster gender inclusivity, and increase practical cooking time in secondary school culinary education. This will ensure that students are endowed with basic life skills, career opportunities in the thriving food industry, and overall development of the nation's economy and health.

Recommendations

- a. The study recommends improving the culinary education of Delta State secondary school girls in Nigeria by addressing disparities in urban and rural schools, overcoming the barriers to effective culinary education, and encouraging inclusive participation in the culinary field by both genders.
 - b. The government of Nigeria should give top priority to funding that equips the secondary schools with the adequate kitchen facilities and materials for hands-on practical training in culinary education. Such collaboration may be explored with other government agencies, private sector companies, and NGOs in supplying schools with kitchen equipment, ingredients, and other necessary materials.
 - c. Communities may also help through donations or partnerships with the local markets.
 - d. The curriculum should ensure the inclusions of modern culinary skills, nutrition education, and food safety.
 - e. Curriculum lessons should be designed to challenge gender stereotypes and position cooking as a life skill that all students should learn, regardless of gender. This might involve partnerships with culinary schools or professional chefs to provide teachers with specialist training.
- b. Confidentiality: All data were treated with confidentiality, and personal identifiers were removed from the final reports. Results were reported in aggregate form to ensure that individual participants could not be identified.
 - c. Voluntary Participation: Participation in the study was voluntary, and participants will have the right to withdraw at any time without any negative consequences.

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Ethical Considerations

- a. Informed Consent: Before data collection, informed consent was obtained from all participants. The

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