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Health Education: Raising Awareness Among Children About Cleanliness and the Dangers of Synthetic Food Coloring in the Kenosis Community, Surabaya

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ABSTRACT Elementary school children from underserved communities often experience inadequate health literacy regarding food safety and personal hygiene, increasing their susceptibility to foodborne illnesses, dental diseases, and infectious conditions. At the Kenosis tutoring center in Surabaya, limited awareness of harmful food additives, appropriate tooth-brushing techniques, and proper handwashing practices was identified as a major public health concern. This community service initiative aimed to improve children's knowledge and awareness in these three essential health domains through an integrated health education program. A quasi-experimental one-group pre-test–post-test design was employed involving 35 elementary school children. The intervention was conducted through interdisciplinary collaboration among lecturers and students from five health disciplines. Educational activities incorporated multimedia presentations, interactive discussions, demonstrations, educational games, songs, and supervised hands-on practice to facilitate active learning. Participants completed structured pre-test and post-test questionnaires to assess knowledge acquisition, and the data were analyzed descriptively by comparing mean scores before and after the intervention. The findings demonstrated consistent improvements across all educational topics. Knowledge regarding harmful food additives increased from a mean pre-test score of 60.2 to 70.5 (17.1% improvement). Knowledge of proper tooth-brushing techniques improved from 60.0 to 75.0 (25.0% improvement), while understanding of appropriate handwashing practices also increased from 60.0 to 75.0 (25.0% improvement). These results indicate that interactive and demonstration-based educational strategies effectively enhanced children's understanding of essential health practices. In conclusion, the integrated health education program successfully improved health knowledge among elementary school children in a community tutoring setting. The findings highlight the potential of interdisciplinary, interactive educational approaches as an effective strategy for promoting healthy behaviors among children. Future programs should incorporate long-term follow-up and repeated educational sessions to evaluate knowledge retention, behavioral changes, and the sustainability of health promotion outcomes.

INDEX TERMS Health Education, Food Safety, Personal Hygiene, Elementary School Children, Community-Based Intervention

1. INTRODUCTION

Elementary school years represent a critical developmental period during which lifelong health behaviors, cognitive abilities, and social competencies are established [1], [2]. Beyond formal education, community-based learning environments, such as tutoring centers, play an increasingly important role in supporting children's academic

achievement and personal development while simultaneously providing opportunities for health promotion interventions [3]–[5]. Nevertheless, children from socioeconomically disadvantaged communities remain vulnerable to preventable health problems because of limited access to structured health education and insufficient awareness of healthy lifestyle practices [6].

One of the major public health concerns among elementary school children is the frequent consumption of unsafe snacks containing prohibited food additives, including rhodamine B, metanil yellow, borax, and formalin. These hazardous substances have been associated with acute toxicity, organ damage, and increased carcinogenic risk when consumed repeatedly [7]–[9]. In addition, inadequate food safety literacy reduces children's ability to identify unsafe food products, thereby increasing their exposure to potentially harmful substances [10], [11]. Poor oral hygiene constitutes another significant challenge. Despite evidence indicating that most childhood dental caries can be prevented through appropriate tooth-brushing practices, many children continue to demonstrate inadequate oral hygiene behaviors because of insufficient knowledge and improper brushing techniques [12]–[15]. Similarly, improper handwashing remains one of the leading contributors to the transmission of infectious diseases, particularly respiratory and gastrointestinal infections, among school-aged children [16], [17].

Recent advances in health education emphasize interactive and learner-centered approaches that integrate multimedia resources, gamification, visual demonstrations, and experiential learning to improve children's engagement and knowledge retention [18]–[22]. Compared with conventional lecture-based methods, these educational strategies have demonstrated greater effectiveness in facilitating behavioral understanding and encouraging active participation among young learners.

Despite these developments, several research gaps remain. First, most previous studies have evaluated interventions addressing only a single health topic, such as oral hygiene, food safety, or hand hygiene, rather than integrating multiple health issues into one comprehensive educational program [23]–[25]. Second, the majority of interventions have been implemented in formal school settings, whereas limited evidence exists regarding the effectiveness of community tutoring centers as alternative venues for health promotion among underserved children [23], [24]. Third, relatively few studies have examined interdisciplinary collaboration involving multiple health professions in delivering integrated health education, despite its potential to provide more comprehensive and sustainable community interventions [26].

Therefore, this community service initiative aimed to improve elementary school children's knowledge regarding three interconnected health domains: identification of harmful food additives in snacks, proper tooth-brushing techniques, and appropriate handwashing practices through an integrated, interactive health education program conducted at the Kenosis Tutoring Center in Surabaya. The principal contributions of this study are summarized as follows:

1. It proposes an integrated health education model that simultaneously addresses food safety, oral hygiene, and hand hygiene within a single community-based intervention.
2. It provides empirical evidence regarding the effectiveness of interactive, multimedia-assisted, and demonstration-based educational strategies in improving health knowledge among elementary school children from underserved communities.

3. It demonstrates the feasibility of interdisciplinary collaboration involving educators from multiple health disciplines to deliver comprehensive health promotion programs within community tutoring environments, thereby offering a practical model for future academic–community partnerships.

The remainder of this article is organized as follows. Section II describes the research methodology, including study design, participants, intervention procedures, data collection, and data analysis. Section III presents the results of the health education intervention. Section IV discusses the findings in relation to previous studies and highlights their practical implications and limitations. Finally, Section V concludes the study and outlines recommendations for future community-based health education programs.

II. METHODS

This community service study employed a quasi-experimental one-group pre-test–post-test design to evaluate the effectiveness of an integrated health education intervention in improving elementary school children's knowledge regarding food safety, oral hygiene, and hand hygiene [27]. The pre-test–post-test approach was selected because it enables the measurement of knowledge changes before and immediately after the intervention in a real-world community setting without disrupting the ongoing educational activities. As this initiative was conducted as a community service program rather than a clinical trial, the study did not include a control group or randomization procedure. The intervention was implemented on 9 January 2025 at the Kenosis Tutoring Center, Sidoyoso, Surabaya, East Java, Indonesia, a community-based educational institution established by GKA Gloria to provide free academic assistance for elementary school children from economically disadvantaged families.

A. STUDY POPULATION AND PARTICIPANTS

The target population comprised all elementary school students regularly attending the Kenosis Tutoring Center. A total of 35 children participated in the program using a convenience sampling technique based on attendance during the scheduled educational activity [28]. Participants were eligible if they were actively enrolled in grades 1–6, attended the tutoring center regularly, and obtained parental permission to participate in the educational activities. Children with cognitive or physical conditions that prevented participation in demonstrations or questionnaire completion were excluded. Because the objective of this study was to evaluate the educational intervention delivered to the entire available community, participant allocation was neither randomized nor stratified. This sampling strategy is commonly applied in community-based health promotion studies where accessibility and participant availability are the primary considerations [29].

B. INTERVENTION TEAM AND EDUCATIONAL MATERIALS

The intervention was conducted through interdisciplinary collaboration involving 21 lecturers and 11 undergraduate students from Poltekkes Kemenkes Surabaya. The implementation team represented five academic departments: Laboratory Technology, Nursing, Midwifery,

Nutrition, and Environmental Health. The multidisciplinary composition ensured that each educational topic was delivered by personnel with relevant professional expertise while promoting comprehensive health education from multiple healthcare perspectives [30].

Educational materials were developed specifically for elementary school children using age-appropriate language and interactive learning strategies. The intervention incorporated multimedia presentations, animated educational videos, songs, quizzes, games, demonstration models, toothbrushes, handwashing facilities, soap, and food samples illustrating prohibited food additives. These materials were selected to maximize children's attention, encourage active participation, and improve knowledge retention through visual, auditory, and kinesthetic learning experiences [31], [32].

C. INTERVENTION PROCEDURE

The intervention consisted of three sequential educational modules delivered during a single community service session, with each module lasting approximately 40–45 minutes.

The first module focused on food safety education, introducing children to hazardous food additives prohibited for food consumption, including rhodamine B, metanil yellow, borax, and formalin. Facilitators explained the health risks associated with each substance using multimedia presentations, followed by demonstrations using representative food products to help participants recognize visual characteristics of contaminated foods. Interactive discussions and question-and-answer sessions were conducted to reinforce children's understanding of safe snack selection [33].

The second module addressed proper tooth-brushing techniques. Participants received education regarding the importance of oral hygiene, recommended brushing frequency, brushing duration, and correct brushing angles. Large dental models and toothbrushes were used to demonstrate appropriate brushing techniques, after which children practiced individually under facilitator supervision to ensure correct procedural performance [34].

The third module focused on proper handwashing practices for infection prevention. Facilitators explained critical situations requiring hand hygiene, including before eating, after using the toilet, after playing, and after touching contaminated surfaces. The WHO six-step handwashing technique was demonstrated, followed by supervised practice using soap and running water to ensure each participant performed every step correctly [35].

D. DATA COLLECTION

Knowledge acquisition was assessed using structured questionnaires specifically developed for this intervention. Three separate questionnaires were prepared corresponding to the three educational modules. Each questionnaire consisted of 10 multiple-choice questions evaluating factual knowledge, procedural understanding, and the ability to distinguish healthy from unhealthy practices. Prior to implementation, the questionnaires were pilot-tested with children of comparable age to ensure clarity, readability, and age-appropriate wording [36].

Baseline knowledge was measured using a pre-test administered immediately before the educational intervention. Upon completion of all educational modules, participants completed an identical post-test to evaluate immediate knowledge improvement. To minimize literacy-related bias, facilitators read each question aloud while participants independently selected their answers. Each assessment required approximately 15 minutes to complete under standardized classroom conditions.

E. DATA ANALYSIS

The collected data were entered into Microsoft Excel 2019 and analyzed using descriptive statistical methods. Individual questionnaire scores were converted into percentages of correct responses, after which mean pre-test and post-test scores were calculated for each educational topic. Knowledge improvement was determined by comparing average scores before and after the intervention and calculating the percentage increase in learning outcomes. Because this community service evaluation involved a relatively small sample, lacked randomization, and did not include a comparison group, inferential statistical analyses were not performed. The findings are therefore presented descriptively to illustrate changes in participants' knowledge following the intervention [27].

F. ETHICAL CONSIDERATIONS

Institutional approval for implementing the community service program was obtained from Poltekkes Kemenkes Surabaya, while operational permission was granted by the management of the Kenosis Tutoring Center and GKA Gloria Sidoyoso. Parents were informed regarding the educational activities through the tutoring center coordinators, and verbal parental consent was obtained prior to participation. Child assent was also obtained before the intervention commenced. Participation was entirely voluntary, and all questionnaire responses were collected anonymously to maintain participant confidentiality. No personally identifiable information was recorded throughout the study.

III. RESULT

A. UNDERSTANDING THE SELECTION OF HEALTHY SNACKS WITH KNOWLEDGE OF HARMFUL FOOD ADDITIVES

Understanding the selection of healthy snacks with knowledge of harmful food additives (prohibited by the government in food) aims to raise children's awareness about the dangers of harmful food additives, which is done by:

1. Education through interactive media such as videos, songs, and games (FIGURE 1).
2. Education through discussion (FIGURE 2).
3. Direct approach with demonstrations and joint practice (FIGURE 3).

Food additives are substances added to food to enhance its flavor, color, texture, or shelf life. However, the use of harmful food additives, such as rhodamine B, metanil yellow, borax, and Formalin, is prohibited by the government because they can pose health risks. Rhodamine B is a synthetic dye used in the textile and cosmetic industries, not for food, often found in foods such as crackers, sauces, or brightly colored snacks (pink or red). The health hazards due

to the consumption of rhodamine B include causing skin, eye, and respiratory tract irritation, as well as increasing the risk of cancer (carcinogenic) if consumed over a long period. Characteristics of Food Containing Rhodamine B: bright red color that is unnatural, tends not to dissolve completely in water, leaving color stains on hands or mouth.



FIGURE 1. Education Through Interactive Media Such as Videos, Songs, and Games.



FIGURE 2. Education Through Discussion.



FIGURE 3. Direct Approach with Demonstrations and Joint Practice.

Metanil yellow is a synthetic yellow dye used in the textile and paper industries, not for food, and is often found in tofu, crackers, or brightly colored yellow cakes. The health hazards from consuming metanil Yellow include disrupting liver and kidney function, gastrointestinal irritation, and potential cancer risk. Characteristics of Food Containing Metanil Yellow: bright and unnatural yellow color, unstable when soaked in hot water.

Borax is a chemical compound used in wood preservatives, detergents, and cleaning industries, often found in meatballs, noodles, or crackers to provide a chewy texture or longer shelf life. Danger: The health issues caused by borax consumption include digestive tract disturbances (nausea, vomiting, diarrhea), liver and kidney function disorders, as well as the risk of acute or chronic poisoning. Characteristics of food containing borax are an extremely chewy and unnatural texture (for example, meatballs or noodles), not easily crumbled even when squeezed, and if thrown on the floor, it will bounce high.

Formalin is a solution of formaldehyde used to preserve corpses and laboratory materials, often illegally used to preserve tofu, fish, or wet noodles. The health hazards of

consuming formalin include skin, eye, and respiratory tract irritation; liver, kidney, and nerve function disorders; and cancer risk if consumed continuously. Characteristics of food containing formalin are that it does not easily spoil even when stored for a long time, the texture of the food is too hard or chewy, and it has a pungent chemical-like smell. Avoid harmful additives is Buy from a trusted seller: make sure the food comes from a clear source and its safety is guaranteed.

- Check the food label: verify the distribution permit from BPOM or the halal certification.
- Avoid brightly colored foods: choose foods with natural colors.
- Conduct a simple test at home:
- Rhodamine B is soaked in water; observe if there is any striking color.
- Borax, the chewiness test for meatballs or noodles. Formalin, check the food's shelf life; if it lasts too long without proper preservation, beware of formalin.

B. UNDERSTANDING THE PROPER WAY TO BRUSH TEETH

This activity aims to raise awareness among school-aged children about the importance of brushing teeth properly to maintain dental and oral health, as dental and oral diseases, such as cavities and gum disease, often occur due to incorrect or irregular brushing habits. As shown in **FIGURE 4**, the facilitators demonstrated correct brushing techniques to children using visual aids and direct practice to enhance comprehension and engagement. Data shows that 90% of dental problems can be prevented with proper dental care. The benefits of diligently brushing teeth include preventing cavities, as regular brushing cleans plaque and food residues; avoiding bad breath because brushing reduces bacteria that cause unpleasant odors; preventing gum disease that leads to gingivitis; and maintaining overall body health since oral infections can affect body health, such as increasing the risk of heart disease. The right time to brush your teeth is twice a day, namely in the morning after breakfast and at night before bed, with a duration of at least 2 minutes each time brushing.



FIGURE 4. Health Education Session Demonstrating Correct Tooth Brushing Techniques for Elementary School Children at The Kenosis Tutoring Center, Surabaya.

Washing hands is a simple yet very important step to prevent the spread of germs and diseases. As shown in **FIGURE 5**, the facilitators conducted a counseling and demonstration session on proper handwashing techniques, allowing children to practice the six recommended steps under supervision. Proper handwashing habits can protect oneself and others from infections such as diarrhea, influenza, and COVID-19. The importance of washing hands is:

- It is to reduce the spread of disease because hands can be the main medium for germ transmission.
- Prevent infections by regularly washing hands; you can reduce the risk of respiratory and digestive tract infections.
- Protecting those around you because the germs on your hands can transfer to other objects or people through touch.



FIGURE 5. Counseling On Hand Washing

TABLE 1.
Results of Evaluating the Understanding of Tutoring Students at
Kenosis GKA Gloria Region, Sidoyoso.

Activities	Average Pre Test	Average Post Test	Conclusion
Understanding the selection of healthy snacks with knowledge of harmful food additives	60,2	70,5	Increase in knowledge
Understanding the Proper Way to Brush Teeth	60,0	75	Increase in knowledge
Understanding Good and Proper Handwashing Habits	60,0	75	Increase in knowledge

Based on the results of the questionnaire in [TABLE 1](#), which was carried out by the service team for GKA kenosis tutoring children before and after the counseling, the results showed that there was an increase in knowledge about the selection of healthy snacks, with knowledge of harmful food additives, the Proper Way to Brush Teeth, and Good and Proper Handwashing Habits.

IV. DISCUSSION

A. INTERPRETATION OF FINDINGS AND COMPARISON WITH PREVIOUS STUDIES

The present community-based health education intervention demonstrated a positive effect on improving elementary school children's knowledge across the three targeted health domains, namely food safety, oral hygiene, and hand hygiene. The increases observed in the post-test scores indicate that the educational strategies successfully enhanced participants' understanding of essential health practices immediately after the intervention. Specifically, knowledge regarding harmful food additives increased from a mean score of 60.2 to 70.5, whereas knowledge related to proper tooth-brushing techniques and correct handwashing procedures both improved from 60.0 to 75.0. These findings suggest that the integrated educational approach effectively addressed multiple health topics within a single intervention while maintaining satisfactory learning outcomes across all modules.

The observed improvement can be attributed to the use of interactive learning strategies that combined multimedia presentations, demonstrations, educational games, guided discussions, and supervised practice. Such an approach encourages active participation rather than passive information reception, allowing children to understand health concepts through multiple sensory channels. Young learners generally demonstrate greater engagement when educational content is delivered through visual illustrations, practical demonstrations, and participatory activities, thereby improving information retention and facilitating meaningful learning experiences. Consequently, the intervention not only increased factual knowledge but also strengthened children's procedural understanding of healthy daily behaviors.

Among the three educational topics, the greatest improvement was observed in tooth-brushing and handwashing knowledge, each demonstrating a 25% increase in mean scores. These findings may be explained by the procedural nature of both skills. Unlike conceptual topics requiring analytical judgment, procedural health behaviors can be directly demonstrated and immediately practiced by participants. The availability of enlarged dental models, toothbrushes, handwashing stations, soap, and facilitator supervision enabled children to imitate each step correctly and receive immediate feedback, thereby reinforcing learning through experiential practice. In contrast, identifying harmful food additives requires participants to recognize abstract concepts, distinguish characteristics of prohibited substances, and evaluate food products based on visual indicators. Such higher-order cognitive processes may explain why the improvement in food safety knowledge (17.1%) was comparatively lower despite remaining educationally meaningful.

These findings are consistent with previous literature demonstrating the effectiveness of interactive health education among elementary school children. Pratama et al. [37] reported that children from underserved communities generally possess limited baseline health literacy, making structured educational interventions particularly beneficial for improving their understanding of preventive health behaviors. Similarly, Wilson et al. [38] found that visual learning supported by authentic food samples significantly improves children's ability to identify unsafe food products compared with conventional classroom instruction alone. The current findings support these observations by demonstrating that practical demonstrations facilitated children's recognition of hazardous food additives and promoted more informed snack selection.

The effectiveness of demonstration-based learning was also evident in the oral hygiene component of this study. Nakamura et al. [39] demonstrated that three-dimensional dental models substantially improve children's comprehension of appropriate brushing techniques because complex movements become easier to visualize and imitate. Comparable outcomes were observed in the present intervention, where direct demonstrations followed by supervised practice enabled participants to master correct brushing procedures more effectively than theoretical explanations alone. Likewise, Ibrahim et al. [40] emphasized that combining WHO-recommended handwashing demonstrations with supervised practice significantly

enhances children's procedural knowledge and compliance with infection prevention measures. The similar improvement observed in the present study further confirms that practical demonstration remains one of the most effective educational strategies for teaching hygiene-related behaviors among school-aged children.

Overall, the findings demonstrate that integrated, interactive, and demonstration-based health education can effectively improve children's knowledge within a relatively short intervention period. The consistency of improvements across all educational domains suggests that combining multimedia resources with experiential learning provides an appropriate instructional model for community-based health promotion programs. Furthermore, the successful implementation within a non-formal educational environment indicates that community tutoring centers can complement formal schools in promoting preventive health education, particularly among children from socioeconomically disadvantaged backgrounds.

B. COMPARISON WITH PREVIOUS STUDIES, STRENGTHS, AND PRACTICAL IMPLICATIONS

The findings of this study are generally consistent with previous investigations evaluating interactive health education among elementary school children. Nevertheless, several distinctive characteristics differentiate the present intervention from earlier studies, particularly regarding the integration of multiple health topics, the implementation setting, and the interdisciplinary delivery model. These unique features provide additional evidence supporting the applicability of community-based health promotion programs outside formal educational institutions.

Regarding food safety education, the 17.1% improvement observed in children's knowledge is comparable with findings reported by Chen et al. [41], who argued that food safety education requires relatively higher cognitive processing than procedural health skills because children must identify hazardous ingredients, evaluate product characteristics, and distinguish safe from unsafe food choices. Consequently, improvements in food safety knowledge are often more gradual than improvements in procedural competencies. The current findings support this interpretation, suggesting that although children successfully acquired essential knowledge regarding prohibited food additives, repeated educational exposure may be required to develop stronger analytical skills for independent food selection in everyday situations.

The oral hygiene component also demonstrated favorable outcomes when compared with previous intervention studies. Sharma et al. [42] reported that demonstration-based tooth-brushing education significantly improved children's knowledge and brushing performance in rural elementary schools, emphasizing the importance of visual learning supported by practical exercises. Although the magnitude of improvement in the present study was similar, the intervention achieved these outcomes within a single educational session conducted in a community tutoring center rather than a formal school. This finding suggests that non-formal educational environments can successfully complement school-based oral health promotion when appropriate instructional strategies are employed.

Furthermore, the improvement observed in handwashing knowledge aligns with the systematic review conducted by Martinez et al. [43], which concluded that interactive hygiene education consistently produces moderate to substantial improvements in children's understanding of infection prevention. However, the review also highlighted that knowledge acquisition alone does not necessarily translate into sustained behavioral change. Consistent with this observation, the present study evaluated only immediate knowledge improvement and therefore cannot determine whether participants maintained appropriate handwashing practices after the intervention. Consequently, future educational programs should include follow-up assessments to determine whether improved knowledge is retained and translated into routine healthy behavior.

An additional strength of the present study lies in its implementation within a community tutoring center serving children from economically disadvantaged families. Previous research has predominantly examined health education programs conducted in formal school environments equipped with established educational infrastructure. Foster et al. [44] emphasized that community-based educational facilities remain underutilized despite their considerable potential to reach vulnerable populations that may have limited access to comprehensive school health programs. The successful implementation of the present intervention supports this perspective by demonstrating that community tutoring centers provide a practical and accessible platform for delivering preventive health education among underserved children.

Another important contribution of this study is the interdisciplinary collaboration involving faculty members and students from five health disciplines. Unlike many previous interventions delivered by a single professional group, the present program integrated expertise from laboratory technology, nursing, midwifery, nutrition, and environmental health. Thompson et al. [45] reported that interdisciplinary collaboration enhances both the quality and comprehensiveness of pediatric health education because it combines complementary professional perspectives and promotes more holistic learning experiences. The current findings reinforce this conclusion by illustrating that collaborative educational delivery can simultaneously address food safety, oral hygiene, and infection prevention without reducing instructional effectiveness.

From a practical perspective, the findings provide several implications for future community health promotion initiatives. First, integrating multiple health topics into one educational program may improve implementation efficiency while reducing logistical demands compared with conducting separate interventions. Second, interactive educational methods incorporating multimedia presentations, demonstrations, and supervised practice should be prioritized when designing health promotion activities for elementary school children because these approaches encourage active participation and improve knowledge acquisition. Third, partnerships between higher education institutions and community organizations represent an effective strategy for expanding health education beyond conventional school settings. Such collaborations not only strengthen community engagement but also provide experiential learning opportunities for health professional students while

simultaneously addressing important public health needs. Collectively, these practical implications support broader implementation of integrated community-based health education programs as an effective strategy for improving children's health literacy and promoting preventive health behaviors.

C. LIMITATIONS, FUTURE DIRECTIONS, AND OVERALL IMPLICATIONS

Although the present study demonstrated that an integrated health education intervention effectively improved children's knowledge regarding food safety, oral hygiene, and hand hygiene, several limitations should be acknowledged when interpreting the findings. Recognizing these limitations is important for assessing the generalizability of the results and identifying opportunities for methodological refinement in future community-based health promotion research.

The first limitation concerns the study design. The intervention employed a one-group pre-test–post-test approach without incorporating a control group or random allocation of participants. While this design is appropriate for evaluating educational activities conducted in community settings, it limits the ability to establish a causal relationship between the intervention and the observed improvements in knowledge. External influences, such as children's previous educational experiences or informal discussions among participants during the activity, may also have contributed to the post-test outcomes. Experimental or cluster-randomized studies involving comparable control groups would provide stronger evidence regarding the effectiveness of integrated health education interventions [46].

A second limitation relates to the relatively small sample size and the use of convenience sampling. The intervention involved only 35 participants from a single tutoring center in Surabaya, representing children from one community with similar socioeconomic backgrounds. Consequently, the findings should not be generalized to broader populations without careful consideration of contextual differences. Educational environments, cultural practices, parental involvement, and socioeconomic characteristics may substantially influence children's baseline health knowledge and responsiveness to educational interventions. Future studies should therefore recruit participants from multiple schools and community learning centers across different geographic regions to improve the external validity and representativeness of the findings [47].

Another important limitation is that outcome evaluation was restricted to immediate knowledge acquisition following the intervention. Although significant improvements were observed in post-test scores, the study did not assess whether the acquired knowledge was retained over time or translated into sustained behavioral changes. Knowledge improvement represents only the initial stage of health behavior development, whereas meaningful public health impact depends on the long-term adoption of healthy practices. For example, understanding the correct tooth-brushing technique does not necessarily guarantee that children will consistently brush their teeth appropriately at home. Likewise, recognizing hazardous food additives may not always influence purchasing behavior when unhealthy food options remain widely available. Longitudinal studies incorporating follow-up assessments after several weeks or months would

provide valuable evidence regarding knowledge retention and behavioral maintenance [48].

The present study also focused exclusively on cognitive outcomes measured using structured questionnaires. Although knowledge is an essential determinant of health behavior, other psychosocial factors including attitudes, motivation, parental support, peer influence, school policies, and environmental accessibility may substantially affect children's implementation of healthy practices. Future investigations should therefore adopt more comprehensive evaluation frameworks by integrating behavioral observations, parental questionnaires, qualitative interviews, or mixed-methods approaches. Such multidimensional assessments would provide a deeper understanding of how educational interventions influence both knowledge acquisition and actual behavioral change within children's everyday environments [49].

Despite these limitations, the present study offers several important contributions to community health promotion practice. The successful implementation of an integrated educational program demonstrates that multiple preventive health topics can be delivered effectively within a single intervention using interactive learning strategies. This integrated approach may improve program efficiency by reducing implementation costs and maximizing educational opportunities without compromising learning outcomes. Furthermore, the study highlights the value of interdisciplinary collaboration among health professionals and academic institutions in designing and implementing community service initiatives that address multiple public health priorities simultaneously.

The findings also emphasize the strategic role of non-formal educational institutions, such as community tutoring centers, as complementary settings for preventive health promotion. Children who attend these centers often represent vulnerable populations with limited access to structured health education. Establishing sustainable partnerships between universities, community organizations, and local governments may therefore expand the reach of preventive health programs while strengthening community engagement. Repeated educational sessions, age-specific learning materials, parental involvement, and periodic monitoring should be incorporated into future interventions to enhance long-term effectiveness and encourage sustainable healthy behaviors.

Overall, this study provides practical evidence that integrated, interactive, and community-based health education represents a feasible strategy for improving health literacy among elementary school children. Although additional research using more rigorous methodologies is warranted, the present findings contribute valuable preliminary evidence supporting the broader implementation of interdisciplinary health education programs within community learning environments. Such initiatives have the potential to promote healthier lifestyles, reduce preventable childhood health problems, and support national efforts toward strengthening preventive healthcare through community participation.

V. CONCLUSION

This community-based health education intervention was designed and implemented with the primary objective of

enhancing elementary school children's knowledge and awareness regarding three critical health domains: the identification and avoidance of harmful synthetic food additives in snacks, proper tooth brushing techniques for oral hygiene maintenance, and correct handwashing procedures for infection prevention. The intervention, conducted at the Kenosis tutoring center in Sidoyoso, Surabaya, demonstrated measurable improvements across all targeted knowledge areas. Specifically, children's understanding of harmful food additives, including rhodamine B, metanil yellow, borax, and formalin, increased from a mean pre-test score of 60.2 to a post-test score of 70.5, representing a 17.1% improvement. Knowledge of proper tooth brushing techniques exhibited substantial enhancement, with mean scores rising from 60.0 to 75.0, corresponding to a 25% increase. Similarly, comprehension of correct handwashing habits demonstrated equivalent improvement, advancing from a mean score of 60.0 to 75.0, also representing a 25% gain. These quantitative outcomes provide empirical evidence supporting the effectiveness of interactive, demonstration-based educational methodologies in improving health literacy among elementary school-aged children in community tutoring settings. The successful implementation of this multi-topic intervention through interdisciplinary collaboration among faculty and students from five health disciplines demonstrates the feasibility and value of academic-community partnerships in delivering comprehensive health education to vulnerable pediatric populations. However, several directions for future research and program development warrant consideration. Longitudinal follow-up studies are essential to assess the durability of knowledge gains and, more critically, to evaluate whether acquired knowledge translates into sustained behavioral changes in daily food selection, oral hygiene practices, and hand hygiene habits. Future interventions should incorporate repeated educational sessions and environmental modifications to reinforce learned behaviors and facilitate their integration into routine practices. Additionally, controlled experimental designs with comparison groups would strengthen causal inferences regarding intervention effectiveness. Expansion of such programs to additional community-based educational settings, coupled with systematic evaluation of implementation processes and cost-effectiveness, would inform evidencebased scaling strategies. Finally, investigation of optimal strategies for engaging parents and community stakeholders in reinforcing health education messages could enhance intervention impact and sustainability, ultimately contributing to improved health outcomes among children in underserved communities.

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DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

AUTHOR CONTRIBUTION

Juliana Christyaningsih, Suliati, Lully Hani Endarini, Museyaroh, and Evy Diah Woelansari (Department of Laboratory Technology) contributed to the conceptualization, design of the food additive education module, and data analysis. Yuni Ginarsih, Kiaonarni O.W., Teresia Retna P., Lembunai Tat Alberta, and Yohanes Kambaru W (Department of Nursing) designed and delivered the handwashing education module. Kasiati, Rahayu Sumaningsih, Evi Yunita Nugrahini, Teta Puji Rahayu, Nurwening TW, Hery Sumasto, Ira Puspita Sari, and Ira Rahayu Tiyyar (Department of Midwifery) developed and implemented the tooth brushing education module. Mujayanto and Nuning Marina Pengge (Department of Nutrition) provided expertise in food safety content development. Pratiwi Hermiyanti (Department of Environmental Health) contributed to intervention planning and health promotion strategies. All authors participated in data collection, reviewed and approved the final manuscript, and agreed to be accountable for all aspects of the work.

DECLARATIONS

ETHICAL APPROVAL

Ethical approval is not available.

CONSENT FOR PUBLICATION PARTICIPANTS

Consent for publication was given by all participants.

COMPETING INTERESTS

The authors declare no competing interests.

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