Hidden Hunger or Knowledge Hunger? An Interventional Study in a Public School ofRawalpindi

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ABSTRACT

Objective: To assess baseline micronutrient knowledge among adolescents in a school of Rawalpindi and to determine effect of educational intervention on micronutrient knowledge and food choices.

Study Design: Quantitative pre-and post-intervention study.

Replace and During of Study: A Public school of Rawalpindi Pakistan from Nov 2021 to Apr 2022.

Methodology: A sample size of 190 was obtained by using Raosoft sample size calculator. Considering 15% non-response final sample size of 230 was taken. Study participants included students of 9th–12th grades enrolled through non probability convenience sampling. A pre-test was taken to assess baseline micronutrient knowledge using standardized, pretested questionnaires. Five invalid responses were excluded, yielding a total of 225. Intervention was carried out via an interactive multimedia lecture on micronutrients. After eight weeks, 217 out of those students were reassessed via same questionnaire. Data was analysed using SPSS Version-25. Qualitative variables were expressed as frequency and percentages and quantitative variables as mean and S.D. Paired sample t-test (for continuous variables) and Chi-square test (for categorical variables) were applied.

Results: Out of 217 participants, 66(30%) were males and 151(70%) were females with a mean age 16.8±0.7 years. Significant improvement was seen on general micronutrient knowledge and knowledge of iron, vitamin A, vitamin D, zinc, calcium and folate (*p*-value <0.05). There was a moderate improvement in food consumption in a frequency of 2-3 times/week.

Conclusion: The intervention improved micronutrient knowledge and positively impacted food choices. Thus, such knowledge-based programs are recommended.

Keywords: Adolescent nutrition science, Food, Health knowledge, Micronutrient.

INTRODUCTION

Hidden hunger refers to micronutrient deficiencies in absence of an energy-deficient diet.[1] It occurs when intake or absorption of micronutrients (vitamins and minerals) does not suffice for promotion of health. When the body faces calorie deficit, the brain triggers signals to communicate the need for increased food intake, making the problem readily detectable. However, in micronutrient deficiency, the signal is not produced, making it difficult to recognize. Due to this "hidden" nature lacking overt signs and symptoms of micronutrient deficit,[2] the problem can be overlooked. Except vitamin D, micronutrients such as iron, zinc, vitamin A and calcium are not synthesized in the body and their sole source is diet. Iron is essential for red blood cell function and production. Iron deficiency is the primary cause of anaemia worldwide.[3] Calcium and vitamin D are required for bone growth. Folate, vitamin A and zinc are crucial for fetal growth, vision and skin, nails and hair, respectively.

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According to Global Hunger Index, around two billion people suffer from hidden hunger, particularly in low and middle-income countries.[4] The adolescent age group is even more vulnerable to effects of malnutrition, owing to relatively greater nutrient requirements.[5] According to World Health Organization, adolescents do not satisfy their daily requirements of micronutrients.[1]

In 2013, 1.7 % deaths among children <5 years in low and middle-income countries were due to deficiency of vitamin A, with 95% of deaths occurring in South Asia and sub-Saharan Africa.[6] In South Asia, anaemia among pregnant women (52%) and children <5 years (58%) exceeds global prevalence (38 and 43%, respectively).[7] Prevalence of zinc deficit stands at 30% against global prevalence of 17%.[8] In India, 0.5% deaths in 2016 were contributed by nutritional deficiencies.[9]

According to Pakistan National Nutrition Survey, prevalence of anaemia among adolescents and women of reproductive age is >40%.[10] Among children, prevalence of iron deficiency anaemia is 28.6%, zinc deficiency is 18.6%, vitamin A deficiency is 51.5% and

vitamin D deficiency is 62.7%. This emphasizes the gravity of the situation in Pakistan and puts these children at a high risk of developing chronic diseases later in life. Therefore, it is necessary to address this pertinent issue. This research aims to determine awareness of micronutrient deficiency and the effect of educational intervention on knowledge and eating habits. It presents multiple suggestions to curb the menace of hidden hunger and to bridge the gap between knowledge and practice.

METHODOLOGY

An analytical, quantitative pre and post intervention study was conducted in a co-education public school of Rawalpindi, Pakistan with a population of 1120 students of 9th-12th grades. Study was conducted over a period of six months i.e from November 2021 to April 2022. Ethical approval was sought from the Ethical Review Committee of Army Medical College prior to the study.

Inclusion Criteria: Students of either gender, aged between 13-18 years, studying in 9th-12th grades were included in the study.

Exclusion Criteria: Students undertaking exams at time of study were excluded from the study.

Using Raosoft sample size calculator, keeping Confidence Interval 95% and margin of error 5%, a sample size of 190 was calculated. Adjusting for 15% non-response rate, a final sample size of 230 was taken. After obtaining informed written consent, students were recruited using non probability convenience sampling. Pre-test was taken to assess their baseline knowledge about micronutrients using an interviewer-administered, validated, closed ended questionnaire.[11] The questionnaire consisted of three parts. Part A was based on sociodemographic details and eating habits of participants. Part B inquired of general knowledge on nutrition along with functions and manifestations of deficits of micronutrients under study i.e iron, calcium, zinc, vitamin A, vitamin D and folate. Part C was based on questions regarding frequency of consumption of different categories of food i.e energy giving foods, body building foods and body protective foods. of the responses obtained,[5] were taken as invalid due to incomplete filling, hence were excluded. Pre-test was followed by an educational intervention in the form of a PowerPoint presentation having overview of nutrition along with sources, functions and symptoms of micronutrients deficiency. Presentation also contained pictures and charts to assist in retention of information. The session was interactive and entertained questions to keep the audience engaged. Eight weeks following intervention, a post-test was carried out in which the participants were reassessed by the same questionnaire. Two hundred seventeen students took part in the post-test. The loss to follow-up was attributed to absentees from school due to upcoming exams. Flow chart of methodology is presented in Figure-1. Statistical analysis was performed using Stastical Package for Social Sciences (SPSS) version-25.0. Each individual response was graded, one point was given for each correct answer, after which they were grouped into 3 knowledge categories i.e very good knowledge (70-100%), good knowledge (40-69%) and poor knowledge (≤39%). Knowledge scores (pre and post intervention) were expressed as Mean±SD. Food consumption habits (pre and post intervention) were expressed as frequency and percentages. Paired sample t-test and Chi-square test of significance were applied. The p-value<0.05 was taken as statistically significant. All results were presented in form of tables and graphs.
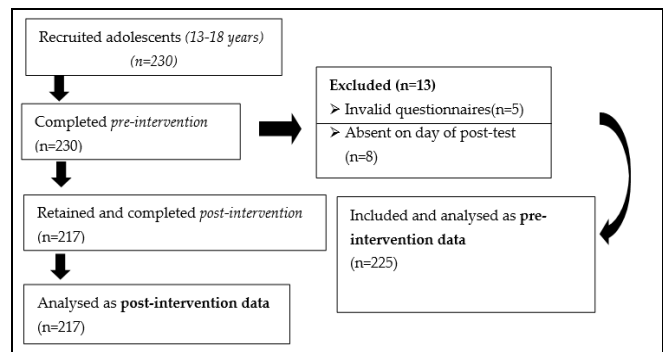

Figure-1: Flow chart of Study Methodology

RESULTS

Among 225 participants, 85(37.8%) were males and 140(62.2%) were females. Their ages ranged from 13-18 years with a mean age of 16.8±0.7 years. Five (2.2%) participants had a household income below Rs.25000 and 220 (97.8%) had a household income above Rs.25000 (Table-I).

Regarding dietary habits, 79(35.1%) of participants did not skip meals while 146(64.9%) participants reported to have a habit of skipping meals. Among them, 26(17.8%) skipped meals every day, 94(64.4%) skipped meals 2-3 times a week and 26(17.8%) skipped meals more than 3 times a week. The most frequently skipped meal was reported to be

breakfast i.e. by 54(37%) of participants. The most common cause of skipping meals was poor appetite i.e., 78(53.4%) participants (Table-II).

Table-I: Sociodemographic details of participants (n=225)

Variables	Frequency(n)	Percentage(%)
Gender		
Male	85	37.8
Female	140	62.2
Age Group		
13-15 years	13	5.8
16-18 years	212	94.2
Parent's Income		
Below Rs. 25000	5	2.2
Above Rs. 25000	220	97.8

Table-II: Dietary profile of participants (n= 225)

Variable	(n)	(%)
Skipping of meals		
Yes	146	64.9
No	79	35.1
Frequency of skipping meals		
Everyday	26	17.8
2-3 times a week	94	64.4
More than 3 times a week	26	17.8
Mostly skipped meal		
Breakfast	54	37.0
Lunch	42	28.8
Dinner	50	34.2
Reason for skipping meals		
Non availability of food	1	0.7
Weight reduction	18	12.3
No liking for food	36	24.7
Getting late for school	10	6.8
No appetite	78	53.4
Others	3	2.1
Source of food		
Hostel facility	10	4.4
Home	213	94.7
Restaurants	2	0.9
Source of food if living at home		
Only from market	128	56.9
Kitchen garden	22	9.8
Farm	4	1.8
Partly from market and partly from farm	71	31.6

Significant improvement was observed in micronutrient knowledge post intervention ($p<0.05$) (Table-III).

Figure-2 depicts consumption profile of various food categories. There was a moderate increase in consumption of cereals (44% to 52.5%), breads (27.1% to 37.8%), fish (21.3% to 22.6%), eggs (29.3% to 38.7%),

liver (10.2% to 20.3%), potatoes (53.3% to 59.4%), milk (23.1% to 39.6%), beans (48.9% to 60.4%), nuts (35.6% to 37.8%), orange (40.9% to 47.5%), apples (36.4% to 37.3%), leafy vegetables (32.9% to 45.2%), guava (33.3% to 43.3%), juices (34.7% to 43.3%) and okra/ladyfinger (24% to 26.7%) in a frequency of 2-3 times a week. There was a decrease in consumption of pasta (30.2% to 29.5%), meat (52.0% to 46.1%) and carrots (37.8% to 37.3%) to 2-3 times a week. There was no significant change in consumption of chicken (49.3% in both pre and post-intervention).

Table-III: Comparison of General nutrition knowledge and Specific micronutrient knowledge between pre and post intervention groups (%)

| Variables	Knowledge Categories (%)			p-value
	Very good	Good	Poor	
General Nutrition Knowledge				
Pre-intervention	16.4	49.3	34.2	0.000
Post-intervention	39.2	37.8	23.0	
Knowledge of iron				
Pre-intervention	1.3	22.7	76.0	0.000
Post-intervention	3.7	40.6	55.8	
Knowledge of Vitamin-A				
Pre-intervention	0.9	13.8	85.3	0.000
Post-intervention	9.7	25.3	65.0	
Knowledge of Vitamin-D				
Pre-intervention	0.9	30.2	68.9	0.000
Post-intervention	7.4	47.9	44.7	
Knowledge of Zinc				
Pre-intervention	0.0	4.9	95.1	0.032
Post-intervention	0.5	11.1	88.5	
Knowledge of Calcium				
Pre-intervention	1.3	13.3	85.3	0.000
Post-intervention	18.9	39.6	41.5	
Knowledge of Folate				
Pre-intervention	0.0	0.9	99.1	0.000
Post-intervention	0.0	13.4	86.6	
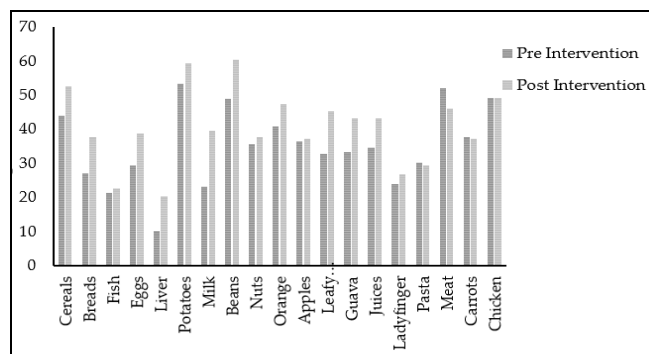
Figure-2: Pre and Post Intervention profile of food consumption (%) (2-3 times a week)

DISCUSSION

In our study pre-intervention assessment showed significantly lower general and specific micronutrient

knowledge. Following the educational intervention, a remarkable increase in knowledge was noted. This is in accordance with interventional studies carried out in Nigeria,[11] ,India,[12] and Tehran,[13] which show that educational interventions carry a significant effect on nutrition knowledge and practices among adolescents. In comparison to the study conducted in Hyderabad, India,[12] in which two modes of intervention were used, our study only used multimedia presentation as the main intervention strategy.

An interventional study conducted by Abu-baker NN et al. in Jordan,[3] yielded similar results to our study in terms of improved knowledge, attitude and practices. In our study, a moderate improvement in healthy food choices was observed post intervention. This is supported by similar studies carried out in Indonesia,[14] and Scotland,[15] which showed a significant improvement in consumption patterns owing to longer duration of educational intervention compared to the limited intervention given in our study due to time restraints.

Our study showed that a majority of participants (64.9%) had a habit of skipping meals and breakfast was the most frequently skipped meal (37%). This is in line with studies carried out in Brazil,[17] and Texas,[18] A study conducted by Pendergast FJ *et al.*[16] show that scarcity of time was the most common reason for skipping breakfast, however, our results show that loss of appetite was the major cause of skipping meals among the adolescents.

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LIMITATIONS OF STUDY

Due to frequent closure of schools owing to COVID-19 pandemic, there was insufficient time interval between pre and post-intervention assessment. There was loss to follow up of participants due to upcoming exams. There was lack of generalizability of results as our single-setting study focused on one public school only. The laboratory levels of micronutrients in the adolescents were not assessed before and after intervention due to lack of funding. Lastly, the participants' inability to recall food consumed prior to intervention could be a cause of increased consumption observed in post-intervention results (recall bias)

CONCLUSION

Hidden hunger (micronutrient deficiency) affects cognitive and physical development of adolescents. In this study, an educational intervention was conducted to establish whether awareness programs would be beneficial in ameliorating the condition. The educational intervention resulted in significant improvement in general nutritional knowledge as well as specific micronutrient knowledge. Moreover, a moderate improvement in food consumption in the frequency of 2-3 times a week was observed. The results show that educational intervention improved knowledge, attitude and practice among adolescents.

Conflict of Intrest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

SFM: Conception and design of research, literature review, data analysis plan, reviewing manuscript, provision of technical and administrative support, coordination with school administration & final apporval of the version to be published.

NK: Conception and design of research, data analysis plan, reviewing manuscript, provision of technical and administrative support & final apporval of the version to be published.

ZM: Conception and design of research, Literature review, data acquisition/ collectiion, laying foundation for data entry, data entry, preparation and delivery of educational intervention,data analysis, write-up of introduction and discussion, drafting and reviewing manuscript, referencing, provision of technical support & final apporval of the version to be published.

MA: Design of research, literature review, data acquisition/ collection, data entry, delivery of eductional intervention, data analysis, write-up of introduction and discussion, formatting of questionnaire, coodination with school administration in seeking permission and conducting the study, data analysis, reviewing and drafting manuscript & final apporval of the version to be published.

SSS: Conception and design of research, literature riview, data acquisition/collection, data entry, preparation and delivery of educational intervention, data analysis, write-up of conclusions, recommendations and limitations, construction of graphs and figures for the manuscript, reviewing and drafting manuscript, provision of technical support & final apporval of the version to be published.

MA: Design of research, literature review, data acquisition/ collection, data entery, delivery of educational intervention, data analysis, write-up of conclusions, recommendations and limitations, coordination with school administration,

reviewing and drafting manuscript & final apporval of the version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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