Assessment of Micro Nutritional Malnutrition in an Urban Area of Bangladesh among the Adult Population on the Basis of Individual Dietary Diversity Score (IDDS)

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Abstract

Background/objectives: Micro nutritional malnutrition is a global public health problem contributing directly and indirectly to morbidity and mortality of billions of peoples worldwide. Vitamin and mineral deficiencies are widespread, affecting one third of the global population. The general objective of the study was assessment of average Individual Dietary Diversity Score (IDDS) in selected adult urban population.

Subjects and methods: In this study 300 subjects of which 150 male and 150 female were studied. Among 300 subjects 100 were hostel student, 100 were non hostel student and 100 were slum people with ranges were 18-30 years of age. The Study was conducted in an urban area of Dhaka. Pre-structured questionnaire was developed with relevant information’s. The food intake patterns of the subjects were recorded by 24 hours recall method and used nine food groups for IDDS information. IDDS was calculated according to Low IDDS (<3 Food groups), Moderate IDDS (4-5 Food groups) and High IDDS (>6 Food groups). Results: Our Results showed that 150 male out of 300 participants IDDS and FCS were 4.15 ± 0.88, 6-2, 9.88 ± 1.88, 15-5. On the other hand, among 150 female their IDDS and FCS were 4.28 ± 1.2, 7-2, 9.43 ± 2.38, 15-4. P value of IDDS and FCS were 0.064 and 0.069. Education was the highly significant (p<0.001) associated with Food Consumption Score (FCS) and sex was significant (p<0.03) with Food Consumption Score (FCS).

Conclusion: Academic qualification of the family is associated with Individual Dietary Diversity Score (IDDS) and Food Consumption Score (FCS).

Keywords: Micronutrients; Dietary diversities; Malnutrition; IDDS and FCS

Introduction

Dietary diversity has long been recognized as a key element of high quality diets because all people need a variety of foods to meet requirements for essential nutrients. Lack of dietary diversity is a particularly severe problem in developing countries where diets are predominantly based on starchy staples and little or no animal products. These plant-based diets tend to be low in a number of micronutrients including zinc, and those micronutrients often exist in the forms with low bioavailability [1]. It reflects household access to a wide variety of foods, and is used as a proxy of the nutrient adequacy for individuals [2,3]. The two dietary diversity scores recommended by FAO are the Household Dietary Diversity Score (HDDS) based on twelve food groups and the Women’s Dietary Diversity Score (WDDS) as IDDS based on nine food groups (FAO, 2011). Twelve food groups were included in the HDDS (Household Dietary Diversity Score). These twelve food groups are Cereals, White tubers and roots, Vegetables, Fruits, Meat, Eggs, Fish and other seafood, Legumes, nuts and seeds, Milk and milk products, Oils and fats, Sweets, Spices, condiments and beverages. The last two groups (sweets; spices, condiments and beverages) are indicators of economic access to food, but do not contribute substantially to micronutrient intake. According to FAO, European Union, 2011 [4] they included that nine food groups in IDDS (Individual Dietary Diversity Score) as WDDS. These nine food groups are starchy staples, dark green leafy vegetables, other vitamin A rich fruits and vegetables, other fruits and vegetables, Organ meat, meat and fish, eggs, legumes, nuts and seeds and milk and milk products. According to FANTA, 2006 said eight food groups included in Children Dietary Diversity Score such as Grains, Roots and tubers, Vitamin A-rich plant food, Other fruits or vegetables, Meat, Poultry, Fish, Seafood, Eggs, Pulses/legumes/nuts, Milk and milk products and Foods cooked in oil/fat [5]. Lack of dietary diversity is a particularly severe problem among poor populations in the developing world, because their diets are predominantly based on starchy staples and often include little or no animal products and few fresh fruits and vegetables. These plant-based diets tend to be low in a number of micronutrients, and the micronutrients contain are often in a form that is not easily absorbed. Although other aspects of dietary quality, such as high intakes of fat, salt, and refined sugar, have not typically been a concern in developing countries, recent shifts in global dietary and activity patterns resulting from increases in income and urbanization are making these problems increasingly relevant for countries in

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transition as well [6,7]. Dhaka is the national capital and the largest city of Bangladesh. 30 million people, over 20% of the total population of Bangladesh, live in urban areas; By the year 2005 this figure will have raised to 46 million and by 2050 projections indicate that 68 million (more than a third of the total population of Bangladesh) will live in urban areas. In the absence of commensurate industrialization and on the account of little planned urban or spatial development, this rapid expansion of the urban population has serious implication for physical and socio-economic conditions for the country’s cities [8].

Over the last decades, Bangladesh has made considerable progress in increasing national level food availability and individual level energy intake. Nevertheless, the intake of energy and other essential nutrients is still far below the nutrient requirements and recommended dietary allowances. Diets are largely imbalanced with the staple food cereals contributing around 73% [9] of total energy intake and a substantial proportion of dietary protein. In addition to imbalances in macronutrient intakes, diets are largely deficient in micronutrients, essential fatty acids and individual amino acids. Partly as a consequence of the paucity of diets, there is a high prevalence of malnutrition notably among young children and mothers along with emerging problems of diet related chronic diseases in the population. Diet plans that identify the quantities of different foods to be consumed to provide the human body with the required energy and nutrients play an important role in supporting long-term planning for balanced food intake but are not yet available for Bangladesh. Policy makers thus lack an important instrument with which to assess the adequacy of food intake and undertake diet planning [10].

Materials and Methods

The most commonly used method to measure dietary diversity is count one score for consumption, one food group out of 10 food groups, known as dietary diversity score (DDS) [11,12] consumed over a reference period, usually ranging from 1 to 3 days, sometimes 7 days [13]. The calculation of score is different if used at household or individual level. The household dietary diversity score (HDDS) reflects the economic ability of a household to consume a variety of foods, whereas individual dietary diversity score (IDDS) aims to capture nutrient adequacy. Andrew, et al., [14] expressed that in Bangladesh there is associations between a simple dietary diversity score and nutrient adequacy. Partly to imbalances in macronutrient intakes, diets are largely deficient in micronutrients, essential fatty acids and individual amino acids. Partly as a consequence of the paucity of diets, there is a high prevalence of malnutrition notably among young children and mothers along with emerging problems of diet related chronic diseases in the population. Diet plans that identify the quantities of different foods to be consumed to provide the human body with the required energy and nutrients play an important role in supporting long-term planning for balanced food intake but are not yet available for Bangladesh. Policy makers thus lack an important instrument with which to assess the adequacy of food intake and undertake diet planning [10].

Name of the study: Cross-sectional study.

Sample size calculation: Samples were estimated by using the following formula.

\[ n = \frac{z^2 \cdot pq}{d^2} \]

Where, \( P \) is the current prevalence of low IDDS which is about 0.5 (50%) and \( q \) is the proportion of attendants which is (1-0.5) and \( z \) value is 1.96 at 95% confidence interval and \( d \) is the difference of interest will be kept at 5% level.

\[ n = \frac{(1.96)^2 \times 0.5 \times 0.5}{0.05^2} \]

\[ = 3.8416 \times 0.5 \times 0.5 \]

\[ = 0.0025 \]

\[ = 384.16 \]

Study population

In this study 300 subjects of which 150 male and 150 female were studied. Among 300 subjects 100 were hostel student, 100 were non-hostel student and 100 were slum people with ranges were 18-30 years of age.

Area of subject collection

- Tejgaon slum, Tejgaon, Dhaka-1215
- Home Economics College Hostel, Azimpur, Dhaka
- Dhaka University Hall
- Azimpur area, Dhaka
- Shabag area, Dhaka

Study period: May, 2012 to April, 2013.

Development of questionnaire

A standard questionnaire was developed in accordance with the study objectives to obtain relevant information regarding dietary intake, socio-economic status, self-occupation, family size and number of family member etc. Anthropometric indices such as height and weight were included in the questionnaire to obtain data from the individual who were 18-30 years of age.

Questionnaire design and final trial

Before starting the final survey, the initial questionnaire was pre-tested among the respondent in another area of different economic status who were unaware about the study. Then it was modified as required and finalized for collection of data from the selected study population.

Collection of socio-economic information

The socio-economic status such as age, educational qualification, and family size, number of family member, monthly income and occupation pattern were obtained mainly from the respondent. Information’s were recorded in the respective places of the questionnaire. The purpose of the study was explained to each respondent. After having permission from them, the data were collected.

Collection of anthropometric data

To assess the nutritional status the anthropometric measures such as height, weight and BMI were taken.

Height: Standing height was measured using appropriate scales (Detect-Medic, Detect scales INC, USA) without shoes. The patient was positioned fully erect, with the head in the Frankfurt plane (with the line connecting the outer canthus of the eyes and the external auditory meatus perpendicular to the long axis of the trunk); the back of the head, thoracic spine, buttocks, and heels touched the vertical axis of the anthrop meter, and the heels were together. Height was recorded to the nearest 5 millimeter. If the reading fell between two values, the lower reading was recorded.

Weight: The balance was placed on a hard flat surface and checked for zero balance before measurement. The subjects were in the center of the platform wearing light cloths without shoes. Weight was recorded to the nearest 0.5 kg.

BMI: BMI of the subjects were calculated as the weight in kg divided by the square of height in meters. The widely used BMI classification was followed in the study.
Collection of dietary information

The food intake patterns of the subjects were recorded by 24 hrs recall method and used nine food groups for IDDS information. The 18-30 years of age male and female were the respondents. The interviews included a detailed description of the foods eaten, the cooking method, and brand names (e.g. for milk consumed or other processed snack foods). The amount consumed by the respondent was estimated, expressed in terms of cups, spoons, matchbox pieces, and other common household utensils. The respondents were shown visual aids to assist them in accurately reporting food intake. For mixed recipes, the respondent was asked how the food was prepared and how much of the visible components (e.g. pieces of meat, vegetables etc.) were eaten by them.

Calculation of IDDS and FCS

For calculation of IDDS nine food groups were included in the questionnaire. IDDS was calculated according to,

- Low IDDS <3 Food groups
- Moderate IDDS 4-5 Food groups
- High IDDS >6 Food groups

The frequency weighted diet diversity score or Food consumption score (FCS) was calculated using the frequency of consumption of different food groups consumed by a Household / individual during the 7 days before the survey. In this study FCS was calculated consumption of different food groups consumed by an individual during the 1 day before the survey. In this study definitive Food groups were also calculated by addition of definitive Weight e.g. Main staples by 2, pulses by 3, Vegetables by 1, Fruit by 1, Meat and fish by 4, and Milk by 4 by following standard FCS profile.

Consumption of fortified foods

Fortified foods are not taken into consideration in the questionnaire. However, it can be useful to obtain information on the local availability and use of fortified foods, particularly those fortified with iron or vitamin A.

Nutrition and food biodiversity

Food biodiversity is defined as the diversity of plants, animals and other organisms used as food, covering the genetic resources within species, between species and provided by ecosystems [15] (FAO, 2011). Information on food biodiversity can be collected by expanding one or more of the dietary diversity food groups of the questionnaire.

Data coding, editing and entry

After collection of raw data through interview and observation it was cleaned and checked for analysis. Data entering into the computer was preceded. To enter and analysis of data software used in computer were SPSS (Version 11.5).

Data analysis

All variables were checked for distribution. Appropriate statistical test were performed to look for the differences.

Results

According to our result, we were found that respondent's regarding age, height, weight, BMI, IDDS, total FCS were 22.6 ± 3, 30-18, 160 ± 9, 183-136, 53 ± 10, 82-31, 21 ± 3, 29-14, 4.4 ± 7, 7-2, 9.7 ± 2, 15-7 (Table 1). We found that all participants consumed Starchy staples, 27.7% consumed dark green leafy vegetables and 38.7% consumed other Vitamin A rich fruits and vegetables (Table 2). We found that among 150 male their IDDS and FCS were 4.15 ± 0.88, 6-2, 9.88 ± 1.88, 15-5. On the other hand, among 150 female their IDDS and FCS were 4.28 ± 1.2, 7-2, 9.43 ± 2.38, 15-4. p value of IDDS and FCS were 0.064 and 0.069 (Table 3). Age, BMI, IDDS and FCS of the Hostel Student Non Hostel Student Slum People were 21 ± 18.4, 21 ± 2.4, 4.41 ± 0.9, 9.7 ± 22 (Mean ± SD) 23 ± 7, 22 ± 3, 5 ± 0.92, 11 ± 2 (Mean ± SD), 23 ± 419 ± 2.75, 3.7 ± 0.95, 8.41 ± 1.7 (Mean ± SD) respectively. IDDS and FCS were highly Significant in Non Hostel Student vs. Slum People, Slum People vs. Non Hostel Student and Non Hostel Student vs. Hostel Student (p<0.001). On the hand, only BMI was highly Significant in Slum People vs. Non Hostel Student (p<0.001) (Tables 4 and 5).

Discussion

In this study, 300 subjects of whom 100 were hostol student, 100 were non hostel student and 100 were slum people with ranges 18-30 years of age. The specific objectives if this study were to assess the gender, religion, educational qualification, family status, family member and monthly income among the study participants. To assess the age, nutritional status (BMI), Individual Dietary Diversity Score (IDDS) and Food Consumption Score (FCS) of the participants and to

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>22.6 ± 3</td>
<td>30-18</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>160 ± 9</td>
<td>183-136</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>53 ± 10</td>
<td>82-31</td>
</tr>
<tr>
<td>BMI</td>
<td>21 ± 3</td>
<td>29-14</td>
</tr>
<tr>
<td>IDDS</td>
<td>4.4 ± 1</td>
<td>7-2</td>
</tr>
<tr>
<td>FCS</td>
<td>9.7 ± 2</td>
<td>15-7</td>
</tr>
</tbody>
</table>

Table 1: Distribution of respondents according to age, weight, height, total IDDS and FCS.

<table>
<thead>
<tr>
<th>Variables</th>
<th>No</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starchy staples</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>Dark green leafy vegetables</td>
<td>83</td>
<td>27.7</td>
</tr>
<tr>
<td>Other vitamin A rich fruits and vegetables</td>
<td>116</td>
<td>36.7</td>
</tr>
</tbody>
</table>

Results were expressed number and percent.

<table>
<thead>
<tr>
<th>Gender</th>
<th>IDDS</th>
<th>FCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.51</td>
<td>9.88</td>
</tr>
<tr>
<td>SD</td>
<td>0.88</td>
<td>1.88</td>
</tr>
<tr>
<td>Maximum</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Minimum</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Mean</td>
<td>4.28</td>
<td>9.43</td>
</tr>
<tr>
<td>SD</td>
<td>1.2</td>
<td>2.38</td>
</tr>
<tr>
<td>Maximum</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Minimum</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

p value

| Gender | 0.064 | 0.069 |

Results were expressed range and Mean ± SD.

<table>
<thead>
<tr>
<th>Gender</th>
<th>IDDS</th>
<th>FCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.51</td>
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<tr>
<td>Maximum</td>
<td>6</td>
<td>15</td>
</tr>
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<td>2</td>
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</tr>
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<td>2.38</td>
</tr>
<tr>
<td>Maximum</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Minimum</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

p value

Table 3: Distribution of respondents (300) according to IDDS and FCS in relation to gender.
Distribution of respondents (300) according to the factors associated with food consumption score (FCS).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age (B)</td>
<td>BMI (T)</td>
</tr>
<tr>
<td>Hostel Student</td>
<td>21 ± 1.84</td>
<td>21 ± 2.4</td>
</tr>
<tr>
<td>Non Hostel Student</td>
<td>23 ± 3.2</td>
<td>22 ± 3</td>
</tr>
<tr>
<td>Slum People</td>
<td>23 ± 3.4</td>
<td>19 ± 2.75</td>
</tr>
</tbody>
</table>

| P value             | Hostel Student vs. Slum People | 0.05 | 0.003 | 0.001 | 0.001 |
|                     | Slum People vs. Non Hostel Student | 1    | 0.001 | 0.001 | 0.001 |
|                     | Non Hostel Student vs. Hostel Student | 0.3  | 0.15  | 0.001 | 0.001 |

Results were expressed Mean ± SD and p<0.05 was considered as significant.

Distribution of respondents according to Age, BMI, IDDS and FCS among hostel student, non-hostel and slum people.

The main finding of this study was the risk factor associated with Individual Dietary Diversity Score (IDDS) and Food Consumption Score (FCS).

The main finding of this study was the risk factor associated with Individual Dietary Diversity Score (IDDS) and Food Consumption Score (FCS). Education was highly significant both Individual Dietary Diversity Score (IDDS) and Food Consumption Score (FCS) (p<0.001). On the other hand occupation was only significant for IDDS (p<0.05).

IDDS and FCS were highly Significant in Non Hostel Student vs. Slum People, Slum People vs. Non Hostel Student and Non Hostel Student vs. Hostel Student (p<0.001).

In 285 Malaysian households they showed Food variety scores (FVS) and dietary diversity scores (DDS) based on foods consumed weekly using a food frequency questionnaire. The scoring system of FVS and DDS was based on a scale of 0-7 and 0-6 respectively. The mean household FVS and DDS was 164.1 Â± 93 and 6 Â± 4.0. The age of respondents (husbands or wives; p<0.01), sex (p<0.05), and household food expenditure (p<0.01) had a significant influence on both FVS and DDS. The food-intake pattern of Malaysian households showed that their typical diets had high protein and energy-based foods Households [15].

A count of individual foods consumed, was significantly associated with weight-for-age, height-for-age, and weight for- height Z scores as well as triceps skin fold and mid-upper-arm circumference [21]. Another study was done by Rah et al. [22] in Bangladesh and they observed total 165111 under-fives who participated in the National Surveillance Project in 2003-2005. The association between stunting and DDS was determined adjusting for confounders using logistic regression models. One-half of the children were stunted. Those having diarrhea in the last week and coming from families with low socioeconomic status were more likely to have decreased diversity (P<0.05). Reduced dietary diversity is a strong predictor of stunting in rural Bangladesh.

This study showed that in hostel students their IDDS were 4.41 ± 0.9, range 2-7 and FCS were 9.7 ± 22, range 4-15. IDDS were 5 ± 0.92; range 3-7 and FCS were 11 ± 2, range 6-15 for non-hostel participants. Interviewer of slum peoples showed that IDDS were 3.7 ± 0.95; range 2-6 and FCS were 8.41 ± 1.7, range 5-15. On the other hand, average male (N=150) IDDS was 4.41 ± 0.88, range 6-2 and FCS was 9.88 ± 1.88, range was 5-15. Similarly, average female IDDS was 4.28 ± 1.2, range 2-7 and FCS was 9.43 ± 2.38, range 4-15. So it can be said that slum peoples had lower IDDS and FCS than other two groups. On average female respondents had lower IDDS and FCS than male respondents, p value of IDDS and FCS of male and female were 0.064 and 0.069 respectively. Food variety scores (FVS) and dietary diversity scores (DDS) were estimated based on foods consumed weekly by 285 Malaysian households using a food frequency questionnaire. The scoring system of FVS and DDS was based on a scale of 0-7 and 0-6 respectively. The mean household FVS and DDS was 164.1 Â± 93 and 6 Â± 4.0. The age of respondents (husbands or wives; p<0.01), sex (p<0.05), and household food expenditure (p<0.01) had a significant influence on both FVS and DDS. The food-intake pattern of Malaysian households showed that their typical diets had high protein and energy-based foods Households [15]. Food Consumption Score (FCS) in Bangladesh Context, 2009 created four food consumption group based on 7 days household survey such as Poor consumption (≤28),
Among 300 respondents all consumed starchy staples. 27.7% consumed dark green leafy vegetables, 38.7% consumed other Vitamin A rich fruits and vegetables, 50.7% consumed other fruits and vegetable, 49.3% consumed organ meat, 90.3% consumed meat and fish, 42.7% consumed eggs, 70.3% consumed Legumes, nuts and seeds, and 15.7% consumed Milk and milk product. Parvin Mirmiran et al., [19] demonstrated that mean ± SD of dietary diversity score (DDS) was 6.5 ± 1.08 (range 0-10). The maximum and minimum scores of dietary diversity were related to the fruit (1.46 ± 0.61) and bread-grain (0.95 ± 0.27) groups, respectively. A study on 286 females aged 18-80 years in 13 District of Tehran, Iran showed that whole grain diversity score mostly correlated with protein and vitamin B2 (r=0.35, p<0.05). Fruit diversity score was correlated with vitamin C (r =0.44, p <0.05). Dairy diversity score was correlated with calcium intake (r=0.54, p <0.05). Meat diversity score was correlated with protein intake (r=0.34, p<0.05). Most subjects failed to meet vitamin B6, zinc, magnesium, calcium, copper, and vitamin B12 adequacy. Parvin Mirmiran et al., [17] in Burkina Faso a study was done on 557 urban women and found that the mean DDS-9 and DDS-22 were 4.961.0 and 6.561.8 food groups, respectively. In the high tertile of DDS-22, more women consumed fatty and sweetened foods, fresh fish, non-fatty meat and vitamin-A-rich fruits and vegetables. The DDS-9 was not associated with the women's socio-economic characteristics whereas the DDS-22 was higher when the women were younger, richer and had received at least a minimum education [20-22].

Limitation of the Study

- Sufficient sample sizes were not included in this study.
- Further a large study is needed in all age group in different society to make a more conducive conclusion and recommendation.
- The interviewee can over or under report intakes of certain food groups or provide a poor memory record of variety and quantities of food consumed.
- Some of the respondent refused to participate in anthropometric measurement. In that case, it was needed to convinced them and make favorable response, in order to obtain data and perform interview ultimately.
- It was observed that some of the respondents did not feel comfortable during the time of data collection.
- Survey period was too short and single survey limits to comment on the real socio-economic condition of the studied.

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