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ORIGINAL ARTICLE

Effects of Diet Pattern on Nutritional Status of Schoolchildren: A Study in One Township of Navi Mumbai, Maharashtra, India

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ABSTRACT

Diet pattern plays a key role in determining the nutritional status of children. The study was conducted to find the impact of diet pattern on the nutritional status of 105 school-going children in Navi Mumbai. Data were collected using survey questionnaire including observation and interview technique.

Food frequency questionnaires were administered to assess dietary intake. To assess growth status of children, z-scores [weight-for-height (WHZ), height-for-age (HAZ), and weight-for-age (WAZ)] were used. The objectives of the study were to determine diet variety and frequency of food intake, to find the nutritional status using food mean score for anthropometric parameters. The article further reveals the relationship between diet pattern and WAZ, WHZ, and HAZ of primary schoolchildren.

Results from the study revealed that there is a variation in the nutritional status of children. The children who eat less dietary variety may be related to malnutrition, while the large variety is related to heavyweight or obesity. The food variety should include all kinds of foodstuff from each category of major group.

Keywords: Diet pattern, Nutritional Status, Primary schools, z-score.

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INTRODUCTION

Malnutrition is one of most important public health problems in growing children, predominantly in low socioeconomic strata. Proper nutrition is therefore, an important prerequisite for better health. The dietary diversity helps to ensure nominal requirement of necessary nutrients. Nutritional status of children is influenced by the eating pattern.

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Adequate nutrition, healthy eating, and physical activities in childhood are the base for good health in adulthood.[1] Anthropometric parameters are the standardized methods for assessing the growth of children.

According to the United Nations International Children's Emergency Fund, "conceptual framework, household food insecurity, inadequate childcare, and the lack of access to health, safe water, and sanitation services are the key underlying causes of under nutrition of children."[2] Some research studies revealed mixed results of the relationship between food consumption and nutritional status of children.[3-7] More research is required to investigate the relationship between child nutrition status and food habits in a developing country like ours.

OBJECTIVE

To determine the impact of dietary patterns and the frequency of food intake using food mean score for anthropometric parameters on the nutritional status of schoolchildren in Navi Mumbai.

MATERIALS AND METHODS

Out of 14 nodes (township) in Navi Mumbai, one node, namely, Central Business District, Belapur, was selected randomly for the present study.

The list of private primary schools for the study area was prepared. From this list of primary schools, one school with children studying in 3rd and 4th standard was selected. All children (n = 105) studying in 3rd and 4th standard attending school at the time of the survey were included.

A pretested questionnaire was filled by the researcher with the help of class teachers and medical doctors. An informal atmosphere was created so that children should feel comfortable to respond to variety of food intake. An attempt was made to help children in recollecting various types of food items by showcasing the items.

To accomplish the objectives, a quantitative method of research was employed. For quantitative analysis, methods of descriptive statistics, inferential statistics, and multivariate statistics were used. Data entry and data analysis were done using Statistical Package for the Social Sciences, PC + version 10 package. To calculate the

growth status, the anthropometric measurements, HAZ, WAZ, and WHZ z-scores, were used.

The z-scores of anthropometric measurements were considered as dependent variables for data analysis. The description of the same is given as follows:

- Moderate stunting: HAZ is between −2.00 and −2.99;
- Severely stunting: HAZ is < −3.00;
- Moderate underweight: WAZ is between −2.00 and −2.99;
- Severely underweight: WAZ is < −3.00;
- Moderate wasting: WHZ is between −2.99 and −2.00;
- Severe wasting: WHZ is < −3.00;

Dietary diversity score was derived by adding food categories or food items for each food group separately for vegetables, fruits, and pulses.

The list of maximum possible varieties of edible oil, grains, pulses, vegetables, fruits, dairy product, nonvegetarian items, eggs, mixed food, beverages, sweets, fats available in this region of India was prepared in the form of a questionnaire. The objective of preparing the list was to enable the children to provide the correct information. The scores for each item were calculated and thereafter in addition, the overall scores were calculated. Table 1 shows the assignment of scores.

DISCUSSION

Nutritional Status of Children: Anthropometric Parameters

A poor z-score of WAZ is assumed to be a sign of malnourishment or, say, underweight and absence of significant wasting.

A short HAZ revealed the stunting and exhibited a slow development and proved that thinness means height is not increased in proportion to weight. A poor z-score for WHZ describes wasting and stunting, which explains thinness and low weight. This condition is related to acute hunger or some serious illness.

Table 2 presents the analysis of mean score of WAZ, HAZ, and WHZ, and body mass index (BMI) for primary schoolchildren. The mean score of dietary variety was calculated to assess the nutritional status of the children.

Weight for Age

It can be seen from Table 2 the total dietary variety scores for −2SD to +2SD, food mean score = 146.8 for primary schoolchildren who have standard weight, or z-score is >+2SD for overweight children whose food mean score = 213.4.

Table 1: Assignment of scores

Frequency of consumption	*Score assigned*
Daily	7
Weekly/2–3 times	3
Sometimes/monthly	1
Occasionally/never	0.5

Table 2: Mean z-score for WAZ, HAZ, and WHZ

	Total edible item score		
	Weight/age	*Height/age*	*Weight/height*
Z-scores	*Mean ± SD*	*Mean ± SD*	*Mean ± SD*
< −3SD	121.6 ± 19.0	0.0 ± 0.0	127.0 ± 26.2
−3SD to −2SD	119.4 ± 31.5	131.0 ± 38.3	116.2 ± 24.5
−2SD to +2SD	146.8 ± 40.6	146.5 ± 41.1	147.0 ± 40.6
>+2SD	213.4 ± 30.9	191.4 ± 16.6	207.0 ± 37.4

SD: Standard deviation

The z-score for WAZ was significantly higher with F = 32.197 at $p < 0.001$ level of significance who have normal weight or overweight. The overall mean score of all the food items were lowest for acute low weight children, and there is no significant difference between the means from the scores of moderately underweight respondents. The mean scores were more for children who are fat or overweight.

Height for Age

It can be seen from the column HAZ for primary schoolchildren (Table 2) that total dietary variety scores for −2SD to +2SD, food mean score = 131.0, and those who have normal height and those who have z-score >+2SD were taller (food mean = 191.4). The z-score for HAZ was significantly higher with F = 10.76 at, $p < 0.001$ level of significance.

Weight for Height

Total overall mean score of food groups was enhanced with better stunting children. Similar picture was observed in case of WHZ for food mean score. Table 2 reveals the overall mean score of food groups that moderately and severely stunted children have lower scores as compared with normal children and above-average height.

Total overall mean score of food was lower in moderately wasted children as compared with normal or overweight children (F = 40.831, $p < 0.001$). These data suggested that malnutrition is related to less dietary variety, while large variety was correlated with obese or fat children.

To determine which food group is associated with obesity of children, individual food group variety scores were analyzed. Tables 3 to 5 display the mean scores of food groups in terms of z-score for WAZ, HAZ, and WHZ respectively.

It can be seen from Table 3 that mean score for grains (wheat, rice, etc.) intake is high with rise in child's weight in primary schoolchildren. The data show that the mean score for grains is 19.8 for severely underweight (<3SD) as compared with children whose mean score for grains was 36.3 (>+2SD). This suggests that the mean score for

Table 3: Mean variety score of individual group in relation to WAZ z-scores

	WAZ			
Edible oil	*< −3SD*	*−3SD to −2SD*	*−2SD to +2SD*	*>+2SD*
Grains	19.8 ± 0.1	21.9 ± 5.8	25.7 ± 7.1	36.3 ± 5.2
Pulses	12.7 ± 0.0	13.5 ± 4.4	14.0 ± 4.4	17.8 ± 4.9
Vegetables	24.7 ± 4.9	25.9 ± 12.2	30.6 ± 10.8	39.7 ± 10.0
Fruits	6.9 ± 2.3	7.5 ± 7.9	10.4 ± 6.0	19.1 ± 10.4
Dairy product	10.3 ± 1.1	9.5 ± 2.9	12.3 ± 5.7	19.4 ± 6.4
Nonveg items	0.0 ± 0.0	0.8 ± 2.2	0.4 ± 1.1	0.8 ± 2.3
Eggs	0.2 ± 0.3	0.9 ± 1.6	1.6 ± 1.8	3.5 ± 2.0
Mixed food	14.2 ± 5.0	9.2 ± 5.0	14.2 ± 6.9	25.2 ± 6.4
Beverages	5.8 ± 3.7	6.4 ± 2.8	9.3 ± 3.4	13.4 ± 3.4
Sweets	16.3 ± 0.7	14.3 ± 6.0	17.8 ± 6.7	23.6 ± 3.4
Fats	9.4 ± 1.9	9.2 ± 2.0	10.5 ± 3.0	14.4 ± 3.1

SD: Standard deviation

Table 4: Mean variety score of individual group in relation to HAZ z-scores

	HAZ			
Edible oil	*< −3SD*	*−3SD to −2SD*	*−2SD to +2SD*	*>+2SD*
Grains	0.0 ± 0.0	23.1 ± 6.0	25.7 ± 7.2	28.9 ± 6.6
Pulses	0.0 ± 0.0	12.8 ± 5.0	14.0 ± 4.4	15.1 ± 1.9
Vegetables	0.0 ± 0.0	30.6 ± 15.4	30.5 ± 10.8	38.4 ± 9.1
Fruits	0.0 ± 0.0	8.9 ± 7.6	10.4 ± 6.1	15.7 ± 3.3
Dairy product	0.0 ± 0.0	11.5 ± 4.0	12.2 ± 5.7	18.1 ± 4.6
Nonveg items	0.0 ± 0.0	0.0 ± 0.0	0.4 ± 1.2	0.82 ± 1.6
Eggs	0.0 ± 0.0	1.3 ± 1.0	1.5 ± 1.8	3.2 ± 1.0
Mixed food	0.0 ± 0.0	12.2 ± 7.0	14.1 ± 7.0	19.4 ± 6.7
Beverages	0.0 ± 0.0	7.0 ± 2.4	9.2 ± 3.5	14.7 ± 2.3
Sweets	0.0 ± 0.0	14.9 ± 5.7	17.8 ± 6.7	24.4 ± 5.5
Fats	0.0 ± 0.0	9.6 ± 1.2	10.3 ± 3.0	12.4 ± 2.1

SD: Standard deviation

Table 5: Mean variety score of individual group in relation to WHZ z-scores

	WHZ			
Edible oil	*< −3SD*	*−3SD to −2SD*	*−2SD to +2SD*	*>+2SD*
Grains	22.3 ± 5.8	22.2 ± 5.6	25.7 ± 7.1	33.9 ± 6.4
Pulses	15.4 ± 5.1	12.3 ± 3.1	14.0 ± 4.4	17.2 ± 5.8
Vegetables	22.9 ± 6.6	23.4 ± 8.4	30.7 ± 10.8	40.4 ± 8.6
Fruits	8.9 ± 6.1	6.7 ± 5.0	10.4 ± 6.1	17.8 ± 6.1
Dairy product	10.0 ± 3.3	10.1 ± 3.2	12.3 ± 5.7	19.0 ± 7.4
Nonveg items	0.4 ± 1.2	0.8 ± 2.1	0.4 ± 1.1	1.0 ± 2.2
Eggs	1.8 ± 2.2	0.6 ± 0.8	1.6 ± 1.8	3.2 ± 2.0
Mixed food	10.2 ± 2.0	9.9 ± 5.0	14.2 ± 7.0	23.6 ± 7.0
Beverages	8.9 ± 3.6	6.7 ± 3.0	9.3 ± 3.4	13.2 ± 3.5
Sweets	15.9 ± 6.3	14.3 ± 5.4	17.8 ± 6.7	23.7 ± 6.9
Fats	10.1 ± 2.4	9.1 ± 1.8	10.5 ± 2.9	13.9 ± 3.7

SD: Standard deviation

grains intake is higher for heavier or higher weight children, the score being approximately twice the scores for children who were severely underweight.

According to study conducted by Liu et al,[8] "The weight gain was inversely associated with the intake of high-fiber, whole-grain foods but positively related to the intake of refined-grain foods in women, which indicated the importance of distinguishing whole-grain products from refined-grain products to aid in weight control."

The average scores for intake of pulses, vegetables, fruits, eggs, beverages, and fat is higher with more gain in weight of children; there was significant difference in mean scores among different WAZ categories.

According to Gopalan et al,[9] "The findings may be generally applicable to poor communities in several Asian countries where dietaries are based largely on cereals and to a smaller extent on legumes and pulses. The current home diets in the concerned poor communities were not satisfactory and need improvement. These diets were deficient in a number of nutrients, particularly vitamin A, riboflavin, iron, and possibly calcium. It should, however, be possible to overcome some of these deficiencies by improving the existing dietaries through the inclusion of relatively inexpensive foods that are locally available and well within the reach of the poor."

In this article, the moderately low weight children are associated with the poor score of dairy products and the higher score was found in obese children.

Many research studies made an attempt to find the relationship between measure of dietary variety and child's nutritional status.[10] The outcome of the study conducted by Sung et al[11] is in line with present findings that there was effect of food habits and physical training on the nutritional status of children. Table 4 exhibits the mean food scores for grain, vegetables, fruits, eggs, and combination of numerous types, and sweet intake is high by increasing child's stature.

There is increase in height of primary schoolchildren if mean food score namely beverages, pulses, dairy manufactured goods and fat intake is higher. A study in Mali also documented a significant relationship between diet variety and nutritional status, for 6- to 59-month-old kids. He has conducted the study in Mexico on 18- to 30-month-old children and concluded that there exists positive correlation between percentage of energy from animal groups (eggs and meat) and HAZ.[12] He further found that there was strong correlation between percentages of energy from dairy product.

A study from Ethiopia in 2000 reported that was a highly statistically significant relation between food-group variety for 1-day and/or 7-day recall and children's HAZ z-scores. Another study was conducted by Taren and Chen[13] in China. They have divided the food group scale (0–7) among rice, egg, vegetables, fruits, soya beans, meat, and other. The study was conducted on a sample of 12- to 47-year-old children.

The results revealed that there was a significant difference between z-scores of height for age for children whose intake is less than three groups of food as compared with others. Increases in this type of variety were associated with greater increases in growth for respondent with lower *vs* higher numbers of foods.

Table 5 reveals increase in food diversity with more intake of seasonal and other fruits and veggies in majority groups associated with lower energy consumption and thus a lower BMI, and perhaps also reduces the risk of obesity.[14]

McCrory et al[15] stated that "dietary variety within sweets, snacks, condiments and carbohydrate food was positively associated and dietary variety within the vegetable food group was negatively with energy intake and body fatness."

Also it was demonstrated that poor BMI was related with more variety of diet in girls as compared with their counterparts. The present findings are similar to Azadbakht and Esmaillzadeh.[16] Azadbakht and Esmaillzadeh[16] reported that "In Iran among female 18-28 years, demonstrated that a direct association between energy intake and dietary variety. Increase energy intake was related to increasing intake of fruit, vegetables and whole grain. This study also showed that there were inverse association among dietary variety score, obesity and abdominal adiposity."

CONCLUSION

The present study for 105 schoolchildren in Navi Mumbai township showed that "nutritional status" of schoolchildren is directly proportional to dietary diversity score, which is calculated by summing the frequency food items for each food group separately.

Children taking less dietary variety are prone to undernutrition.

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