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Striving for Sustainability in Educational Institutions: Assessing the Effectiveness of an Intervention Using the 'Getting Involved in a Change Process (ECP)' Tool

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Abstract: This study aims to evaluate the impact of using the 'Getting Involved in a Change Process (ECP)' tool in promoting sustainable eating practices. A total of 16 public educational institutions (5 primary schools and 11 kindergartens) participated, with interventions spanning six months. Methods included regular workshops with kitchen staff. These workshops focused on optimizing food resources, improving meal quality, and promoting environmental awareness. Of the institutions involved, 87.5% (14 out of 16) completed the intervention, and 68% successfully implemented at least one sustainable change, ranging from increasing plant-based options to reducing food waste ($Z = -2.971$; $p = 0.003$). The findings suggest that, while the ECP tool is effective in motivating staff and reducing the environmental impact of public meals, full integration requires a supportive organizational structure and continued education. These insights contribute to the growing body of research on sustainable food systems in public institutions and their role in climate change mitigation.

Keywords: sustainability; educational institutions; plant-based meals; food waste reduction; behavioral change; public catering; educational impact; long-term sustainability; implementation challenges

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1. Introduction

Education plays a pivotal role in fostering sustainable development, as it equips individuals with the knowledge, skills, and values necessary to address pressing global challenges [1,2]. In recent years, interest in the application of sustainable development principles across multiple sectors worldwide has grown significantly [3], notably in the field of education [1]. This trend stems from an increasing awareness of global challenges such as environmental degradation caused by human activities, including intensive agriculture, industrial practices, and urban expansion. These issues underscore the need for more sustainable practices to mitigate adverse environmental impacts. Furthermore, the long-term effects of climate change have intensified the recognition of the necessity to integrate sustainable development principles across diverse economic sectors [4,5]. Emphasis is also being placed on promoting human health and well-being, which calls for a holistic approach to addressing socioeconomic and health challenges through sustainable development initiatives [6].

Educational institutions are vital platforms for cultivating values and shaping attitudes. They play a crucial role in advancing sustainable development [2].

Figure 1 highlights key elements that influence meal quality in schools and kindergartens, along with their impact on student health.

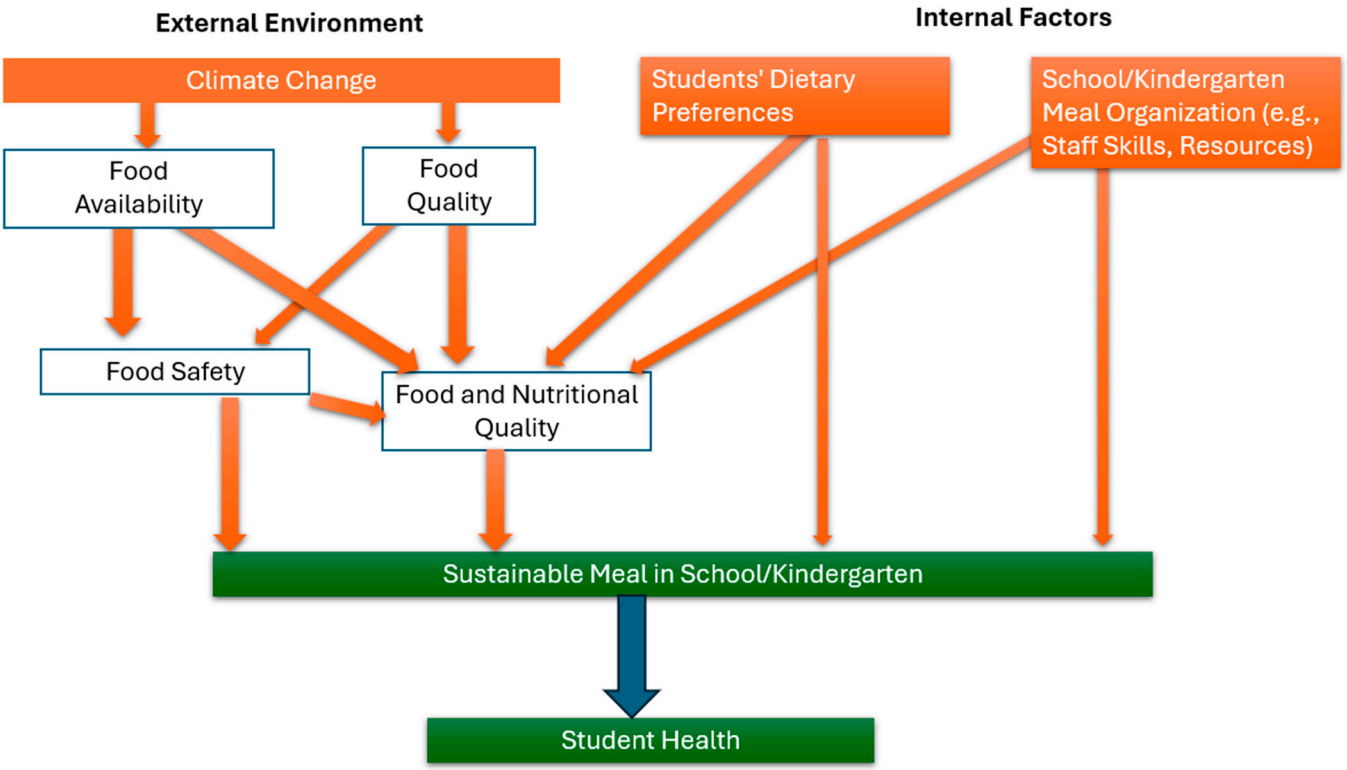

Figure 1. Critical elements shaping sustainable meals in school or kindergarten.

- External environment—this encompasses factors like climate change and food availability, which significantly shape the broader context in which school or kindergarten meal programs operate.
- Internal factors—these include the organization of school or kindergarten meal systems (e.g., staff skills and resource management) and the dietary preferences of students, highlighting internal dynamics that affect meal provision.
- Outcome—the interplay of the external and internal factors directly affects food and nutritional quality, food safety, and, ultimately, the health of students.

By focusing on these dimensions, Figure 1 provides a structured overview of the complexities underlying school and kindergarten meal programs, emphasizing both systemic challenges and opportunities for improvement. It serves as a framework for understanding the multifaceted influences on meal quality and their implications for the health of children. This visual representation intentionally narrows its focus to essential components to maintain clarity while highlighting critical interactions for practical application and further research.

One of the primary strategies educational institutions can adopt to promote sustainable development is implementing changes in the organization of school and kindergarten meals [7,8]. For instance, incorporating meals with a lower carbon footprint into the menu at several Brazilian schools resulted in a reduction in CO_2 emissions by up to 17%, while simultaneously offering more sustainable meals [7]. In the Swedish OPTIMAT™ intervention study, greenhouse gas emissions from school meals were reduced by approximately 28%, with no observed increase in food waste or decline in meal acceptance among students [8].

Efforts to promote plant-based meal options should be accompanied by initiatives to increase their acceptance [9–13]. The study conducted in Sweden indicate that students are generally hesitant to consume plant-based meals, and kitchen staff may discontinue preparing these meals instead of adapting the recipes to better suit students' taste preferences. This creates a cycle where students avoid plant-based options due to low acceptance, and staff, in turn, refrain from offering them. A multidimensional approach is necessary to disrupt this cycle [12].

Efforts to introduce healthy and sustainable school meals are being undertaken worldwide, not only in Europe, but also in Asia [14,15] and Africa [16,17]. In Thailand [14], programs are implemented to improve the nutritional quality of school lunches while simultaneously reducing food waste. In China [15], research highlights the need to minimize food losses in school cafeterias as a critical component of a sustainable food system. In Sub-Saharan African countries [16] and South Africa [17], initiatives focus on utilizing local, climate-resilient crops, which support both students' health and local agriculture.

It is essential to adapt both educational curricula and school meal preparation to align with new sustainability standards. On the other hand, engaging the entire school and kindergarten community in this process is indispensable. Long-term effectiveness and a balance between needs and resources require both adequate infrastructure and the active involvement of all participants in the educational process [13]. Myers et al. underscore that effective cooperation between students and kitchen staff is pivotal for successful change implementation. Consideration should also be given to systematic training for kitchen staff to enable them to prepare sustainable meals effectively, which includes not only education, but also the development of culinary skills [12].

Engaging kitchen staff in the change process is essential, as indicated by the psychological literature on behavior change theories [18]. Kitchen staff should not only understand and accept these changes, but also receive adequate educational support. Without such support, these shifts may be perceived as challenging and frustrating, especially for staff who lack prior experience with sustainable meal preparation. Trained school and kindergarten kitchen staff have demonstrated a greater willingness to innovate and create environmentally friendly meals [12].

An important component of the change process is fostering a sense of self-efficacy among kitchen staff, which can enhance their motivation and job satisfaction [18]. Engagement is higher when employees feel that they have a meaningful role in the process and understand its significance. Kitchen staff who participate in co-creating new meals may experience increased motivation and job satisfaction, facilitating more effective change implementation [19].

The process of implementing behavioral change can be further supported by the 'Getting Involved in a Change Process (ECP)' tool, developed by a Danish team as part of the StratKIT project [20]. This tool aims to motivate those responsible for organizing public meals to adopt sustainable practices, such as introducing meals with a lower carbon footprint and implementing resource-saving measures (e.g., water conservation). The ECP tool is grounded in the exchange of experiences and knowledge among participants, along with the application of industry best practices and expert advice.

The choice of the ECP tool for implementation in Poland is based on several key considerations. Denmark is widely recognized as a leader in implementing sustainable practices within the public catering sector, especially within educational institutions. Danish experiences, which include both the reduction in greenhouse gas emissions and improvements in the nutritional quality of meals, offer a valuable model for other countries, including Poland, which faces comparable environmental and social challenges. Structural factors, such as the framework of collective catering services and the growing awareness of the need for sustainable solutions, make the deployment of a proven tool an effective approach to accelerate change within the Polish educational system.

This study aims to evaluate the impact of using the 'Getting Involved in a Change Process (ECP)' tool in promoting sustainable eating practices in selected educational institutions in Warsaw, Poland. An attempt was made to determine whether the ECP tool's effectiveness in Poland would be comparable to that observed in Denmark.

2. Materials and Methods

2.1. Type of Study

This study utilized an interventional study methodology, with effectiveness assessed through a comparative analysis of pre- and post-intervention changes. This approach

allowed for a rigorous evaluation of the intervention's impact on the organization of public meal services.

2.2. Materials

The intervention study was conducted across six public primary schools and twelve public kindergartens (Figure 2). During the study, one kindergarten withdrew after the initial meeting due to a prolonged staff illness, which created staffing challenges. Additionally, a representative from one of the primary schools did not attend any meetings, despite the school's enrollment in the program, and provided no explanation for the absences, despite repeated contact attempts by the organizers.

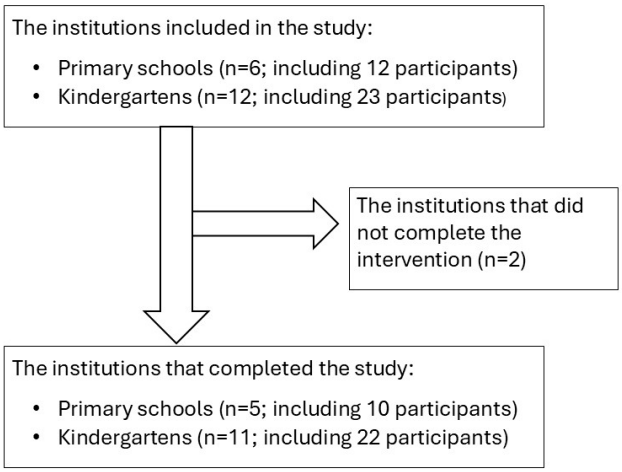

Figure 2. The institutions included in the project.

Ultimately, the project was successfully completed in five primary schools and eleven kindergartens, involving a total of 5778 students, of whom 69% participated in school- or kindergarten-provided meal programs.

The institutions participating in the study were characterized by the number of students, the proportion of students taking advantage of school-provided meals, and the organizational structure of meal provision (Table 1). To ensure complete anonymity for primary schools and kindergartens, each institution received a code consisting of the type of institution (primary school or kindergarten) and the next letter in the alphabet (A, B, C. . .).

Table 1. Characteristics of institutions participating in this study (n = 18).

Institutions	Number of Students	Number of Students Eating School Meals	% of Students Eating School Meals	Number of Lunch Breaks	Meal Provision Format
Primary School A (PS_A)	1480	690	46.62	4 and more	Catering Service
Primary School B (PS_B)	786	561	71.37	3	School Kitchen
Primary School C (PS_C)	284	160	56.34	3	School Kitchen
Primary School D (PS_D)	720	620	86.11	3	School Kitchen
Primary School E (PS_E)	399	300	75.19	2	School Kitchen
Primary School F (PS_F)	646	500	77.40	2	Catering Service
Kindergarten A (K_A)	93	80	86.02	1	Kindergarten Kitchen
Kindergarten B (K_B)	58	58	100.00	1	Kindergarten Kitchen

Table 1. *Cont.*

Institutions	Number of Students	Number of Students Eating School Meals	% of Students Eating School Meals	Number of Lunch Breaks	Meal Provision Format
Kindergarten C (K_C)	123	91	73.98	1	Kindergarten Kitchen
Kindergarten D (K_D)	81	81	100.00	1	Kindergarten Kitchen
Kindergarten E (K_E)	101	81	80.20	1	Kindergarten Kitchen
Kindergarten F (K_F)	211	144	68.25	1	Kindergarten Kitchen
Kindergarten G (K_G)	151	108	71.52	1	Kindergarten Kitchen
Kindergarten H (K_H)	179	132	73.74	1	Kindergarten Kitchen
Kindergarten I (K_I)	100	80	80.00	1	Kindergarten Kitchen
Kindergarten J (K_J)	93	88	94.62	1	Kindergarten Kitchen
Kindergarten K (K_K)	122	86	70.49	1	Kindergarten Kitchen
Kindergarten L (K_L)	151	118	78.15	1	Kindergarten Kitchen

The primary schools included in the analysis had an average enrollment of 719 students, with 66% partaking in school-provided meals. In the kindergartens participating in the project, average enrollment was 122 children, of whom 96% had access to the meals provided on-site. Detailed information is presented in Table 1. The predominant model for meal provision, in both primary schools and kindergartens, was through school kitchens.

2.3. Recruitment and Data Collection Procedures

The recruitment of institutions for this study was conducted in Warsaw (Poland). Prior to sending invitations to participate, a thorough review of Warsaw educational institutions' websites was undertaken, with analysis focused on the following factors:

(a) Healthy eating initiatives implemented by the institutions (e.g., projects, culinary workshops);
(b) Comprehensive environmental education programs;
(c) Menus, with particular emphasis on the presence of plant-based products and appealing plant-based meals.

This initial analysis was prepared by one of the authors (E.C.) and enabled a preliminary evaluation of each institution's efforts in sustainable development, allowing for the selection of institutions with comparable standards in this area. Based on these criteria, several institutions were chosen and, subsequently, email invitations that outlined meeting dates and topics were sent. Each institution was invited to designate two representatives: a procurement or administrative manager and a kitchen staff member. Program participation was limited, with slots allocated on a first-come, first-served basis. The recruitment phase lasted approximately one month.

The project included institutions that expressed interest in the pilot study and operated on-site kitchens. Institutions using external catering services, which primarily prepare meals off-site, were excluded from the study. This decision was based on the fact that sustainable meal preparation in these cases occurs in an external environment, separate from the school or kindergarten setting. Additionally, external catering providers are typically private companies operating independently from the educational institutions, which significantly limits or even precludes the ability to influence their practices. Consequently, the exclusion of such facilities was necessary to ensure that the study focused on institutions where meal preparation and sustainability practices could be directly observed, evaluated, and modified within the educational environment. However, institutions where external companies prepared meals on-site at the school or kindergarten were included in the study.

Figure 3 illustrates the chronological progression of the intervention, detailing the key phases from recruitment to post-test, along with their respective timeframes.

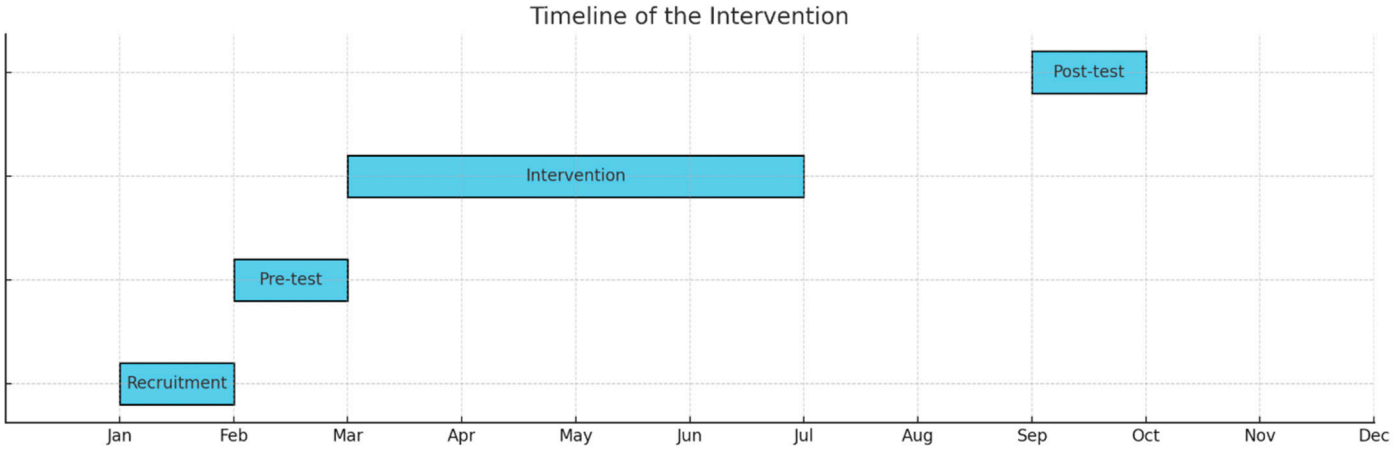

Figure 3. Timeline of the intervention.

2.4. Intervention Characteristics

The intervention was conducted from 28 March 2023 to 28 September 2023. As part of this initiative, the 'Getting Involved in a Change Process (ECP)' tool, developed by Danish researchers [20], was utilized. The primary aim of this tool was to create communication materials that motivate meal organizers to adopt sustainable practices. The tool was tested as part of the "StratKIT+ Innovative Strategies for Public Catering: the Expansion of the Sustainable Public Meal Toolkit" project, co-funded by the European Union under the Interreg Baltic Sea Region program.

The intervention was designed not only to educate participants on sustainable development, but also to motivate and engage them in implementing at least one actionable change within their institutions. Six sessions were held with staff responsible for meal organization in educational settings, each session structured to introduce and elaborate on sustainability principles and facilitate experience sharing among participants (Table 2).

Table 2. Description of sessions realized during intervention.

Session	Duration	Topic	Aim
1	120 min	The concept of a sustainable meal: from theory to practice.	Introduction to the concept of sustainable development and strategies implemented in public food service institutions in other countries (presentation of materials from the StratKIT project).
2	120 min	Strategies for efficient use of water, energy, and cleaning agents in meal production for schools and kindergartens.	Presentation of sustainable practices for the use of energy and cleaning agents in meal production, encouragement to implement these practices in institutions, and mutual exchange of experiences.
3	120 min	Culinary workshop—my sustainable meal at school and kindergarten.	Encouragement to try recipes for school/kindergarten meals based on plant-based products and testing strategies to replace part of the animal-based ingredients (e.g., meat) with plant-based alternatives.

Table 2. *Cont.*

Session	Duration	Topic	Aim
4	120 min	Sustainable meals—a goal and a challenge for all of us.	Collection of information on sustainable practices already present in institutions, and encouragement to experiment with new strategies, fostering mutual exchange of experiences.
5	120 min	Quality and environmental criteria for the public procurement of food.	Demonstration of ways to improve the quality of ordered food products by establishing quality and environmental criteria for public procurement. Encouragement to order organic products and the exchange of experiences regarding public procurement and purchasing organic products.
6	120 min	Healthy and sustainable snacks.	Presentation of recipes for healthy and sustainable meals/snacks and encouragement to try them in the educational institutions.

2.5. Preliminary Assessment of Sustainability Practices Implemented in the Institution

The original research tool was developed to assess both existing and planned sustainability efforts within the institutions. The questionnaire was structured into three sections: (a) increasing the incorporation of plant-based meals; (b) reducing food waste; and (c) advancing sustainability within institutional practices.

The first section included questions regarding strategies to increase the incorporation of plant-based meals, such as (a) salad or vegetable bar (description of available vegetables) (P_1); (b) additional servings of vegetables or fruits to meals (P_2); (c) processing of fruits and vegetables, e.g., into smoothies (P_3); (d) availability of a vegetarian meal option (P_4); (e) legume-based meals (P_5); and (f) incorporating legumes into meat-based meals to partially replace animal protein with plant-based protein (P_6).

The second section focused on practices aimed at reducing food waste, including (a) option to purchase varied portion sizes (W_1); (b) option for parents to collect prepaid and uneaten meals for students/children (W_2); (c) food repurposing practices (W_3); (d) availability of additional servings (W_4); (e) distribution of uneaten meals to interested students (W_5); (f) efficient meal cancellation procedures (W_6); and (g) allowing children to decide on the size of their meal (W_7).

The final section of the research tool addressed additional sustainability initiatives within the institutions, including (a) procurement of certified products, such as those with organic certifications (Z_1); (b) organization of culinary workshops focused on sustainable meals for children/adolescents, involving kitchen staff (Z_2); (c) ordering of food products in reusable packaging (Z_3); (d) use of energy-efficient LED lighting (Z_4); (e) use of natural or eco-friendly cleaning agents (Z_5); and (f) use of foam dispensers (for hand soap and dishwashing liquid) (Z_6).

2.6. Evaluation of Intervention Effectiveness

Throughout the sessions, participants exchanged effective best practices already in use within their institutions. By the sixth session, each participant committed to implementing at least one new sustainable development practice. Ten weeks after the intervention, a follow-up evaluation meeting was held (September 2023), during which participants had the opportunity to present and discuss the outcomes of their initiatives.

2.7. Statistical Analysis

The Wilcoxon test was used to evaluate the effectiveness of the intervention, as it allows for the assessment of differences between paired results (before and after the intervention) without assuming data normality. The data obtained in this study did not follow normal distribution.

3. Results

3.1. Characteristics of Educational Institutions Based on Implemented Sustainability Initiatives

Prior to their participation in the program, the educational institutions had already undertaken various initiatives to enhance sustainability across three primary areas: (a) increasing the proportion of plant-based meals in school and kindergarten; (b) reducing food waste; and (c) advancing sustainability within institutional practices (Figure 4).

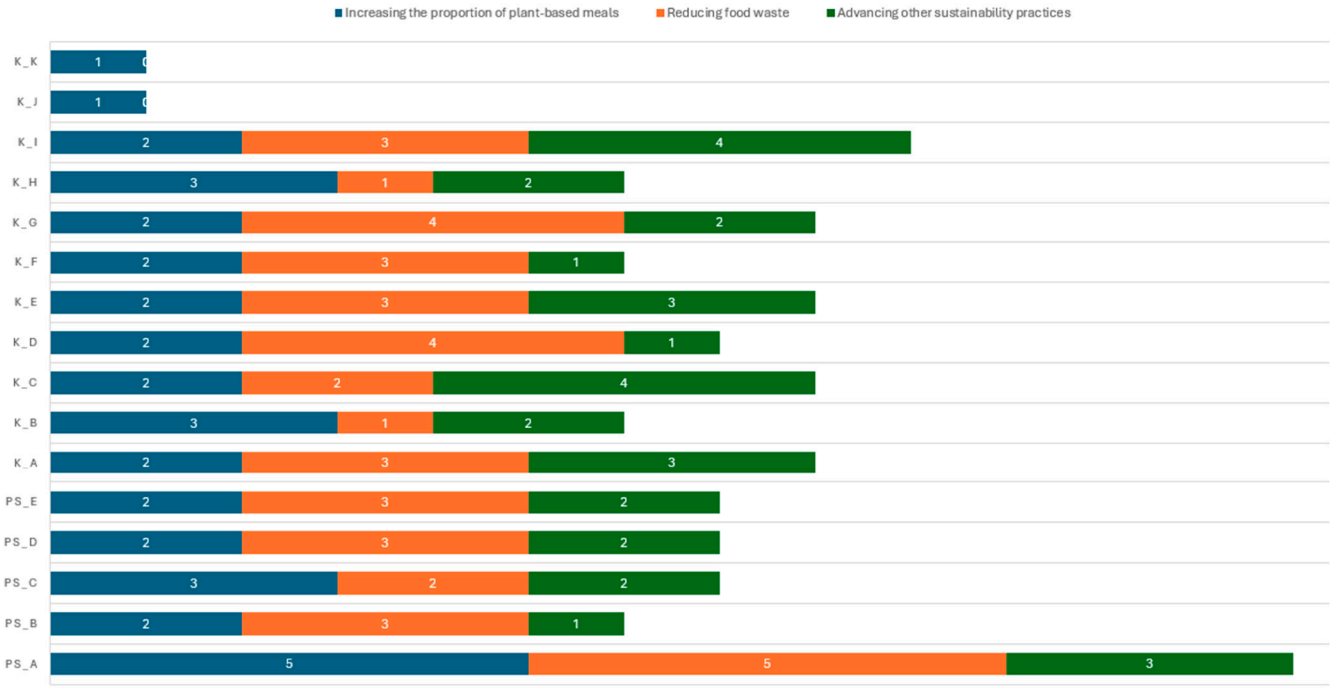

Figure 4. Sustainability practices in institutions before intervention.

In terms of increasing the proportion of plant-based meals, the most frequently reported practices included incorporating legume-based meals (P_5) and providing access to a salad bar for children and teenagers (P_1). Additionally, institutions reported measures such as adding an extra portion of vegetables or fruits to meals (P_2) and processing vegetables and fruits into smoothies (P_3), with a clear listing of specific vegetables and/or fruits used in preparation. Less commonly, institutions offered a vegetarian version of the main meal (P_4) or added legumes to meat-based meals to partially replace animal protein with plant protein (P_6) (see Supplementary Material—Table S1).

To address food waste reduction in kindergartens and schools, a variety of measures were implemented. The most frequently applied strategies included food repurposing practices (W_3) and allowing students to take additional servings (W_4). In some institutions, options were available for purchasing varied portion sizes (W_1), retrieving prepaid but unclaimed meals (W_2), offering uneaten meals to interested students (W_5), implementing an efficient system for meal cancellations (W_6), and enabling students to decide on the size of their meal (W_7) (see Supplementary Material—Table S1).

Among other actions aimed at promoting sustainable development, institutions reported ordering food products in reusable packaging (Z_3), using natural or eco-friendly cleaning agents (Z_5), and implementing energy-efficient LED lighting (Z_4). In some

institutions, culinary workshops on sustainable meals were organized for children and adolescents involving kitchen or cafeteria staff (Z_2). Additionally, products with certificates, including 'organic' certificates (Z_1), were ordered, and foam dispensers were used for hand soap and dishwashing liquid (Z_6) (see Supplementary Material—Table S1).

Figure 5 shows a comparison of the number of actions taken by different educational institutions before and after the intervention. The chart includes primary schools (PS) and kindergartens (K). The bars represent the number of actions 'Before' (prior to the intervention) and 'After' (post-intervention), allowing for a visualization of the effectiveness of the implemented changes.

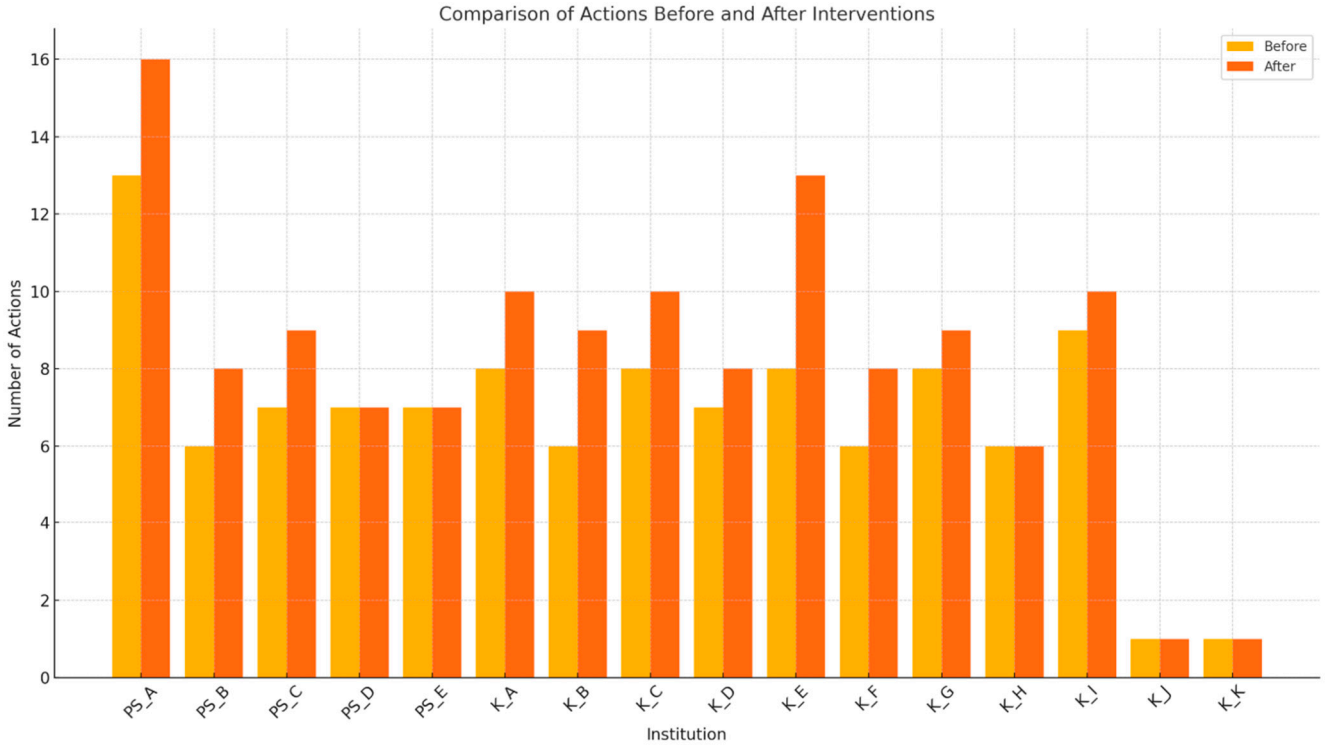

Figure 5. Comparison of actions before and after interventions.

3.2. Sustainability Initiatives Declared by Participants for Implementation in Their Institutions

Throughout this study, 11 institutions committed to introducing sustainability initiatives or had already implemented them between subsequent meetings. Two institutions did not introduce any new initiatives during the final meeting. However, they retained the option to select initiatives at a later stage and participate in the evaluation meeting. Three institutions were unable to attend the final meeting due to staff constraints, requiring them to remain on-site. Nevertheless, these institutions were granted the opportunity to express their intentions to implement the changes via email or telephone.

The initiatives most frequently declared for implementation involved increasing the proportion of plant-based products in meals provided at schools and kindergartens. Such actions were planned in eight institutions and included preparing meals with legumes (e.g., white beans), vegetable spreads, increasing the number of vegetarian meals, partially substituting meat with legumes in meals, adding lentils to meat patties, and adding hummus to the menu.

In three institutions, plans were made to implement food waste reduction strategies, such as repurposing food surpluses and allowing children to decide on the size of their meal. Additionally, six institutions planned other sustainability initiatives, including collaboration with organic farms and the use of natural or eco-friendly cleaning agents, as well as foam dispensers. Generally, one initiative was chosen for implementation. However, three institutions identified three initiatives—one from each of the three analyzed areas.

3.3. Evaluation of Intervention Effectiveness in Terms of Implemented Changes

Representatives from the 11 institutions present at the project's final meeting confirmed that they had implemented the planned initiatives. We noted that 68% of educational institutions (primary schools and kindergartens) implemented initiatives aimed at promoting sustainability. The three institutions that did not attend the final meeting and did not commit to any sustainability initiatives reported no changes in this area during the evaluation meeting. Two institutions were absent from the evaluation meeting, and thus no data or declarations were available. The most reported reason for the lack of implementation was resistance to change from other staff members at the institution who had not participated in the meetings.

Key Finding: 68% implementation success rate
A significant 68% of participating educational institutions successfully implemented at least one sustainability initiative, ranging from increased plant-based menu options to effective food waste reduction strategies ($Z = -2.971$; $p = 0.003$).

The analysis conducted using the Wilcoxon test revealed a statistically significant difference in the change in the number of actions undertaken to achieve sustainability ($Z = -2.971$; $p = 0.003$).

4. Discussion

4.1. Implementation of Sustainability Initiatives in Educational Institutions

This study evaluated both the sustainability measures currently in place and plans for future initiatives within educational institutions, focusing on three key areas: (a) increasing the proportion of plant-based meals; (b) reducing food waste; and (c) adopting additional practices to support sustainable development. The results highlight a varied approach to ecological and health-promoting initiatives among the studied institutions. This variation may result from differences in available resources, staff expertise, and the level of support from both management and other personnel, a finding that aligns with outcomes observed in other studies on implementing pro-environmental practices within educational settings [21].

It is important to recognize that the implementation of such measures is a process requiring effective coordination, defined in the context of schools and kindergartens as the strategic alignment of efforts among teachers, kitchen staff, administrative personnel, and external stakeholders to integrate sustainability goals into daily operations. Effective coordination in educational settings involves clear communication, role allocation, and collective problem solving to ensure all parties work collaboratively toward shared objectives, such as sustainable meal preparation and food waste reduction. Experiences from Spain suggest that one of the primary challenges in establishing sustainable practices was inadequate coordination among stakeholders, which led to fragmented efforts [22].

4.2. Utilizing the 'Getting Involved in a Change Process (ECP)' Tool to Support Implementations

As part of the intervention, the 'Getting Involved in a Change Process (ECP)' tool was used, developed by Danish researchers under the StratKIT+ Innovative Strategies for Public Catering project, co-funded by the European Union through the Interreg Baltic Sea Region program [20]. This tool aimed to create and distribute communication materials designed to motivate kitchen staff involved in meal organization to engage in actions supporting sustainable development.

The findings of our study suggest that this tool played a crucial role in fostering motivation and supporting the change implementation process within educational institutions. The process included identifying key personnel involved in meal preparation, gathering their experiences, and compiling best practices into an informative brochure. This approach proved effective in the majority of the participating institutions, resulting in a marked increase in awareness and acceptance of sustainability-focused changes. These results indicate that the tool is effective not only on a systemic level but also across regional contexts.

An additional outcome of the intervention is a brochure targeted at individuals responsible for public catering in educational institutions. It showcases examples of sustainable practices already in place in schools and kindergartens. The detailed descriptions of specific tested strategies implemented in institutions operating under similar conditions and within comparable contexts are particularly valuable for those involved in public catering in educational settings. The brochure is freely accessible in a Polish version [23].

4.3. Increasing the Proportion of Plant-Based Meals

A central aspect of the sustainability initiatives involved increasing the inclusion of plant-based meals in school and kindergarten menus. These institutions achieved this by incorporating more legumes, offering salad bars, and providing additional servings of fruits and vegetables. For example, Primary School B introduced dishes with chickpeas, such as a chickpea soup, which was met with considerable interest and enthusiasm among students. Similarly, Primary School E served lentils in forms such as patties or stews, which successfully integrated plant-based proteins into the menu. In another case, Kindergarten B incorporated chickpeas into meat-based dishes, such as adding boiled chickpeas to meatballs in tomato sauce, which proved to be a popular choice among children.

This strategy aligns with dietary recommendations for health promotion, which advocate for reduced meat consumption and an increased intake of plant-based products to improve human health, as well as minimize the environmental impact [24]. It also follows the guidelines set by the EAT-Lancet Commission. Although this dietary approach offers various health benefits, including reduced risk of chronic diseases, it faces challenges such as affordability in low-income regions and problems with ensuring adequate nutritional value [25].

Nonetheless, the findings suggest that the full implementation of plant-based meals faced significant challenges. Barriers included limited acceptance among children and the need for procedural adjustments within school and kindergarten kitchens. A study conducted in Swedish schools identified key obstacles, such as low student interest in plant-based meals and a lack of understanding regarding the nutritional value of plant-based proteins [12]. Similar findings were observed in studies conducted in Norway [26] and in the United States [27].

To improve student acceptance of plant-based meals, it is crucial to implement educational initiatives that emphasize the health and environmental benefits of a plant-based diet. Research suggests that a key element is comprehensive food education, along with active collaboration between students and kitchen staff in the co-creation of meals, which can enhance the tolerance of new plant-based meals while also reducing food waste [12].

A critical component of supporting the kitchen staff is providing specialized training in the preparation of flavorful plant-based meals. Practical hands-on training sessions focused on creating plant-based appealing meals may enhance staff confidence and increase their readiness to incorporate new recipes into the daily menu at schools and kindergartens [28]. Furthermore, involving students in the cooking process can effectively engage them in meal preparation, fostering greater interest and openness to trying new meals [29].

4.4. Reducing Food Waste

The findings reveal varied strategies for reducing food waste at schools and kindergartens, including permitting additional servings and repurposing food surpluses. For example, Kindergarten A implemented a system allowing children to serve their own portions during lunch. This practice is linked with educational activities, as teachers initially discuss with the children how to take portions they can eat and finish, leading to higher satisfaction and less food waste. Similarly, Kindergarten C promotes a "clean plate culture" by encouraging smaller initial portions with the option for seconds, significantly reducing the amount of uneaten food. These approaches align with findings from a study conducted in Swedish schools, which demonstrated that increased flexibility in portion sizes, such as

allowing additional servings, can reduce food waste by enabling students to better align portions with their appetites [30].

A study conducted in China highlighted several effective methods for reducing food waste at schools. In Beijing, the promotion of buffet-style lunches allowed students to choose food in portions aligned with their preferences, reducing waste significantly compared to pre-packaged or set meals. Improvements in the school canteen services, such as better-quality meals and regular feedback systems involving students, parents, and staff, also played a critical role. Additionally, educational programs teaching children about food production and the value of food were introduced, aiming to cultivate long-term sustainable habits [15].

A study conducted in Thailand further reinforces the importance of portion size and menu design in reducing food waste. The study found that plate waste was significantly lower in "one-course meals" compared to "rice with side dish" menus, due to better alignment with student preferences and portion control. These findings emphasize the critical role of portion size and menu design in addressing food waste effectively [14].

In addition, Primary School A implemented a system of portion size options, where parents select the portion size (small or large) when ordering meals. The weights of the portions are specified in the menu, ensuring appropriate serving sizes and minimizing overproduction. Such strategies help to avoid overproduction and significantly lower food waste. Furthermore, repurposing surplus food into new meals has proven to be an effective waste reduction method. For example, a study conducted in public school cafeterias indicated that kitchens preparing food on-site had greater flexibility in utilizing surpluses, resulting in a waste reduction of up to 42% compared to external kitchens that merely serve pre-prepared meals [30].

Engaging kitchen staff and involving them in preparing meals from surplus food allows for the more efficient utilization of resources. Kitchen staff who participated in training on repurposing surplus food became more aware and better prepared to manage the challenges associated with waste reduction [31]. Additionally, the joint education of students and kitchen staff on the value of food and the effective utilization of surpluses can play a crucial role in establishing a sustainable food culture within schools.

The 'Getting Involved in a Change Process (ECP)' tool could play a supportive role by facilitating communication and encouraging staff engagement in recognizing the importance of reducing food waste. This approach is aligned with the guidelines of the Food and Agriculture Organization (FAO), which identifies waste reduction as a central element of sustainable food systems. The FAO underscores that minimizing food waste is a critical step toward ensuring food security and advancing global sustainable development. FAO reports indicate that reducing food waste enhances resource efficiency, lowers greenhouse gas emissions, and promotes more sustainable agricultural practices [32].

Less common initiatives, such as allowing the collection of unserved meals, require continued efforts in raising awareness and establishing appropriate organizational frameworks. Implementing an option for students to collect unserved meals could also contribute to the more effective management of food surpluses for future use. Studies indicate that initiatives promoting the packaging and retrieval of leftover food can significantly reduce waste, particularly when paired with educational support on the nutritional value of food and strategies for its reuse [33].

4.5. Introduction of Additional Sustainability Initiatives

Educational institutions (primary schools and kindergartens) have also advanced sustainability efforts by adopting eco-friendly cleaning products and establishing partnerships with organic farms. Research highlights that collaborations between primary schools and organic farms offer numerous educational benefits, including enhancing students' understanding of proper nutrition and fostering healthy eating habits. For instance, Primary School A organizes regular trips to a partnered organic farm, where students can learn about sustainable farming practices, seasonal food production, and the nutritional value

of fresh produce. These hands-on experiences encourage students to explore and try a wider variety of fruits and vegetables, ultimately supporting their overall well-being. Such partnerships not only provide educational opportunities, but also contribute to improving the quality of school meals through access to fresh locally sourced ingredients [34].

In addition to partnerships with organic farms, educational institutions in other parts of the world, such as Sub-Saharan Africa, have implemented innovative approaches to promote sustainability and enhance food education. For instance, schools in this region have established school gardens to cultivate climate-resilient crops such as sorghum, millet, and cassava. These gardens serve as practical learning platforms where students gain hands-on experience in sustainable agricultural practices and the nutritional value of traditional crops. Beyond fostering an understanding of local biodiversity and nutrition, these gardens contribute directly to improving the quality of school meals by providing fresh nutrient-rich ingredients. Similar programs and initiatives like those at Primary School A could be implemented, extending the benefits of local food production and sustainability education [16].

Another common initiative among the institutions participating in the study was the procurement of products in returnable packaging. The importance of sustainable packaging is strongly emphasized in the literature. Research indicates that sustainable packaging can be achieved using bio-based and recyclable materials, which contribute to environmental protection and support sustainable ecosystems [35]. In Primary School A, this commitment extends to sourcing products from suppliers who use returnable or recyclable packaging, further reinforcing the school's commitment to sustainability.

These initiatives reflect a growing environmental awareness among kitchen staff in educational institutions, with the 'Getting Involved in a Change Process (ECP)' tool playing a vital role by providing materials that promote such efforts. Workshops and consultations with the kitchen staff were instrumental in raising awareness and enhancing the understanding of the importance of these changes in the context of sustainable development.

4.6. Barriers to Implementing Change

Staff resistance emerged as the primary barrier for institutions that did not implement new initiatives. This resistance likely arises from a lack of understanding of the purpose behind the changes or concerns about increased responsibilities. The 'Getting Involved in a Change Process (ECP)' tool was designed to mitigate such barriers by actively involving key personnel and developing materials that are easily understood and embraced by staff. However, the findings suggest that some institutions were unable to fully secure buy-in from all staff members, indicating a need for the further adaptation of this tool to better align with institutional conditions.

4.7. Integration of Environment, Education, and Nutrition in Sustainable School Meals

The Venn diagram in Figure 6 vividly captures the interplay between three essential elements: environment, education, and nutrition, all of which are crucial for fostering sustainability within educational institutions. Each of these elements contributes uniquely to creating a sustainable school environment, while their overlapping areas highlight the integrated actions needed to achieve this goal.

The environment circle represents the efforts aimed at reducing the ecological footprint of schools. This includes implementing eco-friendly practices such as minimizing food waste, sourcing ingredients sustainably, and adopting resource-saving measures. Schools are uniquely positioned to take meaningful steps towards environmental stewardship by embedding these practices into their daily operations.

The education circle illustrates the critical role of learning and awareness in driving sustainability. Through initiatives like food education programs and active student engagement, schools can foster a culture that values both health and environmental responsibility. These educational efforts not only raise awareness, but also empower students to adopt and advocate for sustainable practices beyond the classroom.

The nutrition circle emphasizes the importance of providing healthy balanced meals that align with sustainability principles. Strategies such as introducing more plant-based options, reducing waste in meal preparation, and ensuring nutritional adequacy are central to this domain. Proper nutrition not only supports student well-being, but also minimizes the environmental impact of food systems.

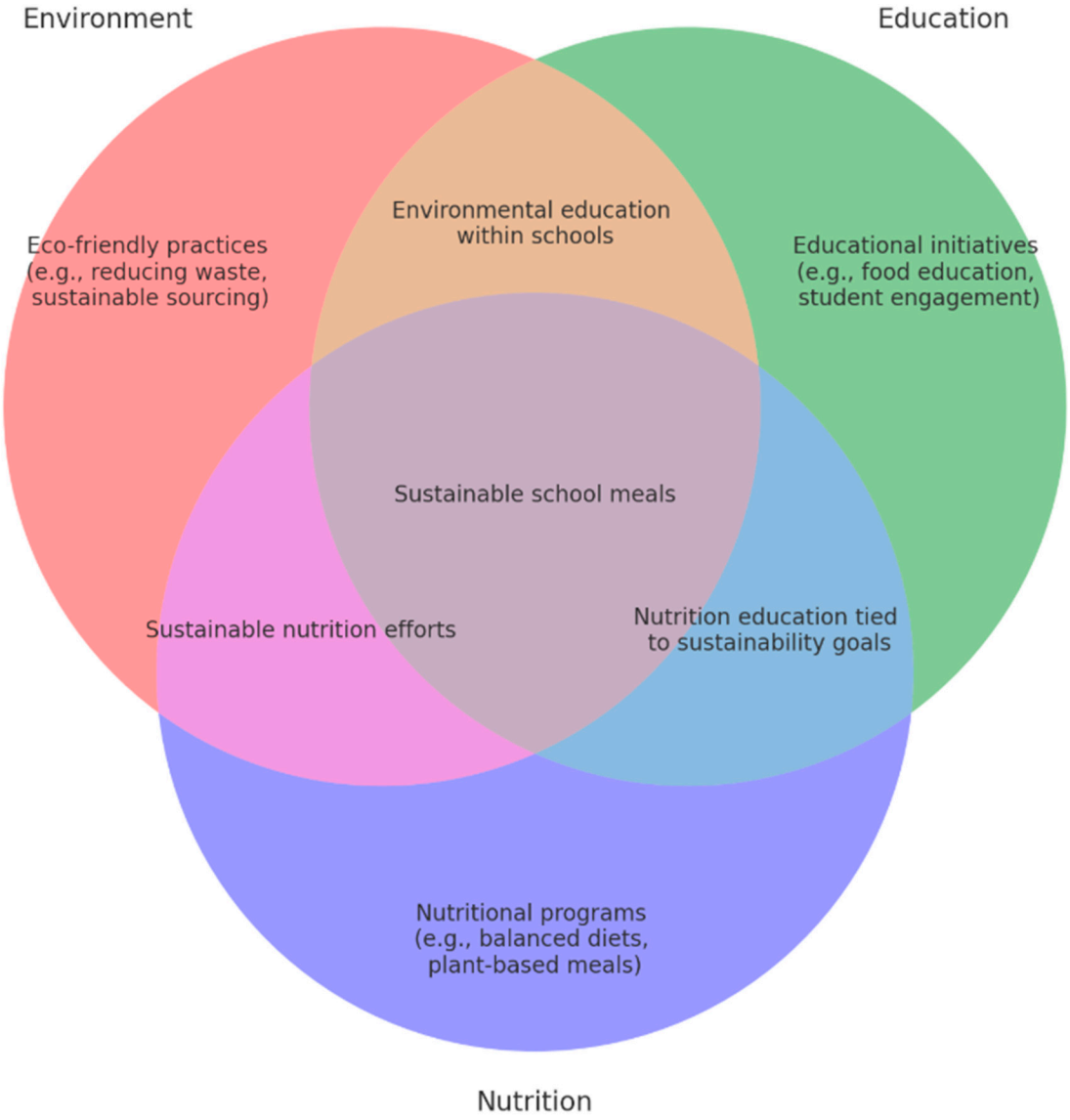

Figure 6. The Venn diagram of the integration of environment, education, and nutrition in sustainable school meals.

This diagram serves as a visual reminder that achieving sustainability in schools requires a holistic approach. By integrating environmental practices, education, and nutrition, schools can simultaneously nurture the planet and students' health. Such a framework not only addresses immediate challenges, but also lays the foundation for a generation that values sustainability in all aspects of life.

4.8. Strengths and Limitations

This study represents a meaningful advancement in promoting sustainable nutrition within educational institutions, addressing the increasing demand for environmental solutions within the public sector.

One of this study's primary strengths is its pioneering approach to implementing sustainable nutritional practices within the educational system. This project utilizes the "Getting Involved in a Change Process" (ECP) tool, developed by a Danish research team, to adapt international methodologies to local contexts effectively. This adaptation respects the cultural and organizational differences between countries, enabling the relatively seamless implementation of validated practices across new settings. Methodologically, selecting the ECP tool as a framework for initiating change within educational institutions is worth paying attention to; it provides both motivational and structural support for sustainable practices within public sector food services.

Another significant strength of this study is its broad recruitment strategy, which includes both primary schools and kindergartens. This comprehensive approach enables a comparative analysis of intervention effectiveness across diverse organizational settings, thereby increasing the generalizability of the findings. Such representativeness is essential in social research, as variations in context and organizational structure can profoundly influence the success of implemented interventions.

An additional strength of this study lies in its integration of educational and practical components. By actively involving school staff and organizing culinary workshops and training sessions, the project aims not only to implement systemic changes, but also to foster awareness and develop skills in sustainable nutrition. This multifaceted approach enhances the likelihood of long-term success by embedding changes both structurally and within the knowledge and competencies of the staff.

Despite these strengths, certain limitations must be acknowledged when interpreting the results and guiding future research. The primary limitation is the relatively short intervention period of six months. Scientifically, changes in dietary and ecological behaviors are typically long-term processes that require prolonged observation to confirm their sustainability. Consequently, the short duration of this study may limit the ability to draw definitive conclusions about the ECP tool's effectiveness in promoting lasting change. To address this, we plan to revisit the participating primary schools and kindergartens in another six months to evaluate the sustainability of the implemented changes and to identify the barriers and facilitators influencing their adoption.

Another limitation pertains to sample selection. Although a range of educational institutions was included, this study was confined to selected institutions in Warsaw, potentially limiting the generalizability of findings to other regions in Poland. The lack of geographical and socioeconomic diversity in the sample introduces a potential interpretive limitation, particularly given that support for sustainable practices may vary according to available resources and local culinary preferences.

4.9. Future Research Directions

Although this study offers preliminary results regarding the implementation of a sustainable nutrition program within educational institutions, long-term studies are essential to assess the durability and effectiveness of these interventions over several years. Future research and application steps should focus on the long-term assessment of program effectiveness via the following actions:

- Analyze changes in students' dietary habits resulting from the introduction of sustainable meals.
- Analyze changes in the degree of food waste reduction achieved through implemented sustainable interventions and evaluate the impact of these programs on greenhouse gass emissions.
- Explore the socioeconomic and environmental variables influencing the acceptance and adaptation of these initiatives across diverse demographic groups.

This study identified resistance from some staff members as a significant barrier to implementing sustainable initiatives. Consequently, conducting in-depth research on the psychological and organizational factors contributing to this resistance, using the following points, would be highly valuable:

- Conducting in-depth research on resistance among staff members, identifying the key psychological and organizational barriers to adopting sustainable practices.
- Investigating perceptions and attitudes towards sustainability initiatives across various stakeholder groups, including students, teachers, parents, and staff.
- Developing and testing the tools or frameworks designed to facilitate the implementation of sustainable programs and minimize resistance.
- Designing comprehensive training programs for kitchen staff, focusing on the preparation of plant-based meals and efficient food waste management.

5. Conclusions

The findings of this study underscore the need for ongoing efforts to support the integration of sustainable development practices in educational institutions, particularly through engagement tools such as the 'Getting Involved in a Change Process (ECP)' tool. Although effective in certain contexts, the full implementation of this tool requires adaptation to local conditions and strengthened administrative support. The success of these initiatives depends on the involvement of all members of the school community, robust organizational backing, and increased awareness of the health and environmental benefits associated with these changes. Future research should aim to assess the long-term effects of these initiatives, considering both health and environmental outcomes.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su162410804/s1, Table S1: Characteristics of educational institutions based on sustainability initiatives implemented prior to the project.

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Institutional Review Board Statement: Ethical review and approval were waived for this study due to the nature of the intervention, which was conducted within the framework of voluntary participation by educational institutions (kindergartens and primary schools). We sent an invitation to the administration of primary schools and kindergartens, and they, together with their staff, decided whether they wanted to participate in the intervention. The study was a non-invasive educational intervention aimed at enhancing knowledge and skills. According to applicable legal regulations, this type of research does not require formal ethical approval. The study methodology was reviewed and supported by the Interreg Baltic Sea Region program, who funded this project.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: All data supporting the reported results are contained within the article.

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