



## THE EFFECTIVENESS OF NUTRITION EDUCATION MODULES IN IMPROVING CHILDREN FOR SCHOOL-AGED STUDENTS AND THEIR KNOWLEDGE ON FOOD AND NUTRITION

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### Abstract

**Objectives:** This review explored the relationship between knowledge among children and adolescents and their dietary behavior.

**Content:** Potentially eligible original research articles were identified through a systematic search in PubMed, SCOPUS, Web of Science and WHO Virtual Health Library from 2000 to 2022. From the initial search, a total of 8,258 research articles were obtained. Duplicate studies were identified and removed. Observational studies on children and adolescents (5–16 years) of any gender, ethnicity and country were included in which the outcome measured was either a scoring of/ association between nutrition knowledge and practices. After screening using the inclusion criteria, 10 studies were selected for this paper. The quality of studies was assessed using the revised Cochrane risk of bias tool by two independent reviewers.

**Keywords:** nutrition education; behavior change; eating behavior; food environment; food skills.

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**Introduction:**

Maintenance of good health requires access to an adequate quantity of nutritious food (1). Child malnutrition is a major epidemiological problem in developing countries, especially in African countries. Child malnutrition is a worrying public health problem in developing countries. According to 2019 statistics, it is estimated that worldwide, one in five children under 5 years of age has some degree of malnutrition, about 150 million suffer from insufficient stature and almost 50 million are wasted (1). Of these, Africa has shown alarming increases in the rates of chronic malnutrition: the 22.4 million cases in 2000 rose to 28.9 million in 2018 (2). To the main underlying drivers of food insecurity, such as climate change, conflict and economic recessions, the impact of COVID-19 has recently been added, disproportionately affecting the African continent (3).

Nutrition-related knowledge, attitudes, and practices (KAP) are important determinants of nutritional status and are probable contributors to malnutrition (4). In delivering health and nutrition services, students are one of the most important target groups in the community, and school is one of the most important places in which students spent a long time of their life, develop their health attitudes and behaviors. School hours are the best time for individuals to learn, so the development of health skills and behaviors during this period can help them grow healthy and increase their physical and emotional health during adulthood (5,6). A common nutrition intervention that aims to address gaps in KAP is nutrition education. Nutrition education is a set of learning experiences designed to facilitate voluntary adoption of eating and other nutrition-related behavior conducive to health and well-being that includes those on a limited budget (7).

With urbanization, children and adolescents were found to consume more of energy-dense, low nutrient foods like deep-fried snacks, sweets, sugary drinks and less of fruit and vegetable (8,9). Easy availability and accessibility of these unhealthy foods in food outlets were commonly observed in their local food environment (10,11). Usually, consumption of unhealthy food products by children was found to be away from home that is when going to school or coming back home. Consumption of high fat and sugary foods is associated with increase in body mass index (BMI) and overweight and obesity among them. Increased obesity risk among children is associated with an increased risk of getting non-communicable diseases like cardiovascular disease, diabetes, hypertension, etc. (12).

**Methods:**

A Literature review were planned based on the preferred reporting items for systematic reviews (PRISMA) (13). We addressed the following research question using review techniques: (a) what is the nutrition education status of students 5 to 16yr old? (b) which factors are effective to improve nutrition knowledge among students? and (c) does nutrition knowledge affect dietary habits and student behaviors?

**Search strategy:**

Four different bibliographic databases : PubMed, SCOPUS, WHO Virtual Health Library and Web of Science were identified and searched. In the database search, using truncation appropriate word combinations of the following terms: knowledge, awareness, practice\*, behavio(u)r, adolescent, teen, children, nutrition, eating habit\*, dietary habit\*, food habit\*, food choice\* were used. Search limiters (filters) like publication date and year, language, age, source type, document type, keywords filter and species (human) were applied wherever options were available. All studies were imported into the reference manager for study selection.

**Inclusion and exclusion criteria:**

Studies were selected based on the following inclusion and exclusion criteria:

Inclusion criteria: (a) Population/Participants: children and adolescents (5–16 years) of any gender, ethnicity ; (b) Outcome measured: scoring of/association between nutrition knowledge and practices; (c) Study design: observational studies were included; (d) Original research articles in peer-reviewed journals; (e) Full-text articles in the English language; and (f) Date and year of publication: 1<sup>st</sup> January 2000–31<sup>st</sup> January 2022.

Exclusion criteria: (a) knowledge related to a specific nutrient, children/ adolescent on any diet therapy, disease; (b) Article whose full-text was not available; (c) Studies only on adults, elders and (d) conference proceedings, unpublished reports (grey literature).

**Data extraction and analysis:**

Data like the author(s), year, country, sample, age (in years), measures and result outcomes (overall associations and various factors association with nutrition knowledge and practices) from selected articles were extracted and entered in a matrix.

**Results and discussions:****Study selection**

From the initial search, a total of 8,258 studies were identified from four major databases i.e.

PubMed = 5,514, SCOPUS = 1,650, Web of Science = 601 and WHO Virtual Health Library = 493. After removal of duplicates, 6,317 studies were obtained. Based on the various inclusion and exclusion criteria and different levels of screening only 10 articles were finally selected for this review.

### Study characteristics

Nutrition knowledge was measured using questionnaires. studies were quantitative in nature. Questions related to healthy eating, physiological functions of nutrients in the human body, food categories, the relationship between diet/nutrient and disease, balanced diet, serving size, skills for

food selection etc. were probed from the questionnaire. Response format included multiple-choice questions, closed-ended items, 'yes', 'no' or 'don't know', Likert type scale with 'never', 'seldom', 'often', 'sometimes', 'usually' responses. Combinations of food frequency questionnaires, 24 h recall, food variety scores (FVS) and questionnaires were used to elucidate information related to eating behaviors. Studies adopted scoring methods for questions related to nutrition knowledge and behavior. From the review of the full-text articles, factors were identified which could affect eating behavior.

**Table 1:** Summary of the studies assessing the relationship between nutrition knowledge and practices among children and adolescents.

Author, year City, country	Sample n/Age range or mean $\pm$ SD, years	Measures	Relationship between overall nutrition knowledge and practices	Relationship between nutrition knowledge and various factors
Al-Yateem and Rossiter (2017) [14] Sharjah, United Arab Emirates	300/9–13 years	Nutrition knowledge and eating habits	Statistically significant relationship ( $p < 0.001$ )	Statistically significant relationship with gender ( $p < 0.001$ ).
Mbgori et al. 2019, Kenya [15]	mothers of infants <5 years (Mothers N= 48; Infants N = 45) Format: Group 5 days (two sessions/day 120–180 min)	Quasi-experimental, EP Educational model: Workshops on infant food and nutrition, practical cooking demonstrations, food hygiene practices and child care	Statistically significant relationship ( $p < 0.004$ ) At 6 months post-intervention. Infants: food consumption Infants: anthropometry, nutrition knowledge	Pre-test–post-test Knowledge: 68–91% $p = 0.004$ Non-significant changes: W/H, H/A and W/A
Mirmiran et al. (2007) [16] Tehran, Iran	7,669/10–16 years; Boys-4,070, Girls-3,599	Nutrition knowledge, attitude and practices	NS	– Significant difference between girls and boys ( $p < 0.001$ ). PA with parents' education level ( $r = 0.14$ , $p < 0.001$ ).
Pirouznia 2000 [17] Lima, Ohio, USA	532/11–13 years	Nutrition knowledge, eating behavior	–	Statistically significant association between nutrition knowledge and eating behavior among 7th grade ( $p < 0.008$ ) and 8th grade ( $p < 0.01$ ) school children. – NS association between nutrition knowledge and eating behavior among 6th graders.
Djordjevic Nikic et al. (2013) [18] Belgrade, Serbia	707/15.8 $\pm$ 0.3 years	Eating habits, physical activity, dietary habits, body mass index	-	Statistically significant difference between males and females ( $p = 0.002$ ). – NA with normal BMI boys ( $r = 0.14$ , $p = 0.02$ ).
Wang et al. (2014) [19] Mi Yun County, Beijing, China	188/12–14 years; Males-91, Females-97	Knowledge, attitude and behavior regarding nutrition and dietary intake	NS	No statistically significant difference between males and females
Turconi et al. (2008) [20] Aosta Valley Region, Northern Italy	532/15.4 $\pm$ 0.7 years	Eating habits, nutrition knowledge, body mass index, physical activity	-	Statistically significant difference between males and females ( $p < 0.05$ ). – NS (with BMI values)
Lin et al. (2007) [21] Taiwan, Republic of China	2,417/1-6 graders; 1st–3rd graders-1,119(Boys-654, Girls-545), 4th–6th graders-1,218(Boys-642, Girls-576)	Nutrition knowledge, attitude and behavior (caring about nutrition, dietary quality)	PA (weak) ( $r = 0.195 - 0.269$ )	– No statistically significant difference between boys and girls. – Statistically significant difference in mean scores of knowledge between 1st–3rd graders and 4th–6th graders ( $p < 0.05$ ).
Bundhun et al. (2018) [22] Mauritius	336/6–12 years; Males-165, Females- 171	Dietary intake and nutritional knowledge	-	– Statistically significant association with fruit consumption ( $p = 0.018$ ). – Statistically significant association among girls with more vegetables ( $p = 0.046$ ) and lower fast foods ( $r = -0.243$ , $p = 0.001$ ) intake.

'–' indicates not specified in the research article; NS, non-significant; PA, positive association, NA, -negative association.

**Discussion:**

The statistical association between overall nutrition knowledge and practices scores was tested and reported in three out of 10 studies [16, 19, 21]. Out of these, two studies showed no significant association [16, 19]. Majority of the children were aware that fruits and vegetables are rich in vitamin C; dairy products and beans are rich in calcium; breakfast is the most important meal [19]; excessive consumption of soft beverages cause overweight or obesity; crisps and corn balls are not healthy snacks [16] but the knowledge did not correlate with consumption of these foods among them. No association between nutrition knowledge and intake of unhealthy food items like sweets and high fat or salty snacks was also found in another study [17]. This highlights disconnect between nutrition knowledge and eating behavior. Significant relationship ( $p < 0.001$ ) was reported in one study [14] highlighting the fact that good nutrition knowledge results in healthy eating behavior while the other study showed a weak positive association ( $r = 0.195 - 0.269$ ) [29]. It may be interpreted that despite possessing knowledge

about nutrition, children and adolescents do not follow healthy eating habits. The consumption of unhealthy foods or poor dietary behavior may make them susceptible to obesity and related health problems. All of these studies have reported a need for health promotion and nutrition education interventions. This will help to increase awareness that will target culture and content-specific issues including poor dietary intake and risk of obesity and related health problems [14]. The interventions should also focus on different factors influencing eating behaviors and techniques that can be used to encourage healthy eating behavior. There are evidences which showed the effectiveness of nutrition education in bringing significant impact on the nutrition knowledge and practices of school going children (20)

**Characteristics of nutrition education programmes in schools that contribute to effectiveness** are summarized in Table 2

**Table 2** Characteristics of successful school-based nutrition education program

Behavioral focus	
Theory-driven strategies	
Adequate time and intensity	
Family involvement	
Multicomponent strategies	
Developmentally appropriate	
Considers needs of students, teachers and school	Self-assessment elements (older children)
Strengthen skills, influence attitudes, behavioral capability	Self-efficacy.
Adequate teaching methods	
Modify school environment: access to healthy food; school food policies ;school meals	
Teacher training opportunities	
Cultural relevance	
Evaluation	

**Conclusion:**

The review highlights a disconnect between nutrition knowledge and practices of children and adolescents. Majority of the studies reviewed in this paper reported that it is not merely knowledge but multiple factors which are related to nutrition behavior like nutritional status and lifestyle, age, gender, peer influence and parents'/guardians' nutrition knowledge, education and occupation. Both individual and environmental factors should be considered to develop any intervention strategies for inculcating healthy eating habits among children and adolescents. Although it is important to improve nutrition awareness, there is a need for holistic health behavior promotion interventions. The focus should be on developing skills for healthy eating among school children and

adolescents and on improving the food environment.

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