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ORIGINAL ARTICLE

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Needs-Based Development of an Experiential Food and Nutrition Education Curriculum for Middle School Students in Pakistan

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ABSTRACT

Background: Nutrition education constitutes an essential component of the formal learning experiences provided to children and adolescents within school settings. Notwithstanding its recognized importance, a substantial gap persists in the breadth, depth, and pedagogical quality of nutritional content currently integrated into school curricula, necessitating a comprehensive and evidence-informed curricular response.

Aims: This study aimed to develop a contextually appropriate food and nutrition education curriculum for middle school students in Pakistan. The formulated curriculum was designed to incorporate active, experiential, and participatory learning methodologies; to address not only theoretical knowledge but also practical competencies and life skills; to align with the developmental and cognitive characteristics of the target age group; and to reflect the prevailing cultural and dietary context of Pakistani society.

Methods: A systematic needs assessment was conducted prior to curriculum development. Data were collected from two private schools selected through purposive sampling yielding a total sample of 170 students enrolled in Grades 6, 7, and 8. Structured pre-validated questionnaires were administered to students to assess nutritional knowledge and perceived learning needs, while a standardized observation checklist was employed by the research team to evaluate the content and pedagogical orientation of the schools' existing nutrition curricula.

Results: Nutritional knowledge scores among the adolescent participants were found to be markedly low, with a mean score of 23.10 ± 5.24 out of a possible 50 points. Notable deficiencies were identified in key practical and life skills, including the ability to compare food items on the basis of nutritional labeling (reported by 45.3% of respondents) and participation in food-related tasks within the household setting (39.4%). Furthermore, 35.3% of respondents expressed dissatisfaction towards the current food and nutrition content delivered in their schools. Nevertheless, a considerable proportion of students recognized the intrinsic value of nutrition as an informative discipline (51.8%), endorsed the compulsory inclusion of nutrition education in the school curriculum (41.2%), advocated for the integration of practical work into assignments (55.3%), and expressed a preference for active, participatory engagement during instructional sessions (53.6%). Evaluation of the existing curricula revealed critically limited nutrition content, with only two (2) of the eight (8) internationally recommended core topics receiving partial coverage, and an overall orientation toward theoretical rather than applied learning.

Conclusions: The findings collectively demonstrate a substantial and multidimensional need for comprehensive food and nutrition education among Pakistani adolescents, including the acquisition of relevant practical competencies, critical life skills, and a reformed curricular framework. In response to these identified needs, a structured curriculum book was developed, comprising eight (8) major topics and 22 subtopics, each systematically allocated to a designated grade level within the middle school continuum.

Keywords: Nutrition Education; Curriculum Development; School Nutrition; Needs Assessment; Adolescent Health Education; Experiential Learning; Pakistan.

Article Information

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1 INTRODUCTION

Childhood and adolescence represent foundational phases of human ontogeny, playing a determinative role in long-term health and developmental trajectories. During these periods, physiological requirements for macro- and micronutrients accelerate substantially, rendering the consumption of a high-quality, nutrient-dense diet imperative (World Health Organization, 2006a). Crucially, core dietary behaviors, lifestyle paradigms, and behavioral patterns are established during this period. Early nutritional interventions during childhood and adolescence are therefore highly favorable, serving to mitigate or reverse the adverse sequelae associated with suboptimal dietary habits, over-nutrition, and under-nutrition (World Health Organization, 2006b). Over the past three decades, the global prevalence of pediatric and adolescent obesity has tripled among cohorts aged 6 – 19 years; this early-onset adiposity is strongly correlated with a group of risk factors for chronic non-communicable diseases (Centers for Disease Control and Prevention, 2011). The prompt cultivation of salutary dietary practices enhances the probability of their long-term maintenance, thereby attenuating the risk of chronic pathologies in adulthood (Verplanken & Aarts, 2002).

The nutritional status of school children's overall diet has a direct influence on behavioral outcomes, academic attainment, and adiposity metrics (Dresler-Hawke, Whitehead, & Coad, 2009). Optimal nutrition promotes systemic well-being and enhances cognitive capacity, thereby augmenting academic performance (The Food Commission, 2001). Furthermore, balanced nutrition supports psychological and social well-being, cultivating robust self-esteem and a positive body image. Consequently, educational institutions are increasingly identified as primary vectors for nutrition education interventions (Mensink *et al.*, 2012). Schools afford a highly effective mechanism for reaching large populations while simultaneously offering supportive, health-promoting environments (Centers for Disease Control and Prevention, 2011). Given these dynamics, enhancing student nutritional literacy and fostering health-promoting attitudes should occupy a prominent position on institutional academic agendas. A primary strategy to achieve this objective is the formal integration of nutrition education into the core school curriculum (Pérez-Rodrigo & Aranceta, 2001).

Although the incorporation of nutrition education within national school curricula has accelerated globally, its overall implementation remains constrained. Numerous educational institutions across both Western and Eastern hemispheres (Kazemian *et al.* 2014) fail to optimize their institutional capacity to deliver robust nutritional pedagogy (Carraway-Stage *et al.*, 2015). Institutional progress is frequently impeded by inadequate instructional time, constrained resources, are devoted to nutrition education and the responsibilities and poorly defined pedagogical responsibilities—challenges primarily driven by overburdened timetables and protracted curricular revision protocols (Contento *et al.*, 2002). When allocating structural space for nutrition education, the most prevalent administrative strategy is its cross-curricular integration into one or two host subjects. While computationally convenient, this approach often marginalizes nutritional content, as primary instructional focus reverts to the core host discipline (Hawes, 2004). Thus, all such issues compromise the efficacy of institutional food and nutrition education (FAO & United Arab Emirates University, 2019). Traditionally, nutrition education has been confined to domestic sciences, home economics, and personal dietary hygiene; however, its pedagogical potential is considerably broader. Contemporary school-based nutrition education must be systematically re-engineered to respond effectively to modern global developments (FAO & United Arab Emirates University, 2019). Nutrition researchers emphasize that students, as active consumers, must be equipped with comprehensive knowledge regarding localized and global food systems (Vidgen, 2016). Curricular content should span the entire agricultural and logistical continuum, encompassing food production, processing, packaging, distribution, consumption, and food wastage as well (Worsley *et al.*, 2015). Elucidating these diverse facets of food systems fosters informed, sustainable dietary choices, thereby promoting informed food choices leading to sustenance and protection of the environment (Sadegholvad, Yeatman, Parrish, & Worsley, 2017).

To maximize efficacy, pedagogical approaches to nutrition education must dynamically bridge classroom theory with practical, real-world application. The instructional focus should prioritize behavioral modification utilizing active, learner-centered methodology (Sherman & Muehlhoff, 2007). The ultimate objective of a school-based nutrition curriculum is the concurrent optimization of student knowledge, practical skills, self-efficacy, and dietary habits (Perez-Rodrigo & Aranceta, 2003). Curricular design must reflect this behavioral orientation, utilizing a structured needs assessment to collect empirical data to guide the developmental process (Wentzell, 2006).

A study conducted in Lahore, Pakistan, reveals a deficient level of nutritional knowledge among school-aged cohorts, with investigators underscoring an urgent imperative for formal curricular integration (Siddique, 2013). Similarly, a study evaluating private and public-school adolescents in Lahore observed highly suboptimal dietary patterns, concluding that prioritized school-based nutritional interventions are essential to cultivate health-promoting behaviors (Amjad *et al.*, 2022). Furthermore, qualitative data from Rawalpindi, Pakistan, identified institutional gaps as a primary barrier to healthy eating due to deficient nutritional instruction, highlighting the necessity for age-appropriate, targeted curricula designed to resolve systemic student misconceptions (Mahmood *et al.*, 2025).

An audit of the national food and nutrition curriculum in Pakistan indicates that while frameworks exist for upper secondary cohorts (grades 9, 10, and 11), a distinct curricular void persists for middle school students. This educational gap justifies the development of an experiential food and nutrition curriculum tailored specifically for the middle school demographic in Pakistan. The present study addresses this objective by engineering a nutrition curriculum informed by the localized needs and structural realities of students and schools. Utilizing an active, experiential, and participatory learning framework, this curriculum targets not only cognitive knowledge acquisition but also student dietary habits, health attitudes, and actionable life skills.

2 METHODS

2.1 Research Design

This study employed a formative research design. Formative frameworks are characteristically deployed to guide the systematically planned execution of novel

interventions or to optimize existing pedagogical programs (UNICEF, Sight and Life Foundation, & The Pennsylvania State University, 2023).

2.2 Target Population

The target population comprised middle school students (specifically cohorts enrolled in the 6th, 7th and 8th grades) in Pakistan, spanning an adolescent developmental age range of 11 – 14 years old.

2.3 Sampling Strategy

A two-stage sampling strategy was executed:

- **Stage 1 (Institutional Level):** Two private institutions (*The National School – AIMED Education* and *The City School – Paragon Campus*, Lahore) were selected via purposive sampling. This non-probability method was mandatory because the proposed curriculum demands active and experiential infrastructure; consequently, only institutions capable of executing these specific participatory modalities could be included. Public schools were excluded due to structural constraints, and selection was restricted to private institutions exhibiting matching tuition fee architectures.
- **Stage 2 (Participant Level):** Cluster sampling was utilized to select student participants, with established classroom sections serving as the primary sampling clusters.

2.4 Sample Size

The final sample comprised a total cohort of 170 students drawn systematically from the 6th, 7th and 8th grades of the participating institutions.

2.5 Data Collection Instrumentation

Quantitative Data was collected for needs assessment. Different tools were used for assessing different needs:

2.5.1 Student-Focused Needs Assessment Questionnaire

A structured self-administered questionnaire was developed based on an extensive literature review and refined via expert panel validation. The instrument was divided into three core domains:

- **Domain A**: Evaluated the baseline nutritional knowledge of the students relative to the proposed curricular themes.
- **Domain B**: Assess practical and life skills, focusing on food procurement literacy, meal preparation, autonomous health decision-making, and peer-to-peer health advocacy.
- **Domain C**: Audited student perceptions of nutrition education (e.g., perceived utility and engagement) and quantified their satisfaction towards the nutritional content embedded in their current coursework.

2.5.2 Curricular Audit Checklist

To evaluate the existing institutional nutrition curriculum, a comprehensive, pre-validated observation checklist was deployed. The research team obtained copies of the active middle school syllabi to audit the scope of nutritional concepts across all taught disciplines. The collected data were evaluated against the benchmark criteria delineated in the Food and Agriculture Organization's (FAO) planning guide for nutrition education curriculum development (FAO, 2006). Evaluated parameters included the integration of active, experiential and participatory learning modalities; targeting students' knowledge as well as habits, attitudes and skills; appropriateness to the age group of students; and alignment with local cultural paradigms.

2.6 Experimental Procedure

The planning, execution, and development phases of this research were guided by the structural adaptation of the FAO planning guide for nutrition education curriculum development (FAO, 2006). Following formal administrative clearance from the participating institutions, the study progressed through two distinct operational steps. The study was carried out in two major steps:

▪ Step 1: Baseline Needs assessment

The institutional audits and questionnaire distributions were executed concurrently. The research team conducted on-site evaluations of the active curricula. Questionnaires were administered in classroom settings with standardized instructions, ensuring students were allocated adequate, unhurried time to complete the instruments. The results were statistically analyzed to shape the structural architecture of the curriculum in the subsequent phase.

▪ Step 2: Curricular Planning and Development

- **Content Selection:** Beyond the empirical insights derived from the needs assessment, content selection was guided by the FAO curricular matrix (FAO, 2006) and current evidence-based international recommendations for school-based food systems education. The finalized themes and subtopics were explicitly mapped to realize the core behavioral aims of the intervention.
- **Curriculum Book Architecture:** A curriculum textbook was compiled. The introductory architecture details the foundational objectives, core pedagogical features, and structural implementation matrix of the program. A comprehensive operational table was integrated to guide schools on cross-curricular mapping, defining the precise grade level and academic

subject for each subtopic. Individual thematic chapters provide explicit instructional modules, including specific learning objectives, conceptual overviews, rationale statements, student reading materials, and pedagogical instructions (featuring engagement hooks to initiate topics). To ensure robust experiential learning, chapters feature individualized and collaborative group activities, home assignments linked to family and community dynamics, interactive worksheets, and post-topic discussion prompts. Academic rigor was supported by embedding targeted resource directories, supplemental teacher references, and curated multimedia/video links to accommodate diverse learning styles.

Curricular Architecture and Grade-Level Allocation Matrix

The finalized food and nutrition curriculum framework comprises eight primary thematic domains and twenty-two specialized subtopics, systematically distributed across the middle school continuum to optimize developmental appropriateness:

a. **Food, Nutrition, and Personal Health**
   - Macronutrients, Micronutrients, and Physiological Functions of Food: Allocated to **Grade 7** to anchor foundational biochemical understanding.
   - Stratified Dietary Demands: Allocated to **Grade 7** to analyze life-stage and population-specific nutritional requirements.
   - Principles of Balanced Nutrition and Dietary Regimens: Integrated into **Grade 7** to introduce core healthy eating paradigms.
   - Diet-Related Pathologies and Non-Communicable Health Risks: Positioned in **Grade 8** to facilitate higher-order pathological and metabolic comprehension.
   - Evidence-Based Dietary Guidelines: Introduced in **Grade 6** as an initial, actionable framework for daily nutrition.

b. **Determinants of Food Choices and Socio-Cultural Influences**
   - **Multifactorial Drivers of Food Selection:** Positioned in **Grade 6** to evaluate physiological, economic, and environmental influences on eating behaviors.
   - **Socio-Cultural Impacts on Dietary Patterns and Shared Meals:** Allocated to **Grade 7** to contextualize regional food traditions and cultural dynamics.

c. **Food Production and Processing**
   - **Institutional and Domestic Food Gardening**: Positioned in **Grade 8** to promote experiential, hands-on agricultural literacy.
   - **Industrial Food Manufacturing and Processing Technologies**: Allocated to **Grade 7** to evaluate the mechanical and chemical transformation of raw commodities.
   - **Organic Agronomy and Sustainable Agriculture**: Integrated into **Grade 8** to introduce concepts of bio-farming and environmental sustainability.

d. **Consumer Economics and Food Literacy**
   - **Food Shopping:** Placed in **Grade 7**
   - **Food Quality:** Placed in **Grade 6**
   - **Food Labeling:** Placed in **Grade 6**
   - **Food Advertising and Marketing:** Placed in **Grade 7**

e. **Food Psychodynamics and Emotional Development**
   - **Psychological Eating Drivers**, **Body Image, Self-Esteem**, and **Clinical Eating Disorders:** placed in **Grade 8**
   - **Responsibility** allocated to **Grade 7**

f. **Food Storage and Spoilage**
   - **Food Spoilage:** Positioned in **Grade 6**
   - **Food Storage:** placed in **Grade 6**

g. **Culinary Arts and Food Preparation**
   - **Kitchen Management, Ergonomics, and Technical Formulation Skills:** Positioned in **Grade 7**
   - **Culinary Techniques and Skills:** Allocated in **Grade 8**

h. **Food Safety and Public Hygiene**
   - **Food Hygiene and Food Contamination**: Introduced in **Grade 6**
   - **Food Poisoning:** placed in **Grade 8**

2.7 Data Analysis

Empirical data collected during the baseline needs assessment were coded, clean-vetted, and analyzed using the Statistical Package for the Social Sciences (SPSS), version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were computed to summarize the data; specifically, categorical variables are expressed as absolute frequencies and percentages, while continuous variables are reported as means and standard deviations.

3 RESULTS

3.1 Needs Assessment of Nutritional Knowledge

As demonstrated in Table 1, the mean nutritional knowledge score achieved by the respondents was 23.10 ± 5.24 out of a maximum possible of 50. The modal score observed within the cohort was 20 with individual performance scores ranging between 11 to 39.

Table 1. Nutritional Knowledge Marks

Variable	Mean	SD	Mode	Min.	Max.
Nutritional Knowledge (Marks out of 50)	23.10	5.239	20	11	39

3.2 Needs Assessment of Practical and Life Skills Related to Food and Nutrition

Regarding the utilization of food labeling data, 51.8% of the respondents reported that they did not read nutritional labels prior to purchasing or consuming food items, and 45.3% indicated an inability to comparative-screen products based on mandatory labeling metrics. Concurrently, 51.2% of the participants self-reported a capacity to comprehend the nutritional metrics displayed on commercial food packaging. In terms of food procurement behaviors, 49.4% of the cohort affirmed their ability to shop independently, 37% acknowledged an absence of strategic or planned purchasing habits. Furthermore, 38.8% of the participants demonstrated an inability to critically distinguish false health claims made by food manufacturers and commercial advertisements (Figure 1).

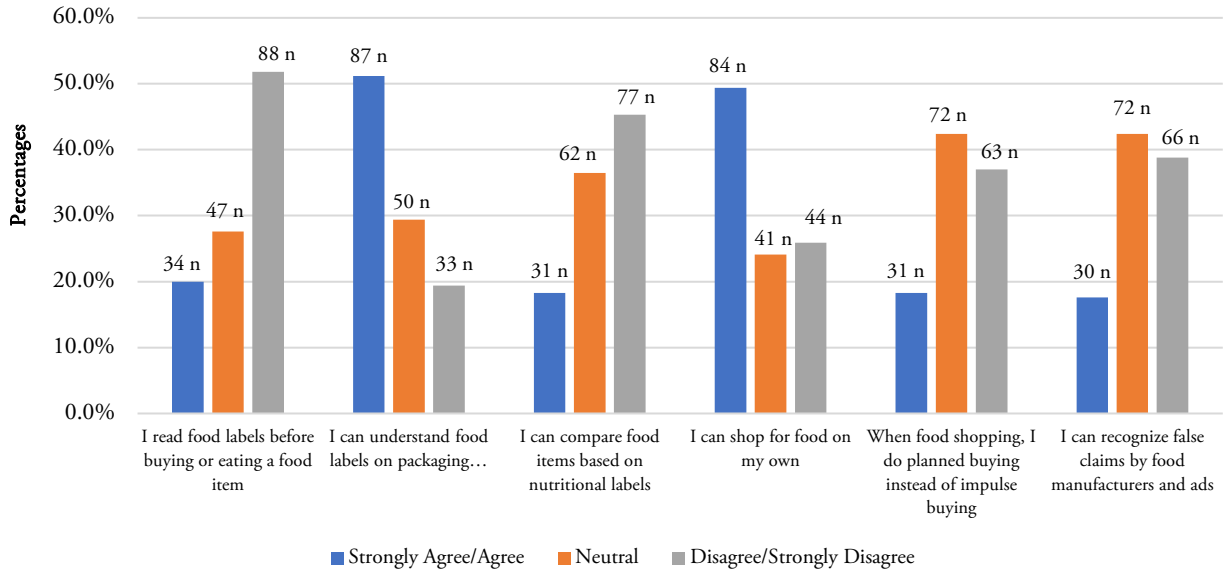

Figure 1. Skills Regarding Food Labels, Food Shopping, and Critical Thinking

n = frequency

Domestic food involvement metrics revealed that 39.4% of the participants did not actively engage in household food-related tasks, and 44.7% reported an incapacity to formulate balanced dietary meal plans. Conversely, 52.9% affirmed proficiency in preparing elementary food items, and 43.6% reported the ability to independently pack their school meals. Regarding agricultural and storage literacy, 54.2% of the respondents lacked the skills necessary to cultivate basic vegetables in a domestic garden, while 36.5% maintained a neutral stance regarding their comprehension of optimal food storage techniques (Figure 2).

A minor majority (40.6%) of the respondents agreed that they could independently select healthier dietary options; however, 57.1% reported an inability to maintain these healthy choices during social events or parties. Quantitative self-regulation analysis indicated that while 38.8% of the participants possessed self-control regarding the volume of food consumed, 34.2% lacked precise self-control over the dietary quality of their food choices. Lastly, 37% of the cohort expressed confidence in participating in structured discussions regarding the intersection of nutrition and public health (Figure 3).

3.3 Needs Assessment of Views Regarding Food and Nutrition

Attitudinal evaluations indicated that 36.5% of the respondents did not derive enjoyment from studying food and nutrition topics. However, 51.8% recognized food and nutrition as an informative academic subject, and 41.1% reported that the subject material did not induce academic disengagement or boredom. Additionally, 41.8% rejected the assertion that current nutrition education frameworks were irrelevant, while 53.0% agreed that nutritional literacy directly benefited their daily life practices (Figure 4).

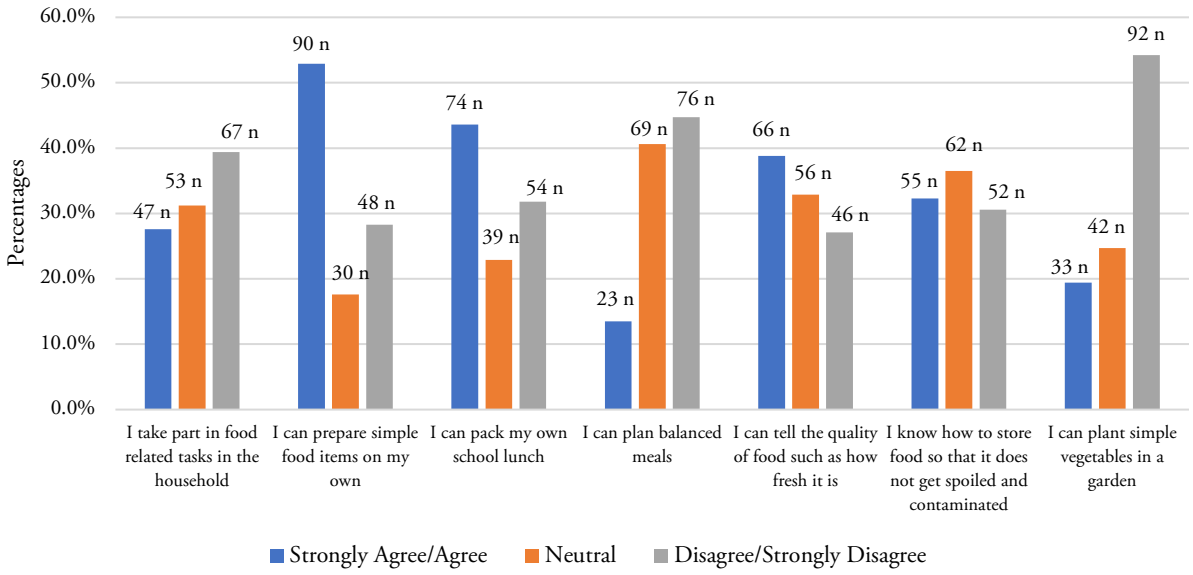

Figure 2. Food Preparation, Planning and Storage Skills

n = frequency

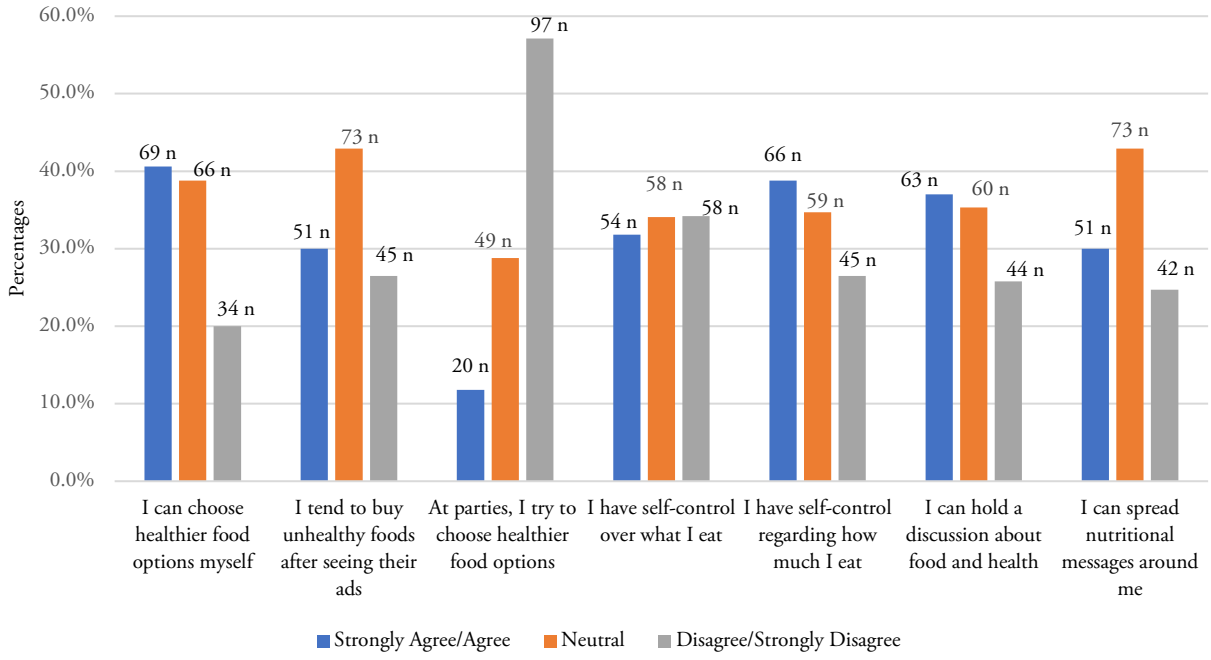

Figure 3. Decision-Making, Self-Control, and Communication Skills

n= frequency

Active classroom engagement was identified as a critical component of nutrition education by 53.6% of the participants. Similarly, the integration of practical assignments (55.3%) and the experiential formulation of healthy recipes (48.2%) were designated as highly important curricular elements. Furthermore, 41.2% of the respondents advocated for compulsory nutrition education across all student demographics, and 39.4% supported the establishment of nutrition as an independent, comprehensive academic discipline (Figure 5).

Curricular satisfaction metrics (Figure 6), 35.3% of the respondents were dissatisfied with the content that they were

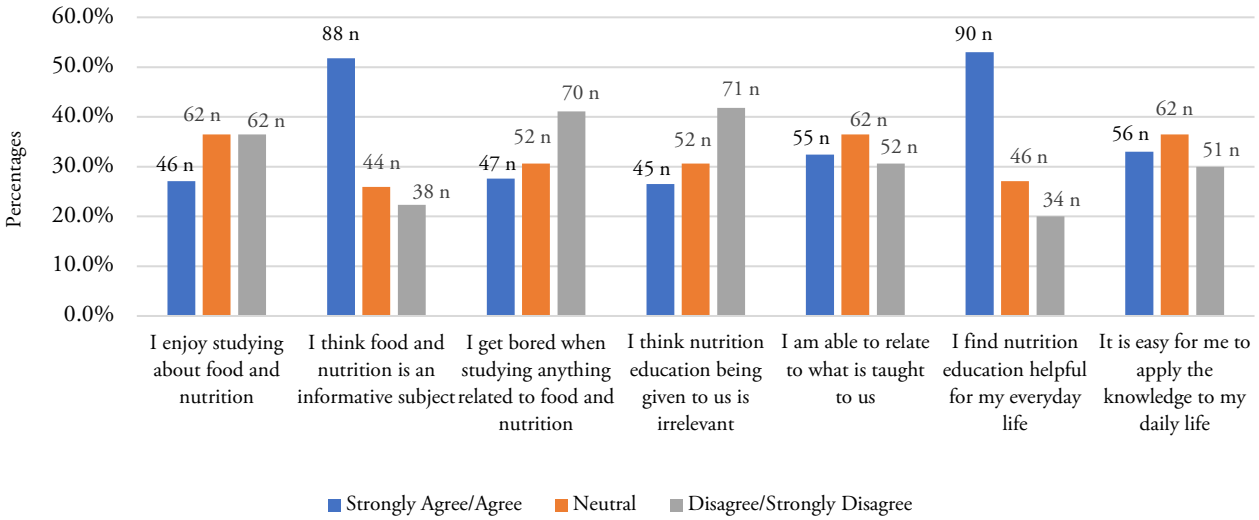

Figure 4. Views Regarding Food and Nutrition Education

n= frequency

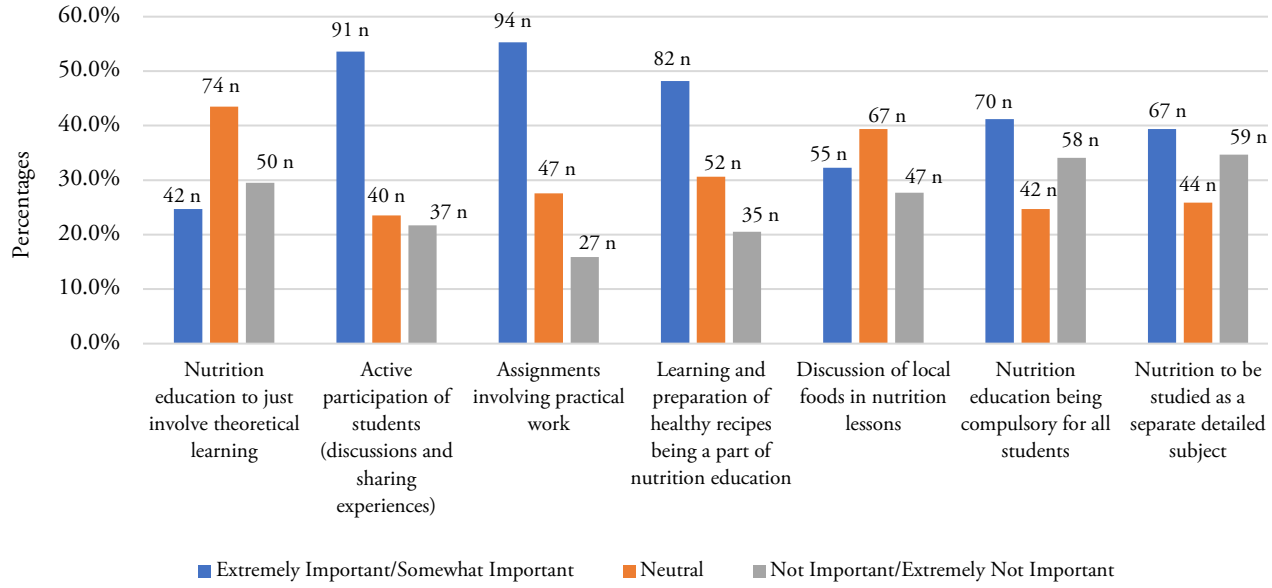

Figure 5. Importance of What Should be Included in Nutrition Education

n= frequency

being taught about food and nutrition. But more were neutral towards the way nutrition was being taught to them (35.9%), and towards the amount of time dedicated to nutrition education in current curriculum (47.6%).

3.4 Needs Assessment of Existing Nutrition Education Curriculum

Objective evaluations using a standardized observational checklist demonstrated that nutritional content within the existing school curriculum was strictly limited. Nutritional concepts were exclusively restricted to the general science syllabi of the 6th and 7th grades, whereas in the 8th grade, nutritional topics were selectively integrated into the biology curriculum.

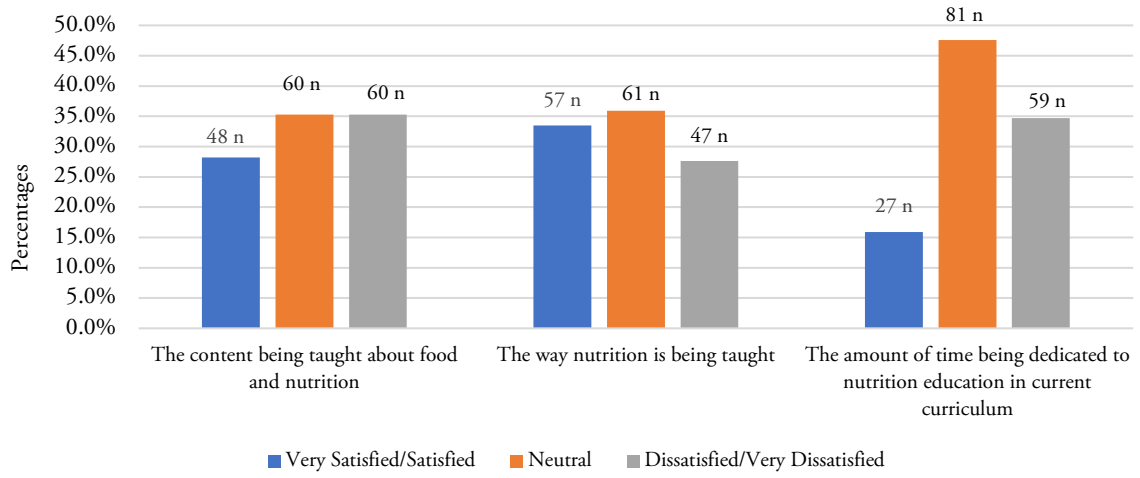

Figure 6. Satisfaction Towards Current Nutrition Curriculum

n= frequency

Table 2. Comparison of the Current Content to the Desired Content

Names of Topics	Covered partially	Not covered at all	What needs to be improved / added
1. Food, Nutrition and Personal Health	√		Dietary needs, principles of healthy eating and dietary guidelines.
2. Factors Influencing Food Choices and Cultural Impact on Meals		√	
3. Food Production and Processing	√		All aspects of food manufacturing and processing need to be added except fertilizers and their hazards.
4. Consumer Aspects of Food		√	
5. Food and Emotional Development		√	
6. Food Storage and Spoilage		√	
7. Food Preparation		√	
8. Food Safety and Hygiene		√	

Table 3. Inclusion of Theoretical and Practical Aspects and Involvement of Active, Experiential, and Participatory Learning

Learning Aspects and Approaches	Present	Partially Present	Absent
Theoretical knowledge and understanding.	√		
Habits and behaviors (concerning what and how much to eat, food safety practices etc.).			√
Attitudes (such as developing a positive approach towards food and nutrition, towards healthy lifestyle, and grasping the concept of how connected nutrition is to daily lives).		√	
Practical skills (such as some level of preparing and cooking, storing food, food shopping).			√
Life skills (such as the ability to choose the right foods, ability to plan meals, and influencing and guiding others).			√
Active Learning			
Assignments and activities involving action.			√
Students acting as informants and not only as learners.		√	
Experiential Learning			
Theoretical knowledge paired with direct experience whenever possible (working with actual food items).			√
Teachers' own experience shared with learners.		√	
Time given for reflecting and interpreting experiences.		√	
Participatory/Interactive Learning			
Exchanging information and ideas in pairs or groups in class.		√	
Tapping the information from family and community (through home assignments).			√

4 Discussion

The primary objective of this investigation was to systematically design a targeted nutrition education curriculum for middle school students in Pakistan, grounded in a rigorous baseline needs assessment. To ensure methodological standardization, the strategic framework was modeled after the Food and Agriculture Organization (FAO) planning guide (FAO, 2006). This approach facilitated a comprehensive assessment of the students' nutritional knowledge deficits, practical life skills, and underlying perspectives on food security and dietary habits, alongside an observational audit of the existing academic curriculum.

The utilization of standardized reference manuals is well-documented in regional curriculum development; for instance, Sherman & Muehlhoff, (2007) successfully applied the FAO planning framework to design, scale, and implement a comprehensive national school nutrition curriculum in Zambia.

Nutritional Knowledge constitutes the fundamental pillar driving behavioral modification and the adoption of health-promoting lifestyles. Consequently, quantifying baseline knowledge deficits allows researchers to isolate specific thematic areas requiring urgent educational intervention. In the present study, the cohort achieved a mean score of 23.10 out of 50. This sub-50% average indicates that the baseline nutritional knowledge of the target population was fundamentally inadequate. This deficit aligns with broader international trends; for example, Sichert-Hellert *et al.*, (2011) reported modest and highly variable degrees of nutritional literacy among European adolescents across both genders. Similarly, Milosavljević *et al.*, (2015) characterized adolescent nutritional knowledge as highly fractional and inadequate, noting that only 28.2% of their study population achieved satisfactory proficiency metrics.

Extending beyond theoretical knowledge, the evaluation of practical food-related life skills identified significant operational deficits. The primary areas of deficiency included poor food label literacy among 51.8% of the respondents reported not reading labels, an inability to compare food items using nutritional matrices in 45.3% of the cohort, a high reliance on impulse purchasing rather than structured budgeting, minimal participation in domestic food preparation (39.4%), an inability to construct balanced meal plans (44.7%), deficient domestic agricultural literacy (54.2%), and poor dietary adherence during social gatherings (57.1%).

These widespread practical skill deficits strongly imply that the prevailing educational framework is structurally insufficient and fails to translate theoretical nutrition into applied life skills—a hypothesis subsequently validated by our curriculum audit.

The practical skill deficiencies observed in this Pakistani study cohort mirror several contemporary peer-reviewed studies. In an assessment of adolescent food literacy perspectives conducted by Ronto *et al.* (2016), the participants failed to apply theoretical knowledge to daily practice due to a profound lack of self-efficacy regarding food preparation skills, despite expressing an explicit interest in developing such competencies. Similarly, a qualitative study in the United States by Leak *et al.* (2019) revealed that adolescents experienced significant discomfort utilizing basic culinary appliances (e.g., stovetops and ovens), with operational skills restricted to basic knife handling and blending. Conversely, higher levels of practical autonomy have been documented regionally; Mamba *et al.* (2019) reported that 78.9% of surveyed South African adolescents exhibited the necessary practical skills to independently prepare breakfast.

Attitudinal evaluations indicated that a substantial portion of the respondents did not find the current food and nutrition topics engaging. Despite that, they still considered the subject an informative subject (51.8%) and 41.1% denied experiencing boredom during instruction. In an Indian investigation conducted by Rathi *et al.* (2017b), 38.7% students reported that they enjoyed attending food and nutrition classes. Approximately half of the respondents (47%) found the curriculum interesting as well as accessible (50.3%). Crucially, however, 48.3% of the Indian cohort noted that the curriculum was undermined by an excessive reliance on rote memorization rather than practical application.

In the present study, over half of the respondents identified active classroom participation (53.6%) and experiential, project-based assignments involving healthy recipes (55.3%) as indispensable curricular components. Conversely, the cohort remained undecided regarding the utility of integrating localized or indigenous food systems into the lesson plans. Furthermore, 41.2% of the participants advocated for making nutrition education a mandatory core requirement for all students. This recommendation is supported by findings from Ronto *et al.* (2021) in Australia, where adolescent cohorts explicitly recommended that nutrition education classes be made compulsory to address public health challenges.

The physical audit of the existing institutional curriculum revealed severe content limitations, with only two out of the eight FAO-recommended core nutritional topics partially integrated into the syllabi. This limited content was restricted to general science and biology modules, leaving the critical areas of "Food, Nutrition and Personal Health" and "Food Production and Processing" highly underrepresented. The instructional paradigm was heavily skewed toward passive theoretical memorization rather than active, experiential

learning, with a total omission of practical life skills and localized cultural context.

Rathi *et al.* (2017b) noted that in Kolkata, India, nutrition education was limited to biology, home science, and general life skills modules with only 23.0% of students receiving culinary skills training and a mere 12.3% learning meal planning or food procurement economics. In a parallel study, Rathi *et al.* (2017a) concluded that the Indian nutrition curriculum was outdated, highly theoretical, and lacked practical assignments, leading participants to prioritize the integration of applied food skills. Similarly, Sherman, & Muehlhoff (2007) confirmed that traditional Zambian educational frameworks failed to properly integrate or standardize food and nutrition topics within the core curriculum materials.

The insights gained from this multi-dimensional need assessment directly informed the development of our newly formulated curriculum manual, which was subsequently optimized via independent double-blind expert peer review.

Limitations of the Study

This study possesses several limitations that warrant consideration. First, the sample population was drawn exclusively from two private schools via purposive sampling; therefore, the findings cannot be directly generalized to the broader adolescent demographic of Pakistan, particularly those attending public institutions or originating from lower socioeconomic strata. Private schools were preferentially selected due to their institutional flexibility and the availability of supportive instructional resources required to simulate an experiential curriculum. Second, due to strict academic timelines and resource constraints, the total sample size was relatively minor for a curriculum development framework. Lastly, the newly formulated curriculum book was not pilot-tested or actively implemented within school environments during the study timeframe; thus, its empirical efficacy in improving nutritional parameters, attitudes, and practical behaviors remains unmeasured.

5 Conclusions

This baseline needs assessment demonstrates that middle school adolescents exhibit significant nutritional knowledge deficits alongside critical gaps in practical food skills, including label literacy, comparative product analysis, planned purchasing, balanced meal formulation, and domestic agricultural skills. Although the students recognize nutrition as an informative and essential discipline, widespread dissatisfaction (35.3%) exists regarding current pedagogical delivery. The institutional curriculum audit confirmed severe structural limitations, characterized by a highly theoretical focus, an absence of applied life skills, and a detachment from localized cultural matrices.

Consequently, there is an urgent public health and educational mandate to overhaul the current middle school curriculum in Pakistan by replacing rote learning with an active, experiential, and skills-based nutrition education framework. The curriculum manual developed in this study serves as a validated initial model designed to address these specific regional deficits.

Ethical Approval

This investigation was conducted after approval from the *Board of Advanced Studies and Research (BASAR)*, Kinnaird College for Women Department of Food Sciences & Human Nutrition, Pakistan.

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Conflicts of Interest: The authors declare no conflicts of interest associated with this research study.

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