Original Research Article

A NOVEL NUTRITION-BASED EDUCATION PROGRAM TO ENHANCE DIETARY KNOWLEDGE AMONG GRADUATING STUDENTS

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ABSTRACT

Background: Malnutrition in college-going children may be attributed to non-communicable diseases, psychological distress, and poor socioeconomic status of life. To prevent this, an intervention program that boosts knowledge regarding nutrition education is required. The study aims to introduce the Nutrition Education Intervention Programme (NEIP) to graduates and assess their knowledge. **Materials and Methods:** A total of 418 graduates from urban and rural areas participated in this study. The intervention group consisted of 237 graduates, while 181 children who did not receive the nutrition education package acted as controls. The nutrition education program, conducted over 3 weeks, comprised a nutrition education pictorial board viewing session and a comic reading session, followed by exercise questions as reinforcement for each session, as well as 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 employed during the intervention, including small-group discussions, group work, and others. **Result:** Only 3.3 per cent 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 individuals in the studied sample was 17.0% and 10.9% respectively. **Conclusion:** This study has shown that a graduate nutrition intervention program could have positive effects on nutrition knowledge. In addition, the utilisation of different teaching and learning strategies may improve nutritional awareness among them.

INTRODUCTION

According to the reports of the World Health Organisation, around 151 million and 51 million children under 5 years of age were stunted and wasted (reduced weight gain followed by thinness are termed as underweight, stunting, and wasting) respectively. The number of overweight children under five was noted to be 38 million in 2017 globally.[1] In Asia, more than half of the children are found to be stunted, wasted, and overweight. Particularly in South-East Asia, one in every four children under five is stunted; one in every ten is wasted and overweight.[2]

As per the first cross-national studies of child growth, India is ranked third with increased patterns of growth faltering among many countries.[3] Structural factors viz. household poverty and hygiene, inadequate food system, poor water, and sanitation are the major attributing factors for India's child undernutrition problem.[4] Strategies like overnutrition and undernutrition coexist majority of

college-going children in India. As per the National Family Health Survey (NFHS)-5 2022, the overall prevalence of stunting was noted in 31.7% of children in India.

College remains a major key to influencing and impacting healthy eating behaviours in adolescents. College setting also helps for free access to a large population for a longer duration and sheds light on minimize population-wide chronic disease. For instance, WHO recommends graduates implement an approach to the entire college regarding healthy eating that combines teaching, learning, and professional development; physical and cultural and student, staff, and community partnerships.[5]

Globally, a considerable amount of research is going on to identify graduate-based nutrition interventions.[6] The study aims to implement the Nutrition Education Intervention Programme (NEIP) and to assess the knowledge of graduates before and after the Nutrition Education Intervention Programme (NEIP).

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MATERIALS AND METHODS

This was a cluster-randomised controlled trial. Graduates are randomised into Intervention Groups and Control Groups by using Block Randomisation. 32 clusters were allotted 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 given using the banner in one session. Nutrition knowledge of 55 students from Control group and Intervention Group were assessed before the intervention using a questionnaire. These subjects were followed after 2 weeks to assess their nutrition knowledge using the questionnaire [Figure 1].

Knowledge Assessment Questionnaire

A questionnaire was developed to assess the knowledge of college 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 college, and location of the college 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 analysed 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 analyse means of nutrition knowledge scores and $P < 0.05$ was considered significant.

Ethical consideration: Ethical approval and logistical support were carried out by college authorities and family members. Due to COVID-19, the expected colleges 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.

Table 1: Total nutrition knowledge score before intervention by gender and college 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	
College 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

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

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 college played a vital role in analysing 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 colleges in the urban area (13.6) or semi-urban area (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 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%).
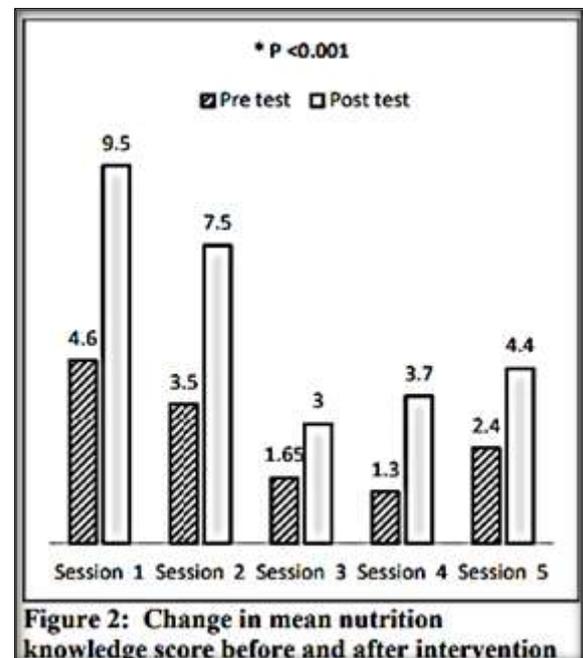

Figure 2: Change in mean nutrition knowledge score before and after intervention

Table 2: Nutrition knowledge score of students before and after intervention by gender

Score of knowledge(know)	Total sample (N=247)		Male students(N=148)		Female students (N=99)	
	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Session 1: Health benefits of Essential nutrients						
Poor	213(86.2)	29(11.7)	131(88.5)	21(14.2)	82(82.8)	8(8.1)
Fair	34(13.8)	87(35.2)	17(11.5)	44(29.7)	17(17.2)	43(43.4)
Good	-	131(53.1)	-	83(56.1)	-	48(48.5)
Mean score of Know±SD	4.6±1.8	9.4±2.4	4.5±1.7	9.6±2.6	4.8±1.9	9.3±2.1
Session 2: Food groups in food pyramid and serving size						
Poor	206 (83.4)	44 (17.8)	121 (81.8)	25 (16.9)	85 (85.9)	19 (19.2)
Fair	41 (16.6)	115 (46.6)	27 (18.2)	73 (49.3)	14 (14.1)	42 (42.4)
Good	-	88 (35.6)	-	50 (33.8)	-	38 (38.4)
Mean score of Know±SD	3.5±2.1	7.5±2.2	3.3±2.3	7.4±2.1	3.8±1.7	7.7±2.3
Session 3: Dietary guidelines						
Poor	172 (69.6)	64 (25.9)	112 (75.5)	38 (25.7)	60 (60.6)	26 (26.2)
Fair	45 (18.2)	72 (29.2)	25 (16.9)	44 (29.7)	20 (20.2)	28 (28.3)
Good	30 (12.2)	111 (44.9)	11 (7.6)	66 (44.6)	19 (19.2)	45 (45.5)
Mean score of Know±SD	1.7±1.4	3.0±1.1	1.4±1.3	3.0±1.1	1.9±1.4	3.0±1.2
Session 4: Milk, Dairy products and Bone health						
Poor	207 (83.8)	48 (19.4)	115 (77.7)	32 (21.6)	92 (92.9)	16 (16.2)
Fair	23 (9.3)	42 (17.0)	17 (11.5)	28 (18.9)	6 (6.1)	14 (14.1)

Good	17 (6.9)	157 (63.6)	16 (10.8)	88 (59.5)	1 (1.0)	69 (69.7)
Mean score of Know±SD	1.3±1.2	3.7±1.3 P1	1.5±1.4	3.5±1.3 P1	1.1±0.9 P2**	3.4±1.3 P1 P3**
Session 5: Physical activity						
Poor	230 (93.1)	111 (44.9)	140 (94.6)	78 (52.7)	90 (90.9)	33 (33.3)
Fair	17 (6.9)	136 (55.1)	8 (5.4)	70 (47.3)	9 (9.1)	66 (66.7)
Mean score of Know±SD	2.4±1.6	4.4±1.5 P1	2.3±1.6	4.2±1.6 P1	2.6±1.5 P3=0.14	4.8±1.3 P1 P4=0.002
All sessions combined						
Poor	237 (96.7%)	30 (12.2)	143 (96.6)	18 (12.2)	94 (94.9)	12 (12.2)
Fair	10 (3.3%)	125 (50.6)	5 (3.4)	81 (54.7)	5 (5.1)	44 (44.4)
Good	-	92 (37.2)	-	49 (33.1)	-	43 (43.4)
Mean score of Know±SD	13.5±4.2	28.1±6.3P1	12.9±4.4	27.7±6.3 P1	14.3±3.9 P3=0.02	28.8±6.2 P1, P4=0.18

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.

P2Comparison between pre-intervention in males and pre-intervention in females using independent samples t-test.

P3 Comparison between post-intervention in males and post-intervention in females using independent samples T-test's= not significant, * p≤0.05, **P≤0.01

Table 2 shows scores of nutrition knowledge pre- and post-interventions by gender. Pre-intervention, the percentages of students who scored fair (50-75% of answers were correct) were 13.8% in session 1(knowledge about health benefits of essential nutrients); 16.6 % in session 2 (knowledge about food groups in the food pyramid); 18.2% in session 3 (knowledge about dietary guidelines), 9.3% in session 4 (knowledge about milk and dairy products and bone health) and 6.9% in session 5 (knowledge about physical exercise). The percentages of students who scored fair after the application of intervention increased to 35.2%, 46.6%, 29.1%, 17.0%, and 55.1% in sessions 1 to 5 respectively. Only Three percent of the studied sample scored fair in all sessions combined pre-intervention and the percentage increased to 50.6% after application of the intervention.

Similar patterns in percentages of those who scored poor, fair, and good were found in both male and female students in sessions 1 to 5 and all sessions combined respectively (see table 2). Table 2 also showed a statistical increase in mean score knowledge post-intervention compared to pre-intervention in the 5 previous sessions (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) with p value less than 0.0001 in all. The overall mean score of knowledge obtained in the five sessions combined increased from 13.5 pre-intervention to 28.1 after the nutrition intervention program and the increase was statistically significant (p-value < 0.0001). There was a statistical difference between male and female students' pre-intervention in session 2 (3.3 vs 3.8, p value= 0.05); session 3 (1.4 vs 1.9, p value=0.002), session 4 (1.5 vs 1.1, p value=0.004) and all sessions combined (12.9 vs 14.3, p value=0.02). Post-intervention there was a significant difference between male and female students only in session 4 (3.5 vs 3.4, p value= 0.006) and in session 5 (4.2 vs 4.8, p value=0.002). Table 2 also showed that there was a significant increase in the mean score of knowledge post-intervention compared to pre-intervention in each session and all sessions combined in both male and female students.

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

	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*

* Paired t-test

[Table 3] showed the overall total score of knowledge of middle college students before and after intervention based on gender and location of college. There was a significant increase in overall scores of nutrition knowledge after intervention in male and female students irrespective of the location of the college and P was less than 0.0001. Also, in Figure 2 the change in mean nutrition knowledge score before and after the intervention is demonstrated.

DISCUSSION

Globally, poor diet quality stands as a leading cause of ill health.[7] A healthy diet is essential in all stages

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of the life cycle; however, children and major adolescents have unique nutritional requirements.[8,9] The present study was conducted to evaluate the effectiveness of a college-based intervention and to prevent malnutrition among graduates in India.

Even though national surveys in India comprise important nutrition information; the prevalence of stunting, wasting, overweight, and anaemia, do not currently summarize overall diet quality. India has 29 states and 9 union territories with varied diets. Each state and regions have diverse culinary traditions and food quality differs across the country. Research on dietary intake in India is thus delayed, by the country's diversity, incomplete expertise in dietary valuation across regions, and the high cost and time load of collecting high-quality dietary data.[10]

Dietary surveys in children and adolescents are important for the progress of effective policies and agendas aimed at enhancing eating behaviours among India's youth. This study highlights marked gaps in nutrition-related knowledge of graduates chosen from our institution. A high prevalence of overweight and obesity was noticed in both male and female students. The findings of this study also showed that after the application of nutrition education intervention, a significant improvement in nutrition knowledge irrespective of gender or location of college. The current study showed that only 3.3% of the studied sample have fair knowledge (50-75% of answers were correct) [Table 2]. However, the percentage of students (aged 12.5-15.49 years old) who have fair knowledge in a study conducted in nine European countries was 15 times much higher (60%) than the percentage reported in the current study.[11] In another study of urban Asian Indian children from governmental colleges (aged 12-14 years old), the percentage was four times higher.[12] The low literacy related to nutrition in the current study may have bad repercussions in their adulthood translated into bad choices of food, energy imbalance, and consequently failure in weight management. However, this low literacy may not generally represent the whole number, as the current study was a purposive sample and included only selected graduates.

Interestingly, the mean score of total knowledge was slightly higher in female students (14.3) compared to male students (12.9). Similarly, studies from several countries in Europe, the USA, and Malaysia found that female students have a higher knowledge score than their male counterparts.[11-14]

The higher prevalence of overweight and obesity among adolescents in the current study could be explained partly by changing dietary patterns associated with rapid urbanization and physical inactivity.[15] The current study also revealed a higher prevalence of obesity in girls compared to boys.

Our study and others from multiple countries make a convincing case through the significant improvement in learning outcomes of the targeted graduates.[16] The period of implementation of the intervention program has a significant effect on the outcome of the intervention. Several studies have shown that an implementation period of 4 to 13 weeks was sufficient to improve the nutrition knowledge of students, but may produce inconclusive results regarding practice.[17] Our study has shown that an intervention of 5 weeks duration produced significant improvements in the overall knowledge of the participants A nutrition intervention program targeting adolescents produced successful results when they have multiple pillars to focus on including behavioral, individual, environmental, and theoretical content (duration and intensity) appropriate to the age of the audience.[18,19]

To summarize, this study has shown that a college nutrition intervention program could have positive effects on graduate children.

CONCLUSION

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

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