Pilot Study

Role of Nutrition Education in Improving Nutritional Knowledge, Attitude, and Practices of School-Going Adolescents Regarding Healthy Eating: A Pilot Study

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ABSTRACT

Background: Adolescents become vulnerable to malnutrition due to growth spurts and various environmental and social factors. This makes nutritional knowledge crucial for them to influence their dietary habits which would ensure their nutrient needs by improving their attitude and practices. For this purpose, schools are considered primary targets for implementing education programs that would enhance knowledge, attitude and practice (KAP) among adolescents. Therefore, this study aims to evaluate the effectiveness of nutrition education intervention on students' KAP while also developing structured and evidence-based nutrition education materials for school-going adolescents regarding healthy eating practices.

Methods: A quasi-experimental pre-test post-test study was conducted among 33 school-going adolescents, aged 09-12 years, studying in grade 4 and 5. This sample was selected through convenience sampling technique. Over the period of 2 months. Students received nutrition education through 4 lectures (1 lesson/week) and educational leaflets in group sessions lasting for 45-50 minutes. Normality of pre-post differences was assessed using Shapiro-Wilk test. Paired t-test or Wilcoxon Signed Rank test was used to analyze changes in KAP and Healthy Eating Index scores, as appropriate. A p-value of <0.05 was considered statistically significant.

Results: A highly significant improvement in the total KAP score (p=0.00) and the Healthy Eating Index score (p=0.00) were observed. Knowledge score also showed a highly significant improvement (p=0.00), suggesting enhanced understanding among the students. However, no statistically significant changes were observed in the attitude and practice score (p>0.05).

Conclusion: This study concludes that nutrition education intervention was effective in increasing nutritional knowledge and healthy eating habits among school-going adolescents. These findings emphasize on the importance of a structured nutritional education intervention program that would improve knowledge, attitude and practices of adolescents, thereby promoting healthy dietary habits in the cohort.

Keywords: *Adolescent, Attitudes, Diet, Education, Health, Knowledge, Practice, Schools*

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INTRODUCTION

Adolescence is typically defined as the age between 10 and 19 years and represents a transition of an individual from childhood to adulthood. However, as transition into adolescence is a gradual process therefore, studies have assessed nutrition-related knowledge and health habits in younger population, starting from 9 years of age, as well[1]. There are approximately 1.3 billion adolescents globally, accounting for nearly 16% of the world's population, making adolescent health a major public health priority[2]. The adolescence period is crucial for human development and lays the foundation of lifelong health. This period is an opportune window for health promotion, as any interventions implemented during adolescence can foster healthy behaviors and reduce the risk of lifestyle-related chronic diseases later in life[3]. Adolescents experience rapid physical growth, cognitive maturation, and psychosocial development, all of which greatly influence their attitudes, behaviors, decision-making abilities, and interactions with the environment[4].

As this age group begin to exercise greater autonomy over their decisions surrounding food, i.e., food choices and behavior, this stage serves as an excellent opportunity to cultivate positive dietary habits and encourage responsibility for personal health. Interventions targeting this age group can yield both immediate and long-term health benefits[5]. The adolescence years is a critical period for the development of many risk factors associated with chronic diseases in adulthood. Due to limited nutrition education, this population

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remain unaware of the long-term consequences of unhealthy eating patterns and dietary behaviors[6]. Despite this, they represent the future workforce and parents; they still receive insufficient attention in national and governmental nutrition programs[2].

This population in the school-going age face multiple nutrition challenges due to social influences and rapidly changing food environments. The consumption of energy-dense, nutrient-poor foods, engaging in late-night snacking, frequent intake of fast food and sugar-sweetened beverages, and skipping regular meals are common behaviors, especially in low and middle-income countries, as evidenced by various studies[7]. These unhealthy patterns of diet give rise to a double burden of malnutrition, particularly in low and middle-income countries, where overweight and obesity coexist with micronutrient deficiency and undernutrition[8]. This duality can serve as a burden, increasing the risk of non-communicable diseases later in life and poor academic performance at present[9].

Knowledge, attitude, and practice (KAP) assessment is an approach that is widely used in public health nutrition to understand behaviors related to nutrition and determinants influencing dietary choices. The assessment of how an individual perceives healthy eating, how much they know about nutrition, and how these perceptions translate into their daily practices lays the foundation for designing effective nutrition education programs. The theory of nutrition education emphasizes the importance of assessing cognitive and psychosocial factors before intervention implementation, as these factors strongly influence behavior change[10]. Additionally, KAP surveys are valuable tools to assess the effectiveness of nutrition education plans and interventions by drawing a comparison between pre and post intervention changes[11].

Nutrition education plays a significant role in improving the nutrition knowledge of adolescents and to shape positive attitude in them towards healthy eating. Studies show that properly structured nutrition education interventions improve nutrition knowledge and awareness significantly in school-going adolescents[12]. Furthermore, school- based nutrition education has been associated with choices that are healthier, although such interventions must be sustainable enough to produce meaningful changes in nutrition knowledge and dietary practices[13].

The importance of early school-based nutrition interventions is well established as dietary habits established during the period of early adolescence often persist into adulthood[14]. Schools, therefore, serve as an ideal platform for nutrition education due to a structured environment and consistent access to adolescents[2]. However, limitations persist in many developing countries, such as inadequate integration of nutrition education in school curricula and reliance on sporadic awareness sessions without continuity and evaluation. These gaps limit adolescents' ability to develop sustainable, healthy eating behaviors[15].

Despite the presence of various global evidence in support of school-based nutrition education interventions, there is limited research from many low- and middle-income countries, with notable scarcity of well-designed and context-specific studies. A systematic review on the lifestyle interventions among adolescents in these settings showed that there are substantial gaps and a scarcity of well-designed school-based interventions. In countries, including Pakistan, context-specific evidence that evaluates the KAP of adolescents is particularly limited, emphasizing the need for localized pilot-scale research[16]. Pilot studies are essential to assess the feasibility, adaptability, sustainability, and preliminary effectiveness of nutrition education interventions before large-scale interventions [17]. Furthermore, existing studies often lack the use of standardized international guidelines and validated assessment tools, resulting in gaps in methodology and limited reproducibility of findings across settings.

To address these gaps, the KAP study was designed and conducted as a pilot intervention to assess the feasibility, adaptability, and effectiveness of a structured nutrition education program among adolescents. This study is among the first in Pakistan to implement a KAP-based assessment using a validated tool aligned with international guidelines, ensuring methodological consistency and reliability. Additionally, the educational intervention was developed in accordance with established global nutrition education frameworks, increasing its relevance and applicability. Standardized assessment methods integrated with context-specific adaptations, including cultural modification, this study aims to generate initial evidence that can inform larger-scale interventions and contribute to strengthening adolescent nutrition research in similar settings.

METHODOLOGY

Study Design and Population:

The study utilized quasi-experimental (one-group pretest-posttest) design. The group consisted of 33 school-going adolescents, aged 09-12 years, selected through convenience sampling technique.

Study Setting and Recruitment:

Lahore is the largest city of Punjab with a substantial population of adolescents, where various school nutrition programs are being carried out, either by the government or through different Non-Government Organizations[18,19]. These nutrition initiatives are more focused on public schools; therefore, the population of private schools often experiences lack of such structured programs.

For this purpose, a list of 5,233 private schools in Lahore district was obtained from the Government of the Punjab[20]. This was narrowed down to one populous Lahore City Tehsil, which listed 1,467 schools. Multiple private schools with relevant study population were situated in Iqbal Town, therefore 11 schools of this area were reached out by researchers. Out of these some schools rejected and others postponed beyond the dedicated timeline. One school agreed to participate and met the eligibility requirements.

Study Duration:

This study was conducted over the course of two months. Pre-testing was carried out in the first week, then, nutrition education was provided through 4 structured lessons with equal intervals (1 lesson/week). Post-test questionnaire was administered 2 weeks after the intervention.

Selection Criteria:

Adolescence with age between 9 to 12 years, having no diagnosed physical or psychological condition. Written consent to participate in the study from the school, parents and assent from students. Those who showed 20% absence in the lectures for past 2 week will be excluded.

Data Collection Tool and Technique:

A quasi-experimental study (pretest-posttest design) was carried out to assess the change in students' knowledge, attitude and practice as a result of nutrition education. Data collection was divided into 3 phases for feasibility and understanding.

Phase 1: According to the methodological guidelines of pilot studies, a sample size of 30 is adequate to assess the feasibility and acceptability of pilot studies[21]. In the first phase, a sample of 33 students was selected through convenience sampling technique from a private school in Lahore. After taking formal consent from school administration and students' parents, assent from adolescents was also ensured. The students were briefed about the study design and its objectives to ensure voluntary participation. The study was then proceeded with pretesting. A close-ended questionnaire was utilized to record demographic data (age, gender and family history), anthropometric measurements (height, weight and BMI) and KAP.

Anthropometric measurements were obtained by trained nutritionists and researchers who measured height and weight with calibrated scales. The students were asked to remove shoes for accurate measurement. The two variables were measured as follows:

- **Height:** Height was recorded in inches, using a stadiometer
- **Weight:** Weight was measured in kg using an analog weighing scale

Using the two variables, the Body Mass Index (BMI) of each students was calculated and categorized according to WHO criteria for BMI scores of 5–19-year-olds[22]. According to these guidelines, the z-score evaluation for BMI-for-age was used to categorize the students and deduce an overall trend in target population. The students were categorized as follows:

- BMI-for-age z-score < - 2 SD - underweight
- BMI-for-age z-score ≥ - 2 SD to + ≤ 1SD - normal
- BMI-for-age z-score > + 1SD to ≤ +2 SD - overweight
- BMI-for-age z-score > +2 SD – obesity

Following this, a pre-designed KAP questionnaire, referenced in a previous study, was used to assess the nutritional knowledge, attitude and practices of the students[11]. This questionnaire was tailored according to the cultural context of Pakistan and the study-specific lectures that followed. It was divided into three sections, each constituting 10 questions.

Knowledge was assessed with 10 close-ended questions with yes/no options. The scoring criteria applied was:

- Correct = 1
- Incorrect = 0

Next followed the section that asked attitude relevant questions. These were also 10, but used Likert Scale throughout. The scoring was done as follows:

- Definitely no = 0
- Somewhat no = 1
- Somewhat yes = 2
- Definitely yes = 3

The final part of the questionnaire assessed practice. The primary structure of this part was a Food Frequency Questionnaire referenced from a previous study[23]. The food items in the food groups were changed to reflect cultural practices and local availability. As the modifications were in the respective food groups that is why the scoring criteria of the referenced article remained unchanged. Each food group was assigned scores for various answers. This modified FFQ was first analyzed by a researcher and then administered to 10 randomly selected adolescents to assess its relevance.

- Never or almost never = 0 times/day
- Less than once a week = 0.06 times/day
- Once a week = 0.14 times/day
- 2–4 times/week = 0.43 times/day
- 5–6 times/week = 0.79 times/day
- Every day = 1 time/day
- Several times a day = 2 times/day

The Healthy Eating Index scores obtained from the questionnaire were converted to percentages and categorized as they had been in previous studies as well[11].

- Low = ≤ 33.33%
- Medium = ≤ 66.66%
- High = > 66.66%

Phase 2: Pretesting was subsequently followed by intervention that was planned and carried out accordingly. Nutrition education comprising 4 lectures; 1 lesson per week was planned. Each lesson was 45-50 minutes long and was delivered through digital presentations. These lessons were planned for targeted age groups and were based on evidence-based guidelines from organizations such as World Health Organization, UNICEF, and FAO[24-27]. The modules were designed by modifying the international guidelines according to the cultural practices of the students. These lectures were curated as follows:

- Lesson 1: Balanced Diet

To initiate our intervention, the students were introduced to the fundamentals of nutrition. Keeping it simple and easy to understand, the students were first taught about macronutrients (carbohydrate, protein and fats) along with essential components of the diet such as dietary fiber, water and micronutrients[24].

- Lesson 2: Healthy Eating Habits and Portion Size

The second lecture was conducted exactly a week by the same team of trained nutritionists. Connecting it to the previous session the students were taught about principles of healthy eating and maintaining a balanced diet. The difference between healthy and unhealthy snacks as well as appropriate portion sizes were introduced in this lecture[25].

- Lesson 3: Food Labels

In the third week, the students were educated about reading food labels. They were practically shown different labels on different food items for better clarity. In this lecture all four sections of food labels; nutrition label, serving size, % daily value and calories, all were explained to them. At the end of the lecture a game of word puzzle was played with every student to help them retain the information[26].

- Lesson 4: Implications of Poor Eating Habits

The concluding lecture comprised little recap of the previous three lectures while emphasizing on the long-term consequences of poor dietary habits. Through visual representation, the students were shown a side-by-side comparison of the physical benefits of healthy eating and the implication of poor eating. The session discussed the results of unhealthy dietary habits such as, consumption of excessive sugar, added salt, trans fat and over-consumption of processed foods while encouraging balance in eating patterns[27].

Overall; the researchers taught the students about the basic facts of each food group, the serving size of each food in the list and provided them with sufficient knowledge of nutrition so that they may make informed choices regarding their eating habits. All lectures were delivered by the same team to maintain consistency in content delivery. Nutrition education tools such as My Plate, Food Guide pyramid and Hand Jive rule were explained in the lectures. Activities such as mini quiz were held at the end of each lecture to ensure active engagement of the students. Educational leaflets were provided to help them understand the best

sources of each food group to be used in their diet.

Phase 3: After completing all the lectures, the students were given post-test KAP questionnaire to fill in, that would assess the impact of this nutrition education intervention, on their knowledge, attitude and dietary practices.

Data Analysis:

Descriptive (percentages and frequencies) and inferential statistics were used for categorical variables (KAP scores) and mean standard deviation was used for continuous variables (age, BMI, height). For normally distributed data paired t-test was used to compare and observe the effect of nutrition education before and after intervention. For non-normally distributed data, the Wilcoxon signed rank test was applied to compare KAP scores. For both the p-value of less than 0.05 was considered significant. After analysis, data was presented in the form of tables and graphs. Data analysis was statistically analyzed by using SPSS version21.

Ethical Consideration

Following the ethical guidelines, an official permission letter was obtained from the Department of Public Health, University of the Punjab. Written consent was taken from the school authority before. The students were informed about the purpose of this study design before data collection and written consent of the parents/ guardians was also obtained to ensure voluntary participation of the children. Moreover, confidentiality of the data was maintained.

RESULTS

The mean age of the student was 10.39±0.86 with a height of 56.50±4.13 inches and weight of 35.75±11.0 kg as shown in (Table 1).

Table 1. Baseline Characteristics of Study Students

Baseline Characteristics	Mean ± SD	P-Value[a] (Shapiro Wilk)
Demographic Characteristic		
Age (years)	10.39±0.86	0.00[c]
Anthropometric measurements		
Height (inches)	56.50±4.13	0.49[b]
Weight (kg)	35.75±11.0	0.22[b]

Note: *[a]Shapiro-Wilk test assesses normality of continuous variables, [b]p-value>0.05 indicates normal distribution, [c]p-value<0.05 indicates data not normally distributed.*

Out of 33 students, 60.79% had the healthy weight as per the BMI criteria, followed by 15% students who were underweight. Only 3.09% were obese. The details are depicted in (Figure 1).

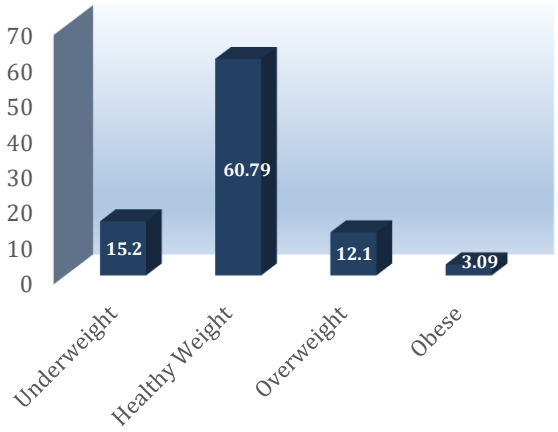


Figure 1: Distribution of Body Mass Index

There was a significant improvement in healthy eating scores and KAP score after 4 weeks of intervention (p=0.00). Prior to the intervention, the vast majority of students exhibited moderate diet quality (90.9%), with only 6.1% achieving a high Healthy Eating Index (HEI) score and 3% falling into the low tier. Post-intervention results demonstrate a clear upward shift across categories. The low-adherence tier was completely eliminated (0%), while the moderate tier contracted to 69.7% as students migrated upward, nearly quintupling representation in the high HEI bracket (30.3%) (Figure 2). The overall KAP score improved from 15.53±2.68 to 18.14±3.22 (p=0.00), with knowledge improvement from 4.33±1.76 at baseline to 6.58±1.95 post intervention. Non-significant results (0.58) were shown in the attitude scale of students with baseline value at 7.37±1.63 to 7.44±1.61 post intervention. Practice score again showed non-significant results (p=0.19) with baseline value at 3.82±1.13 to 4.08±1.24 post intervention (Table 2).

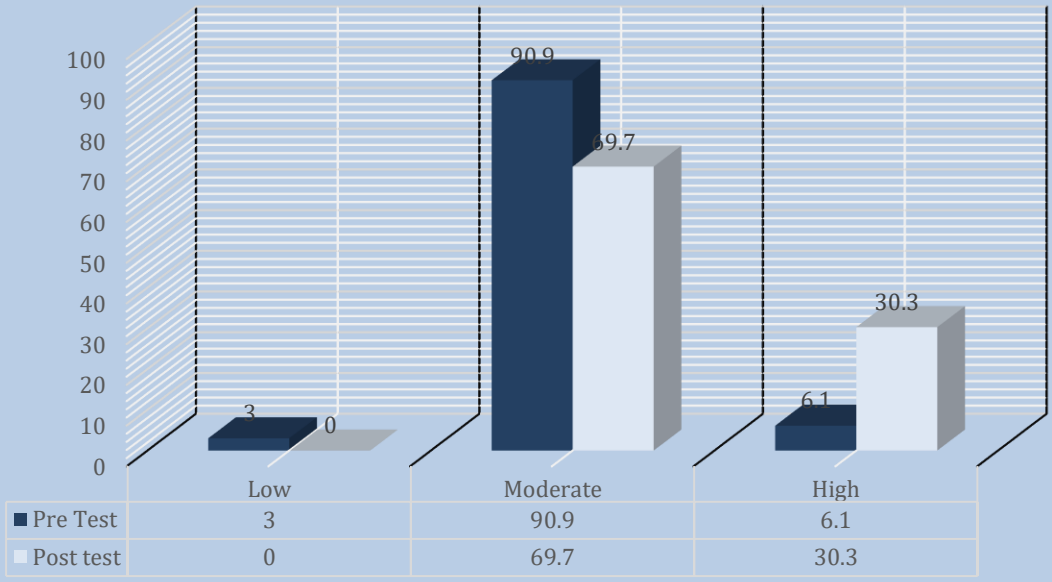


Figure 2 Showing Pre-Post Values for Healthy Eating Index

Table 2. Pre- and Post-intervention Knowledge, Attitude and Practice (KAP) and Healthy Eating Index Scores of the Students

	Mean ± SD	Shapiro Wilk	Percent Difference[f]	P-Value[d] (Paired t-test)	P-Value[e] (Wilcoxon signed-rank test)
Knowledge score (pre-test)	4.33±1.76	0.20[b]	51.96%	-	0.00***
Knowledge score (post-test)	6.58±1.95	0.00[c]			
Attitude score (pre-test)	7.37±1.63	0.12[b]	0.95%	0.58[ns]	-
Attitude score (post-test)	7.44±1.61	0.20[b]			
Practice score (pre-test)	3.82±1.13	0.10[b]	6.81%	-	0.19[ns]
Practice score (post-test)	4.08±1.24	0.01[c]			
Total KAP Score (Pre-test)	15.53±2.68	0.97[b]	16.81%	0.00***	-
Total KAP Score (Post-test)	18.14±3.22	0.69[b]			
Healthy Eating Index Score	51.77±8.94	0.97[b]	16.82%	0.00***	-
Healthy Eating Index Score	60.48±10.75	0.69b			

Note: *[d]Paired t-test was applied for comparing pre post KAP intervention scores as data were normally distributed, [e]Wilcoxon Signed-Rank Test was applied for comparing pre-post KAP intervention scores as data were not normally distributed, ***Highly Significant (p=0.00), [ns]Not Significant (p>0.05). [f]Percent difference: (Posttest score-Pretest score)/Pretest score*100. KAP, Knowledge, Attitude and Practice; HEI, Healthy Eating Index; SD, standard deviation. Values are presented as mean ± SD.*

DISCUSSION

It was hypothesized in the current study that nutrition education would improve knowledge, attitude and practice (KAP) of school going adolescents; regarding healthy eating. It was tested by running t-test analysis for finding the differences in pre and post analysis of KAP scores of school going adolescents. At the end of the 2-month nutrition education intervention, the mean knowledge score, total KAP score and Healthy Eating Index Score increased.

The results revealed highly significant improvement in the total KAP score as supported by studies concluding similar results[29]. The KAP model is based on the rationale that increasing an individual's knowledge about something will prompt a change in behavior[30]. The increase in KAP score is indicative of the effectiveness of the nutrition education.

Similarly, the Wilcoxon signed-rank test showed a highly significant improvement, suggesting enhanced knowledge among the students as evidenced by a quasi- experimental study conducted in Nepal to analyze the effect of nutrition education intervention on nutrition knowledge, attitude and diet quality among school going adolescents[11]. A similar study in China also reported significant increase in knowledge of the students[31]. The improvement in knowledge score is a result of enhanced understanding of the students due to the intervention provided in the form of nutrition education[11]. As a study carried out on Malaysian adolescents also reported significant results in terms of knowledge score. The findings of the study suggest the higher knowledge score is because of increased awareness of the individuals either through social media platforms, blogs or other information sources[30]. In the context of the current study the improvement in knowledge can be associated with the modules and methods of delivery used for nutrition education.

However, no statistically significant changes were observed in the attitude and practice scores, as validated by the literature that translating knowledge into attitude and practice is a long-term phenomenon[31,32]. On the contrary, a study demonstrated change in attitude of the students after intervention[11]. This contradiction indicates that long-term intervention can be helpful to bring about changes in attitude or develop healthy eating practices in individuals as the literature explains translating knowledge into practice takes time and effort[31,33]. Factors like peer influence, parental guidance and family support evidently dictate behavior change in adolescents. Multicomponent strategies that involve modifications in school environment and family support better help in influencing dietary changes[34]. As this study was able to enhance knowledge in the given period of time, similarly with repeated nutrition sessions and a longer intervention plan are more likely to influence attitudes and practices[35]. Additionally, the results revealed highly significant improvement in the Healthy Eating Index (HEI) score; a validated tool; used in nutrition and public health researches to assess the diet quality and formulate nutrition regulation policies[36]. Although a few studies explain the effect of intervention HEI score, evidence from the study on school going adolescent in Nepal indicated that nutrition education have positive impact on the indicators of diet quality[11]. A systemic review on the effect of nutrition education intervention on diet quality of young adolescents concluded that nutrition education strategies yield significant improvements in diet quality of adolescents[35]. The present research highlights the changes on HEI after an intervention addressing a major gap in the literature.

CONCLUSION

This pilot study observed improvements in nutrition knowledge, total KAP score and HEI score, which indicates the importance of nutrition education in developing an understanding about food and nutrition to improve healthy eating. The two parameters that could not be significantly enhanced in this study were; attitude and practice. However, considering that these findings are preliminary in nature they cannot be considered definitive. Subsequent research with adequate sample size, longer duration and repeated follow-up sessions would confirm these findings and assess the effectiveness of structured nutrition education in school going adolescent.

Recommendation

The study outcomes indicated the need for early initiation of nutrition education preferably at preadolescence as it is transitional period characterized by major cognitive development, growth spurts with increased nutritional needs, strong peer influence and learning readiness. Integrating mandatory nutrition education in school curricula is recommended to ensure systematic exposure to basic nutritional concepts for better and early understanding. Moreover, comprehensive school nutrition programs emphasizing age appropriate,

interactive and engaging activities may further strengthen the outcomes. Conducting frequent and entertaining activities like quizzes, group projects, sessions and healthy meal competitions is a practical approach to reinforce healthy eating patterns and informed choices in students. Furthermore, parental awareness and involvement in such programs and initiatives will also help strengthen healthy and balanced dietary habits by providing supportive and appreciating environment at homes. These multifaceted approaches together have a great potential to improve nutritional KAP among school going children thereby supporting overall wellbeing and preventing non-communicable diseases in future.

Limitation

This pilot study had a few limitations which need to be considered when interpreting the over-all result and success of the study. First limitation was that of the relatively smaller sample size which suggests that the findings of this particular study cannot be generalized to a wider population. Second, a short intervention duration resulted in non-significant changes in attitude and practices as these parameters require longer and consistent follow-ups. Despite, these limitations, positive changes in knowledge, overall KAP and HEI scores, suggest that with future research including larger sample size and a longer intervention period, these findings could be confirmed. This could be achieved through school support, parental involvement and adequate funding from local and international organizations.

Author Contributions

NAW: Conception & Design, Data Collection, Data Analysis & Interpretation, Manuscript Writing, Critical Revision, and Final Approval
SJJ: Conception & Design, Data Collection, Data Analysis & Interpretation, Manuscript Writing, Critical Revision, and Final Approval
AM: Conception & Design, Data Analysis & Interpretation, Manuscript Writing, Critical Revision, and Final Approval
LG: Conception & Design, Data Collection, Manuscript Writing, and Final Approval
ARA: Conception & Design, Data Collection, Manuscript Writing, and Final Approval

Conflict of Interest

The authors declare no conflict of interests.

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