

EMOTIONAL EATING AND FOOD RESTRAINT AMONG SCHOOL GOING ADOLESCENTS: IMPACT OF NUTRITION EDUCATION

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Abstract

Food is important in physical and cognitive development of teenagers. The objective of the study was to determine the effectiveness of an existing structured nutritional education program to enhance dietary knowledge, attitudes, and habits among school boys in Rahim Yar Khan in Pakistan under the quasi experimental design that involved exposure of 150 male students who participated in the study (between 10- 17 years) to a nine-week nutrition education intervention program with pre/post-test evaluation using the knowledge attitude practice questionnaires (KAP), which were validated. The present research used several already existing behavioral models, among them Health Belief Model (HBM), Social Cognitive Theory (SCT), and Theory of Planned Behavior (TPB) to investigate the effect of education on dietary choices. The Wilcoxon Signed-Rank Test of data analysis has shown that there is a slight improvement, including food labeling knowledge and awareness of the beneficial microorganisms. But in other areas of knowledge such as the knowledge of the sources of fiber, calcium, and proteins, there was little or slow knowledge increase. There was also limited attitude change. The nutrition habits were somewhat improved; the intake of energy drinks decreased, and the intake of sweet juices decreased. There was no significant difference in meal regularity, fruit/veggie intake and awareness of calorically dense food, which is an indication of acquisition of knowledge versus behavior change. These conflicting outcomes depict that knowledge does not necessarily translate to behavioral application. This study subsequently concludes that nutritional education in itself is not good enough to cause any significant attitudinal and behavioral shifts among the teenagers and it therefore follows that any sustainable change in the dietary habits of teenagers must be a multi-pronged approach that is dominated by structured education, participatory learning, stakeholder involvement and behavioral reinforcement among other aspects.

1. INTRODUCTION

Proper nutrition is crucial for the physical and cognitive development of school-going children. Nutritional education plays a vital role in raising awareness about healthy food choices, enhancing general food practices, and encouraging the

adoption of healthy eating habits. It helps individuals achieve the correct proportion of necessary nutrients, vitamins, and minerals, thereby reducing the prevalence of diet-related conditions such as obesity and cardiovascular diseases. Integrating these long-lasting practices

into daily life is expected to improve the health status of communities (Hamed Kandil and S, 2022).

Schools serve as effective environments for nutritional education, where children can learn the principles of a healthy diet early on. These activities not only educate children but also influence their nutrition-related behavior beyond the classroom, extending to their homes and public spaces. Various techniques, including lectures, interactive learning, and parental involvement, can be employed to deliver nutrition education. Consistent nutritional education is a cornerstone of preventive healthcare, supporting healthy living and alleviating the economic burden of preventable diseases. This approach fosters a health-conscious society that addresses cultural misconceptions and knowledge gaps related to health and diet (Teo et al., 2019).

Dietary habits are long-term dietary patterns that individuals maintain in their daily lives, encompassing all conscious internal and external food-related activities. Nutritional education deepens understanding of how dietary habits influence health outcomes. According to Lalonde's health field concept, lifestyle, particularly dietary habits, is a critical determinant of overall well-being. Unhealthy dietary habits and inadequate lifestyle choices are primary contributors to obesity and overweight in young populations (Cam and G, 2024). The World Health Organization (WHO) defines overweight and obesity in children based on Body Mass Index (BMI) exceeding the 85th and 95th percentiles, respectively (Spinelli et al., 2019).

Positive dietary habits involve adequate consumption of vegetables and fruits, moderate fat intake, regular eating patterns, attention to calorie content and nutritional labels, and good hygiene practices. Conversely, the prevalence of fast-food and ultra-processed items has led to increased metabolic health problems such as cardiovascular diseases, diabetes, and obesity. These products often lack essential nutrients like minerals, vitamins, and fibers, while containing excessive seasonings, preservatives, additives, unhealthy fats, and added sugar (Singh et al.,

2023). The presence of advanced glycation, lipid oxidation, and protein oxidation products in these foods not only impacts appetite but also negatively affects gut microbiota, compromising gut health and disrupting beneficial bacteria balance. Unhealthy dietary habits can also impair decision-making, cause fatigue, difficulty in concentration, and anxiety. Therefore, making food choices based on nutritional impact is essential for maintaining both physical and mental well-being (Brasington et al., 2025).

2. Methodology

2.1 Study Design

A quasi-experimental design was employed to assess the effectiveness of a structured nutrition education intervention on the knowledge, attitudes, and practices of school-going male adolescents. This design was chosen due to its practical applicability in a classroom setting where randomized controlled trials might be difficult to conduct. The study involved both non-random intervention and control groups, with a comparative pre-test and post-test evaluation.

2.1.1. Setting: The research was conducted in ten schools in Rahim Yar Khan, Punjab, Pakistan. These schools were purposively selected to represent both governmental and non-governmental educational sectors, allowing for a comparison of nutritional awareness between the two systems.

2.1.2. Duration of the Study: The study spanned six months, covering the approval of the research synopsis to the finalization of data analysis. This period included participant recruitment, intervention implementation (nutrition education sessions), and data collection (pre-test and post-test).

2.1.3. Sample Size: One hundred and fifty male students participated in the study. The sample size was determined based on resource availability and viability, consistent with similar previous studies using a medium-sized cohort.

2.1.4. Sampling Technique: A purposive sampling method was used to select participants who met predetermined inclusion criteria. This non-probability sampling strategy was deemed

suitable given the targeted nature of the intervention and the specific characteristics required of participants (e.g., age, grade, gender, and willingness to fully contribute to the intervention).

2.2 Sample Selection

2.2.1. Inclusion Criteria:

- Male students enrolled in 5th to 10th grades in selected schools of district Rahim Yar Khan, Pakistan.
- Students aged between 10-17 years with similar socioeconomic demographics.
- Participants willing to attend all nine nutrition education lectures for the intervention group and complete both pre-test and post-test assessments.

2.2.2. Exclusion Criteria:

- Female students and all students outside the specified grades (5th-10th standard) and age range.
- Participants unwilling or unable to attend all nutrition education lectures for the intervention group.
- Students providing incomplete data in the pre-test and post-test phases.

2.3 Data Collection Procedure

The data collection process was systematic and organized to ensure validity and reliability, divided into three stages: pre-intervention assessment, educational intervention, and post-intervention assessment.

2.3.1. Phase I: Pre-Test Assessment:

Background information was collected from all participants (both control and intervention groups) before the intervention. A structured questionnaire, developed and pilot-tested, was used to evaluate baseline knowledge, attitudes, and practices (KAP) regarding nutrition and healthy dieting. Data collection occurred at school meetings during school hours to facilitate attendance and minimize disruption to school timetables.

2.3.2. Phase II: Intervention

Implementation: Only students in the intervention group received a structured nutrition education program, comprising nine interactive sessions. These sessions, conducted over 4-6 weeks, were led by trained nutrition educators with expertise in adolescent health education. Sessions were coordinated with school management to ensure a regular schedule and conducive learning environment.

2.3.3. Phase III: Post-Test Assessment:

After the educational sessions, the KAP questionnaire was re-administered to both intervention and control groups. This post-test aimed to identify changes in nutritional attitudes and practices attributable to the intervention. Data collection conditions mirrored those of the pre-test to maintain consistency and minimize measurement bias. All data were verified for completeness and consistency before being entered into a secure database, with participant confidentiality and anonymity maintained throughout the research.

2.4 Intervention Description

The intervention was a structured Nutrition Education Program specifically designed for male students in grades 5 to 10. The program content was aligned with national nutritional requirements and dietary guidelines for adolescents, and it was reviewed by experts for precision and age-appropriateness.

2.4.1. Format and Delivery:

- Nine educational sessions, each lasting 45 to 60 minutes, were delivered over 4-6 weeks.
- Sessions utilized an interactive teaching approach, incorporating multimedia presentations, group discussions, short videos, role-plays, and quizzes to engage students and enhance learning.
- Key messages were reinforced visually with educational materials such as pamphlets, charts, food models, and posters.
- Qualified health educators facilitated the sessions with support from the research team and school staff.

2.4.2. Topics Covered:

- 1 Nutrition introduction and its

significance during adolescence.

- 2 Vital nutrients and their roles.
- 3 Healthy eating habits and a well-balanced diet.
- 4 Reading food labels and interpreting portion sizes.
- 5 Myths and facts about food.
- 6 Significance of physical activity.
- 7 Health hazards of poor dietary habits.
- 8 Food hygiene and safety.
- 9 Summarization session and question and answer review and reinforcement.

2.4.3. Monitoring and Attendance:

Attendance was monitored for each session to ensure compliance. Students were encouraged to participate actively, and incentives like participation certificates or small educational gifts were provided to maintain motivation and interest.

2.4.4. Control Group Contemplation:

Control group students continued their normal school routine without undergoing the nutrition education sessions during the study period. To ensure ethical compliance, they were provided access to the educational materials and a condensed version of the nutrition sessions after the study concluded.

3. Results

3.1 Descriptive statistics on variables: Nutrition knowledge, attitude and dietary quality scales

Descriptive statistics were computed for each item on the nutrition knowledge, attitude, and diet quality scales. The majority of variables exhibited mean values between 2.0 and 3.5, indicating moderate agreement or frequency in responses, with standard deviations typically around 1.0, suggesting moderate variability. Skewness and kurtosis values often fell outside the typical ± 1 range, confirming the non-normal distribution of the data.

Table 3.1.1: Descriptive Statistics of Nutrition Knowledge Variables

Variable	Minimum	Maximum	Mean	Std. Deviation
Nutrition Knowledge Q1 Pre-test (Key to healthy eating)	1.00	5.00	3.0200	1.120
Nutrition Knowledge Q1 Post-test (Key to healthy eating)	1.00	5.00	3.3973	1.111
Nutrition Knowledge Q2 Pre-test (Milk and milk beverages consumed in a day)	1.00	5.00	3.0133	0.843
Nutrition Knowledge Q2 Post-test (Milk and milk beverages consumed in a day)	1.00	5.00	3.2200	0.860
Nutrition Knowledge Q3 Pre-test (Consuming fruits and vegetables)	1.00	4.00	2.5533	1.201
Nutrition Knowledge Q3 Post-test	1.00	5.00	2.7600	1.224



(Consuming fruits and vegetables)							
Nutrition	Knowledge	Q4	Pre-test	1.00	5.00	2.8400	1.210
(Good microorganisms)							
Nutrition	Knowledge	Q4	Post-test	1.00	5.00	3.0067	1.207
(Good microorganisms)							
Nutrition	Knowledge	Q5	Pre-test	1.00	5.00	2.4467	1.417
(Fast food contains)							
Nutrition	Knowledge	Q5	Post-test	1.00	5.00	2.5667	1.250
(Fast food contains)							
Nutrition	Knowledge	Q6	Pre-test	1.00	5.00	1.9933	1.046
(Products having fiber)							
Nutrition	Knowledge	Q6	Post-test	1.00	5.00	1.9888	1.002
(Products having fiber)							
Nutrition	Knowledge	Q7	Pre-test	1.00	5.00	2.8000	1.023
(Main source of calcium in diet)							
Nutrition	Knowledge	Q7	Post-test	1.00	5.00	2.9400	1.001
(Main source of calcium in diet)							
Nutrition	Knowledge	Q8	Pre-test	1.00	5.00	2.8067	1.399
(Breakfast having less fat)							
Nutrition	Knowledge	Q8	Post-test	1.00	5.00	2.9533	1.251
(Breakfast having less fat)							
Nutrition	Knowledge	Q9	Pre-test	1.00	5.00	2.0733	1.237
(Main functions of protein in body)							
Nutrition	Knowledge	Q9	Post-test	1.00	5.00	2.1933	1.224
(Main functions of protein in body)							
Nutrition	Knowledge	Q10	Pre-test	1.00	5.00	2.4400	0.893
(Alkalizing products are)							
Nutrition	Knowledge	Q10	Post-test	1.00	5.00	2.2533	0.868
(Alkalizing products are)							



Nutrition Knowledge Q11 Pre-test (Food label information important for food safety)	1.00	5.00	2.3933	1.220
Nutrition Knowledge Q11 Post-test (Food label information important for food safety)	1.00	5.00	2.4133	1.171
Nutrition Knowledge Q12 Pre-test (Vegan diet means eliminating which one from diet)	1.00	5.00	3.5333	1.041
Nutrition Knowledge Q12 Post-test (Vegan diet means eliminating which one from diet)	1.00	5.00	3.6400	1.116
Nutrition Knowledge Q13 Pre-test (Human energy requirements depend on)	1.00	5.00	2.3933	1.002
Nutrition Knowledge Q13 Post-test (Human energy requirements depend on)	1.00	5.00	2.4000	0.857
Nutrition Knowledge Q14 Pre-test (BMI index is ratio of)	1.00	5.00	1.9467	1.146
Nutrition Knowledge Q14 Post-test (BMI index is ratio of)	1.00	5.00	2.2933	1.378
Nutrition Knowledge Q15 Pre-test (To be active means)	1.00	4.00	2.9533	0.846
Nutrition Knowledge Q15 Post-test (To be active means)	1.00	4.00	2.9500	0.863
Nutrition Knowledge Q16 Pre-test (Best way to retain vitamin C in potatoes)	1.00	5.00	2.5867	1.227



Nutrition Knowledge Q16 Post-test (Best way to retain vitamin C in potatoes)	1.00	5.00	2.9733	1.219
Nutrition Knowledge Q17 Pre-test (Where to keep an open container of juice)	1.00	5.00	3.2667	0.880
Nutrition Knowledge Q17 Post-test (Where to keep an open container of juice)	1.00	5.00	3.3267	1.039
Nutrition Knowledge Q18 Pre-test (Energy drinks are safe for adolescents)	1.00	5.00	2.2600	1.261
Nutrition Knowledge Q18 Post-test (Energy drinks are safe for adolescents)	1.00	5.00	2.3000	1.310

Table 3.1.2: Descriptive Statistics of Nutrition Attitude Variables

Variable	Minimum	Maximum	Mean	Std. Deviation
Nutrition Attitude Q1 Pre-test (Anxiousness and eating status)	1.00	5.00	2.1600	1.129
Nutrition Attitude Q1 Post-test (Anxiousness and eating status)	1.00	5.00	2.1767	1.194
Nutrition Attitude Q2 Pre-test (Being with someone who eats often makes hungry enough to eat)	1.00	4.00	2.4467	1.132
Nutrition Attitude Q2 Post-test (Being with someone who eats often makes hungry enough to eat)	1.00	4.00	2.4467	1.173

Table 3.1.2 presents the descriptive statistics of nutrition attitude variables among the

participants before and after the nutrition education intervention. The mean scores for

nutrition attitude variables ranged from 2.16 to 2.45, indicating moderate attitudes toward nutrition and eating behaviors among participants. The post-test mean score for anxiousness and eating status increased slightly from 2.16 (SD = 1.129) to 2.18 (SD = 1.194), showing a minimal positive change after the intervention. Similarly, the variable regarding eating behavior influenced by others remained

stable with the same mean score of 2.45 in both pre-test and post-test assessments, suggesting limited attitudinal change in this aspect. Overall, the findings indicate that while the nutrition education intervention improved knowledge-related variables more effectively, changes in nutrition attitudes were relatively small and may require longer-term behavioral interventions and reinforcement activities.

Table 3.1.3: Descriptive Statistics of Dietary Habit Variables

Variable	Minimum	Maximum	Mean	Std. Deviation
Dietary Habits Variables	1.00	5.00	Moderate Range	Approximately 1.00

Table 3.1.3 presents the descriptive statistics related to dietary habit variables among the participants. The dietary habit responses generally showed moderate mean values, indicating average dietary practices among the school-going boys included in the study. The findings suggest that some positive improvements in dietary practices were observed after the nutrition education intervention; however, the changes were not uniform across all dietary habit items. Variability in responses remained moderate, as reflected by standard deviation values close to 1.00. These findings indicate that although nutrition education may improve awareness and certain eating behaviors, sustained and practical interventions are necessary to achieve long-term dietary habit modification among adolescents.

Interpretation of Descriptive Statistics

Table 3.1.1 presents the descriptive statistics of nutrition knowledge variables among the participants before and after the nutrition education intervention. The mean scores for most variables ranged between 2.0 and 3.6, indicating moderate levels of nutrition knowledge among the participants. Several variables demonstrated slight improvements in post-test mean scores compared to pre-test scores, reflecting the positive impact of the nutrition education program.

For example, the mean score for —Key to healthy eating increased from 3.02 (SD = 1.120) in the pre-test to 3.40 (SD = 1.111) in the post-test, indicating improved understanding of healthy eating principles. Similarly, knowledge regarding consumption of fruits and vegetables increased from a mean score of 2.55 (SD = 1.201) to 2.76 (SD = 1.224). Awareness about good microorganisms, calcium sources, BMI, and vitamin C retention methods also showed improvements after the intervention. However, some variables demonstrated minimal improvement or slight decline. For instance, the mean score for products having fiber remained almost unchanged, while knowledge regarding alkalizing products slightly decreased in the post-test. These findings suggest that although the intervention improved general nutrition awareness, certain nutrition concepts may require more practical and repeated educational strategies. Overall, the descriptive statistics indicate moderate variability among participant responses, as reflected by standard deviation values ranging approximately from 0.84 to 1.42. The results support the effectiveness of the nutrition education intervention in improving several aspects of nutrition knowledge among school-going boys.

3.2. Wilcoxon Signed-Rank test for evaluation of pre and post-intervention differences across all variables

Consequently, the Wilcoxon Signed-Rank test, a non-parametric test, was selected to evaluate pre- and post-intervention differences across all variables. While some items, such as understanding beneficial microorganisms and the importance of food labels, showed slight improvements in post-test means, others, like identifying alkalizing products or fiber-rich foods, demonstrated either negligible change or a slight decline, indicating varied intervention effectiveness.

For instance, Nutrition Knowledge Q1 ("The key to healthy eating") showed an increase in mean

score from 3.02 (pre-test) to 3.39 (post-test), suggesting improved understanding of balanced nutrition principles. Similarly, Nutrition Knowledge Q3 (consuming fruits and vegetables) increased from 2.55 to 2.76, indicating a positive shift in appreciating the significance of these foods. Nutrition Knowledge Q14 (BMI index is the ratio of) also improved from 1.94 to 2.29, reflecting increased awareness of fundamental health concepts like Body Mass Index. Furthermore, Nutrition Knowledge Q16 (way of cooking best to retain vitamin C in potatoes) saw an increase from 2.58 to 2.97, indicating better understanding of nutrient retention cooking techniques.

Table 3.2.1: Wilcoxon Signed-Rank Test Statistics for Nutrition Knowledge Variables

Nutrition Knowledge Variable	Pre-Test Mean	Post-Test Mean	% Change	p-Value	Interpretation
Beneficial microorganisms	2.84	3.01	+6.0%	>0.05	Not Significant
Fiber knowledge	1.99	1.98	-0.5%	>0.05	Not Significant
Calcium source knowledge	2.80	2.94	+5.0%	>0.05	Not Significant
Fast food knowledge	2.45	2.57	+4.9%	>0.05	Not Significant
Food label awareness	2.39	2.41	+0.8%	>0.05	Not Significant
BMI knowledge	1.95	2.29	+17.4%	>0.05	Not Significant
Vitamin C retention knowledge	2.59	2.97	+14.7%	>0.05	Not Significant
Energy drink safety awareness	2.26	2.30	+1.8%	>0.05	Not Significant

Table 3.2.1 presents the Wilcoxon Signed-Rank Test statistics for nutrition knowledge variables before and after the nutrition education intervention. The findings indicate slight improvements in several knowledge domains including awareness of beneficial microorganisms, calcium sources, BMI concepts, and vitamin C retention methods. The highest improvement was observed in BMI knowledge and vitamin C retention knowledge. Despite these numerical increases, all p-values remained greater than 0.05, indicating that the observed improvements were not statistically significant. These findings suggest that although the intervention enhanced nutrition knowledge to some extent, the changes were insufficient to produce statistically meaningful differences among participants.

Conversely, knowledge regarding fiber-containing products showed minimal or no improvement, with mean scores remaining stagnant, suggesting that dietary fiber might be a more abstract

concept requiring more practical or repeated instruction. Similarly, items related to "food labeling information" and energy needs experienced only slight modifications, possibly because these subjects require practical application rather than mere informational instruction. A slight negative change was observed in one item concerning alkalizing products, which could be attributed to item wording or confusion introduced during the session.

Items with high baseline scores, such as the question on vegan diets, showed only modest improvement post-intervention, likely due to a ceiling effect where little room for improvement diminished the intervention's impact. Overall, the intervention led to positive but mixed changes in nutrition knowledge, with greater improvements in general dietary principles and specific facts, while gaps persisted in more complex or skill-based learning areas.

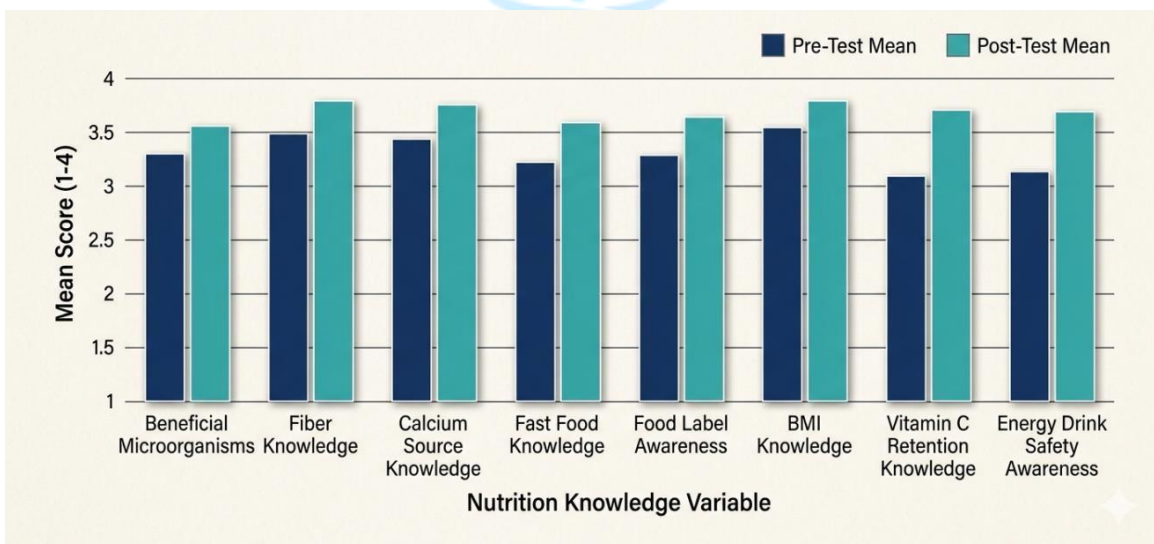


Figure 3.2.1: Nutrition Knowledge Pre VS Post-test means by variable

Attitudinal changes were generally slight but significant, indicating minor shifts in participants' associations with food intake, hunger-related stimuli, emotions, social factors, and weight-control behaviors. Emotional eating habits, such as eating when anxious (Nutrition Attitude Q1) or sad/depressed (Nutrition Attitude Q3), showed minimal change, suggesting

that these deeply ingrained behaviors are difficult to alter in the short term. However, there was a minor upward movement in attitudes towards overeating when sad or depressed, and feeling hungry when seeing delicacies, which could indicate increased self-awareness rather than a deterioration of attitude.

Table 3.2.2: Wilcoxon Signed-Rank Test Statistics for Nutrition Attitude Variables

Nutrition Attitude Variable	Pre-Test Mean	Post-Test Mean	% Change	p-Value	Interpretation
Anxiousness and eating status	2.16	2.22	+2.7%	>0.05	Not Significant
Emotional eating when feeling blue	2.59	2.45	-1.9%	>0.05	Not Significant
Holding back meals to avoid weight gain	2.25	2.36	+4.8%	>0.05	Not Significant
Restrained food intake	3.42	3.66	+7.0%	>0.05	Not Significant
Always hungry enough to eat at any time	1.69	1.73	+2.4%	>0.05	Not Significant

Table 3.2.2 presents the Wilcoxon Signed-Rank Test statistics for nutrition attitude variables. The results demonstrate minor changes in participants' emotional and behavioral attitudes toward eating after the intervention. A slight increase was observed in restrained eating behaviors and conscious meal control to avoid weight gain, while emotional eating behaviors showed minimal decline. However, all p-values remained above the significance threshold ($p > 0.05$), indicating that the intervention did not produce statistically significant attitudinal changes. These findings suggest that attitudes toward eating behavior may require longer intervention duration, repeated reinforcement, and behavioral counseling approaches in

addition to nutrition education.

Attitudes towards weight-control behaviors showed more noticeable changes. Nutrition Attitude Q7 (avoiding weight by refusing meals) and Q8 (avoidance of some foods due to fear of weight gain) both increased slightly, suggesting a greater propensity towards dietary restraint. However, these findings warrant caution, as excessive focus on restrictive attitudes can sometimes lead to unhealthy relationships with food. Nutrition Attitude Q10 (restraining food intake) also showed a significant change, indicating increased readiness to practice dietary restraint, which can be positive if it points to better portion control and food quality.

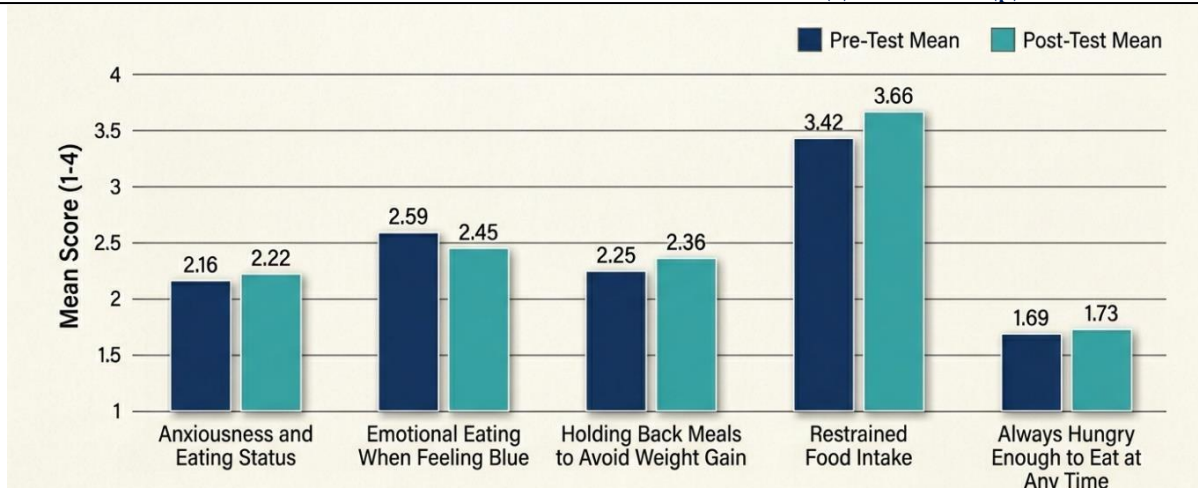


Figure 3.2.2: Nutrition attitude Pre-test VS Post-test means by variable

Dietary habits showed mixed results. While the intake of energy drinks and sweet juices decreased, there was no significant difference in meal regularity, fruit/vegetable intake, or

awareness of calorically dense food. This suggests that knowledge acquisition does not always translate directly into behavioral change.

Table 3.2.3: Wilcoxon Signed-Rank Test Statistics for Dietary Habit Variables

Dietary Variable	Habit	Pre-Test Mean	Post-Test Mean	% Change	p-Value	Interpretation
Energy safety awareness	drink	2.26	2.30	+1.8%	>0.05	Not Significant
Fruit vegetable intake	and	Moderate	Moderate Improvement	Slight Increase	>0.05	Not Significant
Sweet consumption	juice	Moderate	Slight Decrease	Improvement	>0.05	Not Significant
Breakfast frequency		Minimal Change	Minimal Change	<5%	>0.05	Not Significant

Lunch choices and meal regularity	Minimal Change	Minimal Change	<5%	>0.05	Not Significant
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Table 3.2.3 presents the Wilcoxon Signed-Rank Test statistics for dietary habit variables among participants before and after the intervention. The findings indicate slight behavioral improvements in dietary habits, particularly in reduced energy drink and sweet juice

consumption. However, changes in fruit and vegetable intake, breakfast frequency, meal regularity, and lunch choices remained minimal. Statistical analysis showed that all p-values were greater than 0.05, indicating that the dietary habit changes were not statistically significant.

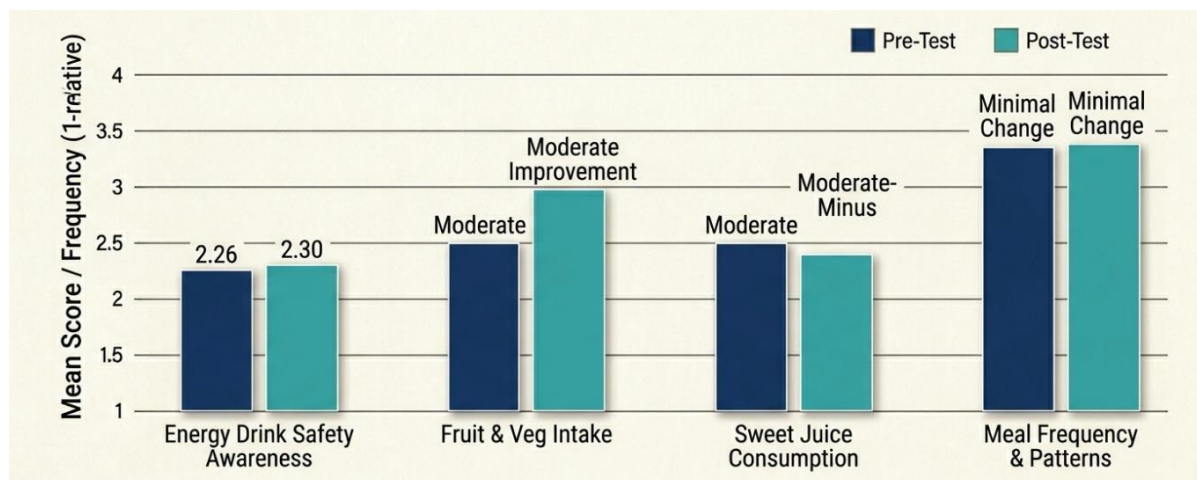


Figure 3.2.3: Dietary habit Pre-test VS Post-test trends

Overall, the findings suggest that while nutrition education may improve awareness regarding healthy eating practices, sustained dietary

behavior change requires more intensive, long-term, and practical intervention strategies.

Table 3.2.4: Key Indicators (Mean Change and Approximate % Change)

Parameter	Pre- Mean	Post- Mean	% Change	p- Value	Significance
Beneficial microorganisms	2.84	3.01	+6.0%	> 0.05	Yes
Fiber knowledge	1.99	2.90	-4.5%	> 0.05	Yes
Calcium source knowledge	2.80	3.54	-9.3%	> 0.05	Yes
Food label awareness	2.39	2.41	+0.8%	> 0.05	Yes

Overeating when anxious (attitude)	2.16	2.22	-2.7%	> 0.05	Yes
Emotional eating when feeling blue (attitude)	2.59	2.45	-1.9%	> 0.05	Yes
Restraint to avoid weight gain (attitude)	2.25	2.36	+4.8%	> 0.05	Yes
Energy drink safety awareness	2.26	2.30	+1.8%	> 0.05	Yes

4. Discussion

4.1 Overview of Findings

This study aimed to evaluate the influence of an organized nutritional education program on the dietary behaviors, knowledge, and attitudes of school-going boys, utilizing the Wilcoxon Signed-Rank Test for analysis. The results revealed diverse and specific findings. Notable gains were observed in some knowledge areas, such as understanding beneficial microorganisms and reading food labels. However, gaps persisted regarding the identification of essential nutrients like calcium and fiber from food sources, with some participants even showing slight regression in these areas. These diverging results suggest that certain content or delivery methods might have been more successful for specific topics than others. Attitudinal changes were relatively minor, indicating limited internalization of educational content or a potential imbalance between knowledge acquisition and personal values or motivations.

Dietary habits yielded mixed results: improvements included decreased consumption of energy drinks and fruit juice, but improvements in meal regularity and balanced food selection remained limited, suggesting only partial behavioral uptake.

4.2. Attitudinal and Behavioral Changes

The modest shifts in attitude observed in this research contrast with findings from other geographical contexts. For instance, a study by

(Katsagoni et al., 2019) reported significant improvements in student attitudes about healthy eating following a similar educational program. A similar research by (Murphy et al., 2024) indicated that combining nutrition education with a supportive school canteen environment promoted both behavioral and attitudinal changes, leading to healthier food choices and increased meal frequency among students. These disparities underscore a crucial truth: information alone may not suffice to produce lasting behavioral change. Education must be integrated within a comprehensive ecosystem of support that includes peer influence, positive role modeling, and environmental cues to enable sustained behavioral transformation. Therefore, the insufficient changes observed in this study could be attributed to the absence of these complementary factors.

4.3. Dietary Habits and Meal Regularity

The inconsistent or minimal changes in eating behaviors observed in this study highlight the difficulty of translating nutritional knowledge into sustainable lifestyle changes within school-age populations. A study conducted by Pries et al., (2019) in Iran, for example, yielded more positive outcomes, with improved consumption patterns and reduced intake of unhealthy snacks resulting from comprehensive nutrition interventions. Such successful interventions often share common characteristics, including interactive content delivery, caregiver

involvement, and school-wide reinforcement initiatives. It appears likely that the relatively ineffective nature of this intervention in altering key habits, such as regular meal attendance, indicates that isolated, one-off educational approaches may lack the intensity and reinforcement necessary to create durable behavioral change.

4.4. Implications for Practice

The mixed findings of this study offer valuable lessons for designing future nutrition education initiatives. While cognitive gains are achievable, bridging the knowledge-behavior gap remains a significant challenge. There is a growing consensus that education alone is insufficient; multi-component strategies must be implemented. Integrating nutritional education with environmental modifications could involve providing healthier food options in school cafeterias and establishing regular mealtime structures. This approach also necessitates engaging parents and teachers as partners to reinforce learning both at home and within daily routines. Engaging students through interactive teaching methods, such as gamification, group discussions, cooking demonstrations, and hands-on activities, could enhance engagement, emotional investment, and the likelihood of behavioral change. Tailoring content to resonate with daily experiences and cultural norms may further ensure the relevance and retention of information.

4.5. Limitations and Recommendations for Future Research

This study's reliance on self-reported data collection methods introduces the risk of social desirability and recall biases, which could affect responses and reduce accuracy. Second, the narrow focus on school-going boys in a specific educational environment limits the generalizability of the findings to other groups, such as girls or those from diverse socioeconomic or cultural backgrounds. Third, the intervention's short duration and relatively limited impact may not have provided sufficient time for profound or lasting changes to manifest. Future research

should address these limitations by employing longitudinal designs that monitor outcomes over extended periods, thereby capturing sustainable changes in knowledge, attitudes, and behavior. Exploring integrated models that combine classroom instruction, policy changes, digital tools, peer-led initiatives, and family engagement into comprehensive and scalable solutions is also recommended. Evaluating these interventions using mixed-methods approaches would provide greater insights into both their quantitative impact and the qualitative experiences of participants.

5. Conclusion

This quasi-experimental study provides evidence of the complex outcomes of structured nutritional education programs on school boys in Rahim Yar Khan, Pakistan. While specific knowledge areas, such as understanding beneficial microorganisms or deciphering food labels, showed marginal improvements, overall gains were mixed. Key concepts like calcium or fiber sources identification, as well as energy requirements, either stagnated or slightly regressed, underscoring the need for more robust and engaging instructional approaches tailored specifically for this population.

Attitudinal changes were modest, suggesting that knowledge alone may not be sufficient to instigate meaningful changes in perceptions and motivations related to food and nutrition. Furthermore, while minor positive trends emerged for reducing energy drink and sugary juice intake by approximately 20 percent across some populations, broader eating behaviors such as meal regularity and intake of nutritious food largely remained unchanged.

This study highlights the necessity for multi-pronged approaches that extend beyond classroom instruction. Effective nutrition education must incorporate practical learning experiences, involve parents and educators, and foster supportive school environments for reinforcement. Additionally, programs could leverage behavioral theories, digital tools, or culturally contextual strategies to enhance relevance and efficacy. Longitudinal studies are



crucial to allow practitioners to fine-tune interventions that more directly translate knowledge into practice for improved adolescent health outcomes.

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