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An Innovative Nutrition Education Intervention to Improve Nutrition Knowledge in School Children

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Abstract: *Background: Malnutrition in school-going children may be attributed to non-communicable diseases, psychological distress, and poor superiority of life. To prevent this, an intervention program that boosts knowledge regarding nutrition education is required.*

Aim: The study aims to introduce the Kolar Nutrition Education Intervention Programme (KNEIP) to children and assess their knowledge. Materials & Methods: A total of 418 schoolchildren from urban and rural areas participated in this study. The intervention group consisted of 237 children while 181 children who did not receive the nutrition education package acted as controls. The nutrition education program that was conducted for 3 weeks comprised of a nutrition education pictorial board viewing session and a comic reading session followed by exercise questions as reinforcement for each session, and also classroom activities. The intervention program was run over five weeks and included five sessions encompassing several topics related to nutrition. Several teaching strategies and activities were used during the intervention such as small group discussions, group work, and others. Results: Only 3.3 percent of the studied sample scored fair (50-75% of answers were correct) in pre-intervention (all sessions combined), however, the percentage increased to 50.6% after the application of the intervention(P<0.0001). The percentage of overweight and obese in the studied sample was 17.0% and 10.9% respectively. Conclusion: This study has shown that a school nutrition intervention program could have positive effects on school children's nutrition knowledge. In addition, the utilization of different teaching and learning strategies may improve nutritional awareness among school children.

Keywords: *school-based intervention, diet, nutrition, healthy lifestyle*

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Introduction

The World Health Organization states that around 151 million children under five years of age are stunted, while 51 million are wasted, with underweight, stunting, and wasting defined as reduced weight increase followed by thinness. In 2017, the global count of overweight children under the age of five was recorded at 38 million. In Asia, almost fifty percent of children are identified as stunted, wasting, or overweight. In South-East Asia, one in four children under five is stunted, and one in ten is either wasting or overweight. 2

According to the initial cross-national assessments on child growth, India ranks third in terms of heightened patterns of growth faltering among numerous countries.Structural issues such as household poverty and hygiene, an inadequate food system, and poor water and sanitation are the primary contributors to child undernutrition in India. [4] Both overnutrition and undernutrition are prevalent among the majority of school-aged children in India. As per the National Family Health Survey (NFHS)-5 2022, the overall prevalence of stunting was recorded in 31.7% of children in India.

Schools remain a vital element to influencing and promoting healthy eating practices in children and adolescents. School settings also aid for free access to a big population for longer duration and throw light to lessen population-wide chronic disease. For instance, WHO suggests schools employ an approach to the entire school about healthy eating that involves teaching, learning, and professional development; physical and cultural and student, staff, and community partnerships. [5]

Globally, a large amount of research is going undertaken to find school-based nutrition interventions [6], this project is planned with the Kolar Nutrition Education Intervention Programme (KNEIP) in partnership with the District Director of Public Instructions (DDPI), Kolar.

The study intends to execute, the Kolar Nutrition Education Intervention Programme (KNEIP) and to measure the knowledge of children before and after the Kolar Nutrition Education Intervention Programme (KNEIP).

Materials and Methods

This was a Cluster randomized controlled study. The list of 162 schools was collected from the Office of DDPI, Kolar District. Out of which 64 were selected randomly. Schools are randomized into Intervention Groups and Control Groups by employing Block Randomization. 32 clusters will be provided for each group. A 10’ × 10’ banner was pre-designed which includes various concepts such as Height and weight standard references (ICMR 1990), 5 food groups to be consumed daily, symptoms of Protein-Energy Malnutrition (Bony appearance, Potbelly shape, stunted growth, underweight), Vitamin A deficiency (Bitot spots, Phrynoderma), Vitamin D and Calcium deficiency (Rickets), Vitamin B & C deficiency (Angular Stomatitis, Bleeding Gums, BeriBeri, Pellagra), Iron deficiency(Pale hands, pale eyes, pale tongue, Koilonychia), Sample menu for a day. Nutrition Education was presented utilizing the banner in one session. Nutrition knowledge of 55 students from each school both in the Control group and Intervention Group will be examined before the intervention using a questionnaire. These respondents were followed after 2 weeks to measure their dietary knowledge using the questionnaire (Figure 1).

parenthesis, following the example. Some components, such as multi-leveled equations, images, and tables are not prescribed, however the various table text styles are offered. The formatter will need to generate these components, incorporating the applicable criteria that follow.

Figure 1: Education tool used for the study

Knowledge Assessment Questionnaire

A questionnaire was developed to assess the knowledge of school children before and after the intervention Questionnaire consists of two sections.

Demographic profile

Demographic characteristics like age, date of birth, sex, level of education, name of the school, and location of the school were noted.

Nutrition Knowledge-related questions

The questionnaire consists of 20 questions related to different food groups to be consumed daily, 2-3 symptoms of Protein-Energy Malnutrition, Vitamin A deficiency, Vitamin D and Calcium deficiency, Vitamin B & C deficiency, Iron deficiency, Sample menu for a day, Height and weight standard references. The questions are partially categorized questions which are open-ended questions that require respondents to provide short answers in their own words, accompanied by a list of correct answers plus the options "Other" and "Don't know."

Data Collection

All the students participating in the study were explained regarding the study. Participants' information sheets were given and informed written consent was taken. Data were collected before and after the intervention using the questionnaire. These subjects were followed after 2 weeks to assess their nutrition knowledge after the intervention.

Statistical analysis: The collected information was analyzed using SPSS version 23.0. Student t-test was used to identify mean nutrition scores before and after intervention. Analysis of variance (ANOVA) was used to analyze means of nutrition knowledge scores and $P < 0.05$ was considered significant.

Ethical consideration: Ethical approval and logistical support were carried out by school authorities and family members. Due to COVID-19, the expected schools as well as sample size were not met.

Results

Among a total of 330 students, one-quarter of the sample (80 out of 330) was lost in the follow-up, and the final sample was 247 including 148 (59.9%) males and 99 (40.1%) females. The reasons for the loss of the sample were incomplete post-intervention and student absences on data collection days. Total knowledge scores related to nutrition in the studied sample before the application of the education intervention program are shown in Table 1.

Table1. Total nutrition knowledge score before intervention by gender and school type

Variable	Total number	Total knowledge Mean±SD	P value
Gender	N=247		0.02*
Male	148	13.0±4.4	
Female	99	14.3±3.9	
School type			
Male	N=148		0.004**
Urban	80	13.6±4.6	
Semi urban	33	13.8±3.4	
Rural	35	10.9±3.9	
Female	N=99		0.002**
Urban	40	15.9±3.4	
Semi urban	22	13.4±2.7	
Rural	37	13.1±4.4	
All samples	N= 247	13.5±4.2 (33%)	

*Student's t-test ** Analysis of variance (ANOVA) test

The mean and standard deviation of the total score of nutrition knowledge (all sessions combined) for the studied sample was 13.5±4.2. The mean total nutrition knowledge score in females (14.3) was significantly higher than that in males (13.0) (P=0.02). Moreover, the location of the school played a vital role in analyzing gender. In males, the mean total score of nutrition knowledge of students from rural areas (10.9) was significantly lower compared to scores of students from schools in the urban area (13.6) or semi-urban area in Kolar taluk (13.8) (P=0.004). However, in females mean of the total score of nutrition knowledge of students from semi-urban areas o (15.9) was significantly higher than

Table 2. Nutrition knowledge score of preparatory school students before and after intervention by gender

k	(N=247)		
	Pre	Post	Post
P	213(86.2)	29(11.7)	8(8.1)
F	34(13.8	87(35.2	43

	)	)	
g	-	131(53.1)	48
Mean sc	4.6±1.8	9.4±2.4	9.3±2.1
Poor	(83.4)	(17.8)	19
Fair	41 (16.6)	(46.6)	42
Good	-	88 (35.6)	38
Mean sc	3.5±2.1	7.5±2.2	7.7±2.3
Poor	(69.6)	64 (25.9)	26
Fair	45 (18.2)	72 (29.2)	28
Good	30 (12.2)	(44.9)	45
Mean sc	1.7±1.4	3.0±1.1	3.0±1.2
Poor	(83.8)	48 (19.4)	16
Fair	23 (9.3)	42 (17.0)	14
Good	17 (6.9)	(63.6)	69
Mean	1.3±1.2	3.7±1.3	3.4±1.3 P1 P3**

sc			
Poor	(93.1)	(44.9)	33
Fair	17 (6.9)	(55.1)	66
Mean sc	2.4±1.6	4.4±1.5 P1	4.8±1.3 P1 P4=0.002
Poor	(96.7%)	30 (12.2)	12
Fair	(3.3%)	(50.6)	44
Good	-	92 (37.2)	43
Mean sc	13.5±4.2	28.1±6.3P1	28.8±6.2 P1, P4=0.18

Scores; good, score>75%; fair, score 50%-75%; poor, score<50% of maximum

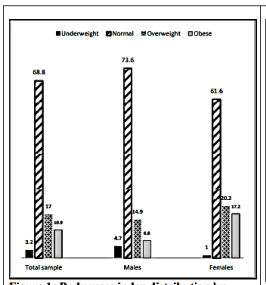

Figure 1: Body mass index distribution by gender among studied sample

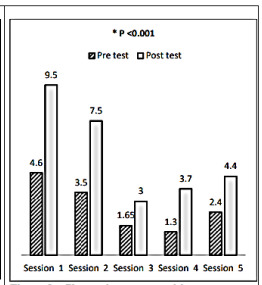

Figure 2: Change in mean nutrition knowledge score before and after intervention

The scores of students in semi-urban (13.4) and rural areas (13.1) (P=0.002).

Figure 1 showed the percentage of students according to weight status by gender. This figure showed that the percentages of overweight and obese in the studied sample were 17.0% and 10.9% respectively. The prevalence of obesity among female students (17.2%) was significantly higher (p value= 0.01) than the prevalence of obesity among male students (6.8%).

Scores; good, score>75%; fair, score 50%-75%; poor, score<50% of maximum

P1 Comparison between pre-intervention and post-intervention using paired samples T-test, all p1 was <0.0001.

P2: Use the independent samples t-test to compare the pre-intervention status of males and females. P3 Using independent samples, the post-intervention outcomes for males and females are compared. T-tests: * p≤0.05, **P≤0.01, not significant
Nutrition knowledge ratings by gender before and after interventions are displayed in Table 2. In session 1 (knowledge of the health benefits of essential nutrients), 16.6% in session 2 (knowledge of food groups in the food pyramid), 18.2% in session 3, 9.3% in session 4 (knowledge of milk and dairy products and bone health), and 6.9% in session 5 (knowledge of physical exercise), the percentages of students who scored fair (50-75% of answers were correct) prior to the intervention were 13.8%. Following the implementation of the intervention, the proportion of students who received fair scores rose to 35.2%, 46.6%, 29.1%, 17.0%, and 55.1% in sessions 1 through 5, respectively. Prior to the implementation of the intervention, just 3% of the sample under study received fair scores across all sessions combined; following the intervention, this percentage rose to 50.6%.

Male and female students in sessions 1 through 5 and all sessions combined showed similar trends in the percentages of those who received low, fair, and good scores (see table 2). In the five preceding sessions, Table 2 also demonstrated a statistically significant increase in mean score knowledge after the intervention as compared to before (9.4 vs 4.6 in session 1; 7.5 vs 3.5 in session 2; 3.0 vs 1.7 in session 3; 3.7 vs 1.3 in session 4 and 4.4 vs 2.4 in session 5). The total p-value was less than 0.0001. The nutrition intervention program resulted in a statistically significant improvement in the mean score of knowledge over all five sessions, from 13.5 before the program to 28.1 after it (p-value < 0.0001). Male and female students' pre-intervention scores in session 2 (3.3 vs. 3.8, p = 0.05), session 3 (1.4 vs. 1.9, p = 0.002), session 4 (1.5 vs. 1.1, p = 0.004), and all sessions combined (12.9 vs. 14.3, p = 0.02) differed statistically. Male and female students only differed significantly after the intervention in sessions 4 (3.5 vs. 3.4, p value = 0.006) and 5 (4.2 vs. 4.8, p value = 0.002). Additionally, Table 2 demonstrated that both male and female students' mean knowledge scores significantly increased after the intervention as compared to before, both for each session and for all sessions combined.

	Semiurban	Semiurban	Semiurban Giza	Rural Giza
Males	N=80		N=33	
preintervention	13.6±4.6		13.7±3.4	
Post-intervention	27.4 ±6.6		29.1±6.5	
P value*	<0.0001		<0.0001	<0.0001
Females		N=40	N=22	N=37
preintervention		15.9 ±3.4	13.4±2.7	13.05±4.4
Post-intervention		27.5 ±5.5	29.6±7.1	29.7±6.4
P value*		<0.0001*	<0.0001*	<0.0001*

Table 3: Overall total nutrition knowledge score (all sessions combined) of preparatory school students before and after intervention based on gender and location of the school.

* Paired t-test

Table 3 displayed the overall knowledge score of middle school pupils by gender and school location both before and after the intervention. Regardless of the school's location, both male and female students' total nutrition knowledge scores significantly increased following the intervention, with a P-value of less than 0.0001. Additionally, Figure 2 shows how the mean nutrition knowledge score changed before and after the intervention.
Talk about
One of the main causes of illness worldwide is a bad diet.[7] Although eating a nutritious diet is important at every stage of life, children and major teenagers have special nutritional needs. [8,9] The goal of the current study was to prevent malnutrition among Indian school-age children and assess the efficacy of a school-based intervention.

The prevalence of stunting, wasting, overweight, and anemia does not currently describe the overall quality of diet, despite the fact that national surveys in India contain crucial nutrition data. The diets of India's 29 states and 9 union territories vary. Food quality varies throughout the nation, and each state and region has its own unique culinary traditions. Therefore, India's dietary consumption research is delayed due to the nation's

diversity, a lack of regionally specific knowledge in dietary value, and the expense and time commitment of gathering high-quality dietary data. [10]

For the advancement of successful policies and initiatives targeted at improving eating habits among India's youth, dietary surveys of children and adolescents are crucial. This study identifies significant gaps in the understanding of schoolchildren picked from a subset of Kolar's governmental schools on nutrition. Both male and female pupils have a significant frequency of being overweight or obese. The results of this study also demonstrated that, regardless of gender or school location, there was a notable improvement in nutrition knowledge following the implementation of a nutrition education intervention. Only 3.3% of the group under research had fair knowledge, according to the current study (50–75% of answers were correct) (Table 2). But according to a study done in nine European countries, the proportion of pupils (ages 12.5–15.49) with fair knowledge was 15 times greater (60%) than the percentage in the current survey. [11] The rate was four times greater in a different survey of Asian Indian urban children aged 12 to 14 attending government schools. [12] The inadequate nutrition literacy in the current study may have negative consequences in maturity, such as poor food choices, energy imbalance, and ultimately, inability to control weight. However, since the current study was a purposeful sample and only included a few chosen governmental schools from Kolar Taluk, this low literacy rate might not typically reflect Kolar's entire school population.

It's interesting to see that female students had a little better mean score (14.3) for total knowledge than male students (12.9). According to surveys conducted in a number of European, American, and Malaysian nations, female students score higher on knowledge tests than their male counterparts. [11–14]

Changing eating patterns linked to rapid urbanization and physical inactivity may help to explain the increasing prevalence of overweight and obesity among teenagers in the current study. [15] Additionally, the recent study found that girls were more likely than boys to be obese.

The substantial improvement in the learning results of the targeted schoolchildren supports our study and others from several other nations. [16] The length of time the intervention program is implemented has a big impact on how well it works. Numerous studies have demonstrated that a 4- to 13-week implementation period was adequate to enhance students' understanding of nutrition, while it may have equivocal effects in terms of practice. [17] According to our research, a five-week intervention significantly increased the participants' general level of knowledge. Adolescent nutrition intervention programs that include several pillars to focus on, such as behavioral, individual, environmental, and theoretical content (length and intensity) appropriate for the audience's age, have shown positive effects. [18, 19]

In conclusion, our study has demonstrated that schoolchildren may benefit from a school nutrition intervention program.

Conclusion

To conclude, school-based nutrition interventions could have a positive effect on dietary intake in children and adolescents. These study findings could be used by researchers, health professionals, and several school authorities to plan and execute the intervention in preventing malnutrition.

Statement and Declaration

All the authors declare that this manuscript is not published elsewhere

Competing interests

None

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