A Study on the Incidence of Infections and Infestations among the Malnourished Children of the Slum Area

Md. Sabir Hossain[1], Nayla Binte Iqbal[2], Md. Hafizur Rahman[2], Md. Tanvir Sarwar[2], Asad Ud- Daula[2], Md. Fuad Hossain[3] and Md. Ibrahim Khalil[1*]

[1]Department of Biochemistry and Molecular Biology, Jahangirnagar University, Savar Dhaka, Bangladesh.

[2]Department of Applied Nutrition and Food Technology, Islamic University, Kushtia-7003, Bangladesh.

[3]Department of Microbiology, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh.

[*]**Corresponding Author:** E-mail: drmkhalil@yahoo.com

ABSTRACT

Aims: To make approaches to data collection and analysis for reviewing the impact of malnourishment upon the high incidence of infections and infestations among children in slum.

Study design: This prospective study was carried out among the total of 110 slum children and incidence of infections and infestations among them was observed. Data were collected by survey of dwelling condition, face to face interviews with the mother and examination of physical condition of children aged less than 12 years. To calculate the incidence rate for infections and infestation among the malnourished children and their association with aspects of demographic, socioeconomic, health and community factors Gomez's original classification and Waterlow cassification was used and statistical analysis was done.

Place and Duration of Study: The study was conducted from July 2011 to June 2012 in Kushtia Districts of Bangladesh.

Methodology: The survey form was prepared in two sections. The first part was conducted in order to assess the nutritional status by taking anthropometric measurement and dietary history of the child and the second part was prepared for examining presence of any disease. Children were eligible for inclusion in the study if they were less than 12 years of age. For all dwellings with at least one eligible child data on socioeconomic and demographic variables were collected through structured face-to-face interviews. Where the main householder or career or mother was not available the interview was conducted with a secondary householder or career.

Results: Of the total 110 slum children 67.27% were found moderately malnourished, 12.72% were severely malnourished and 11.81% were mild malnourished. It also found that a greater part of the children were wasted (52.72%) and 15.45% of the children were both wasted and stunted. In this study 45 children (40.9%) out of 110 were found to be infected with one or more of the infections. Among these infections the most prevalent are - cough (17.27%), skin abscess (14.54%), diarrhea (13.63%), tonsillitis (8.18%) and respiratory distress (15.45%) are also very common. Among the malnourished boys 43.24% were infected and the infestation rate among the malnourished boys was 45.94%. Among the malnourished girls the infection and infestation rate was 45.31% and 37.5% respectively. By sexes combined 44.5% malnourished children were infected and 40.6% were infested.

Conclusion: The analysis proved that the factors which predispose the host to malnutrition also predispose to infection, thus establishing the vicious circle of infection-malnutrition-infection. The analysis

also revealed that intestinal parasitic infestations contribute significantly to poor growth and malnutrition in children.

Key words: malnutrition, infection, infestation, slum

1. INTRODUCTION

Malnutrition contributes to more than a third of under-five deaths globally. It has many short- and long-term consequences, including delayed mental development, heightened risk of infectious diseases and susceptibility to chronic disease in adult life. In low-income countries, child under nutrition is likely to be a consequence of poverty, characterized as it is by low family status and income, poor environment and housing, and inadequate access to food, safe water, guidance and health care. Recent estimates point out that one in every four children under-five (including 146 million children in the developing world) is underweight of the 146 million; 78 million children are in South Asia [1]. Malnutrition is the primary cause of immunodeficiency worldwide, with infants, children, adolescents, and the elderly most affected. There is a strong relationship between malnutrition and infection and infant mortality, because poor nutrition leaves children underweight, weakened, and vulnerable to infections, primarily because of epithelial integrity and inflammation (Figure 1) [2].

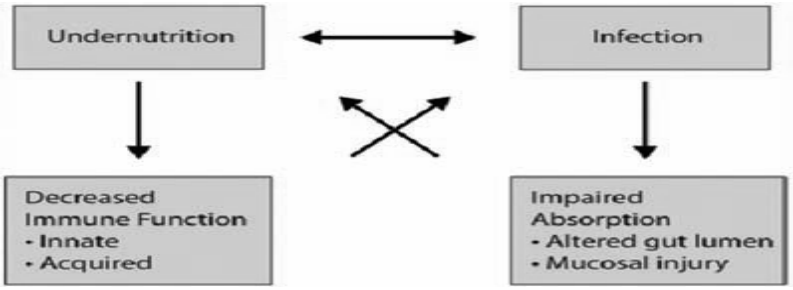

Figure-1: Interactions between malnutrition and infection.

Malnutrition can make a person more susceptible to infection, and infection also contributes to malnutrition, which causes a vicious cycle. An inadequate dietary intake leads to weight loss, lowered immunity, mucosal damage, invasion by pathogens, and impaired growth and development in children. A sick person's nutrition is further aggravated by diarrhea, malabsorption, loss of appetite, diversion of nutrients for the immune response, and urinary nitrogen loss, all of which lead to nutrient losses and further damage to defense mechanisms. These, in turn, cause reduced dietary intake. In addition, fever increases both energy and micronutrient requirements. Malaria and influenza, for example, have mortality rates proportionate to the degree of malnutrition [3].

In Bangladesh enteric infections, infectious diseases and malnutrition are common, while maternal and infant mortality are extremely high due to the tropical climate, combined with the existence of large open water-bodies, dense population, poverty and poor access for the majority to reliable health services. The nutritional status of slum children is worst amongst all urban groups and is even poorer than the rural average. Lack of basic amenities like safe drinking water, proper housing, drainage and excreta disposal make this population vulnerable to infections which further compromises the nutrition of those living in the slums. In order to address these issues it is essential to develop and disseminate realistic solutions to major health and nutrition problems faced by poor urban slum people [4].

Infestation refers to the state of being invaded or overrun by pests or parasites. It can also refer to the actual organisms living on or within a host. Malnutrition and intestinal parasitic infections or infestations are common among children in poor communities in developing countries. An estimated global infection rate for some parasites has primarily been attributed to the appalling unhygienic and environmental condition, poverty and over dispersion of parasites within the human communities. The most common mode of spread of roundworm from the contamination of food item e.g. uncooked vegetables, fruits and meat. Parasitic infestations in children fewer than 5 years of age are especially problematic because they

have negative lifelong health consequences. These infections can contribute to malnutrition, which in turn can result in delayed growth and malnutrition as well as impaired cognitive growth [5]. Hookworm infection is generally as one of the more serious of helminthes infections because of its debilitating association with anemia due to blood loss from the intestines [6].

2. METHODOLOGY

Three remote slums in Kushtia district, Bangladesh were approached to participate in the study. Communities were selected to ensure some variation in size, development and geographic spread. The three communities typified the very poor environmental conditions prevalent in remote Indigenous communities in Kushtia. Participation was initially negotiated with community councils and individual consent was subsequently provided by individual participants.

Data were collected by survey of dwelling condition, face to face interviews with the mother and examination of physical condition of children aged less than 12 years. Among several types of study design a cross sectional study was conducted. It includes their economic and socio-demographic data, cultural practice, food habits, food beliefs and data of their physical condition.

110 children (40 males and 70 females) with malnutrition interlinked with infections or infestation and age range 12 months to 12 years were studied. A detailed physical examination and dietary history of children with malnutrition was done and the various infections or infestations associated with malnutrition were evaluated by detail history, clinical examination.

The study instruments were questionnaires and anthropometric measurements, obtained using standard techniques [7]. A questionnaire was developed to obtain relevant information on anthropometric data, dietary information, health information, socio-economic condition. Two data collection processes were used: (1) interviews with the main householder of each dwelling and with the main career of each child aged under 12 years. (2) Examining each eligible child and taking of their measurements. All dwellings in each community were included in the housing survey. Over 20 infrastructure items in and around the dwelling were examined in the survey. Height and weight were measured using standard techniques. 24-hour recall method was used for obtaining data on nutrient intakes. Nutritional status was determined by anthropometric measurement performing standard methods (NCHS), Gomez Classification and Water Low classification. In 1956, Gómez and Galvan studied factors associated with death in a group of malnourished children in a hospital in Mexico City, Mexico and defined categories of malnutrition: first, second, and third degree. The degrees were based on weight below a specified percentage of median weight for age. The risk of death increases with increasing degree of malnutrition. An adaptation of Gomez's original classification is still used today.
In a paper titled "Classification and Definition of Protein-Calorie Malnutrition", John Conrad Waterlow established a new classification for malnutrition. Instead of using just weight for age measurements, the classification established by Waterlow combines weight-for-height (indicating acute episodes of malnutrition) with height-for-age to show the stunting that results from chronic malnutrition

3. RESULTS

The following results were obtained after surveying on 110 children of slum dweller area in Kushtia town and comparing various data. .

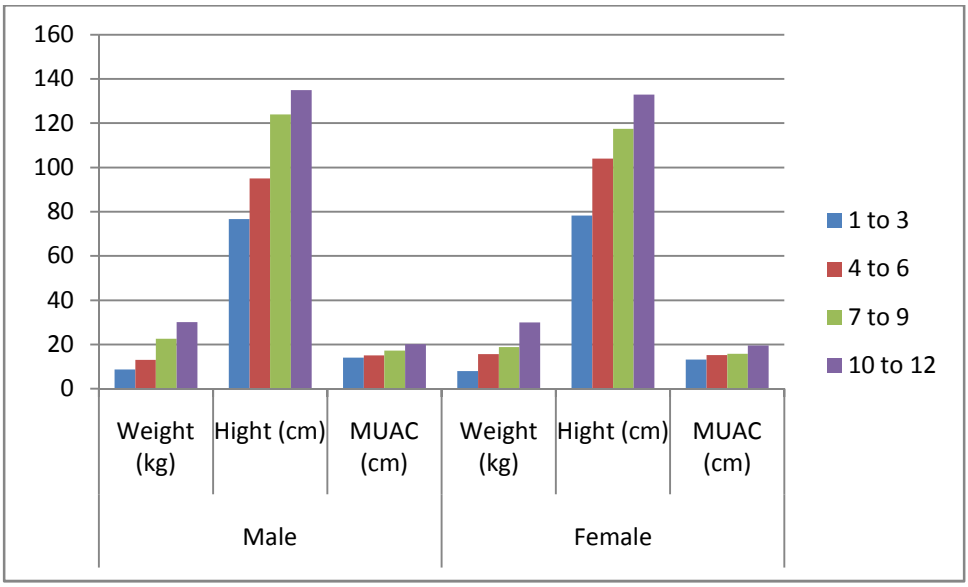

Figure-2: Mean weight, height and Mid-Upper Arm Circumference (MUAC) of the study children by age and sex.

Table-1: Distribution of children by Gomez classification.

% Expected Weight for age	Number				Percentage
	Type	Male	Female	Total	
>90%	Normal	3(7.5%)	6(8.57%)	9	8.18
76-90%	Mild malnutrition(1st degree)	5(12.5%)	8(11.43%)	13	11.81
61-75%	Moderate malnutrition(2nd degree)	29(72.5%)	45(64.28%)	74	67.27
<60%	Severe malnutrition (3rd degree)	3(7.5%)	11(15.71%)	14	12.72

Table-1 indicates the nutritional status of the 110 slum children using the indicator weight for age of Gomez classification. It shows that greater part of the children is moderately malnourished (67.27%). The next highest category is severely malnourished (12.72%) children. Mild malnutrition is 11.81%. Only 8.18% of the children are found to have normal weight for age.

Table-2: Distribution of children by Water low classification.

Category of nutritional status	Number			Percentage
	Male	Female	Total	
Normal	3(7.5)	19(27.14)	22	20
Wasted	17(42.5)	41(58.57)	58	52.72
Stunted	8(20)	5(7.14)	13	11.81
Wasted and Stunted	12(30)	5(7.14)	17	15.45

Table-2 indicates the nutritional status of the 110 slum children using the indicator weight for height and height for age of Water low classification. It shows that greater part of the children is wasted (52.72%). 20% of the children are found here to be normal. 15.45% of the children are wasted and stunted. The percentage of only stunted children is 11.81%. 15% of the children are both wasted and stunted.

We confirmed intestinal worm infestation in children by observing that few children came to us with complaints of bloating abdomen with mild pain. They were found to be moderately malnourished with distended abdomen. Their mother noticed worms passing with their child's feces. Most of these mother said, they noticed those worms were tiny, mixed with stool and found also over their skin around anus. They were likely to be threadworm. Later on we confirmed that those worms were Entrobins vermiculams.

Among the 110 slum children studied, 41 children (37.27%) were found to be infected with intestinal parasites. Present study included 110 slum children, 70(63.63%) were girls and 40 (36.36%) were boys. 45 children (40.9%) out of 110 were found to be infected with one or more of the infections listed in table. The different types of detected infections were indicated in table 1.

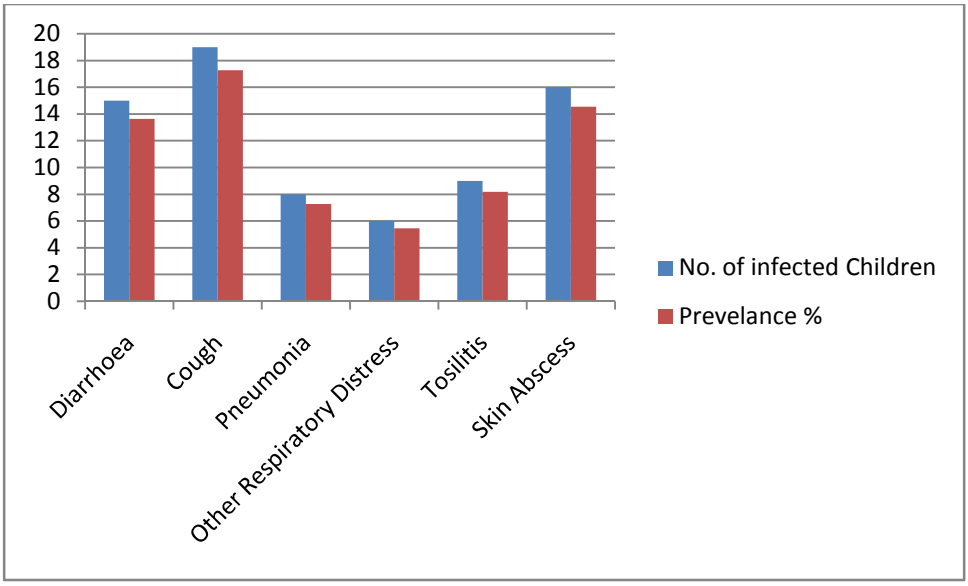

Figure-3: The Detected Common Infections among Children in Slums of Kushtia Town.

During the survey period the most common type of infections observed and confirmed by taking history are listed in the Figure-3. Among these infections the most prevalent are - cough (17.27%), skin abscess (14.54%), diarrhea (13.63%). Tonsillitis (8.18%) and respiratory distress (15.45%) are also very common.

It is important to note that a large portion of the infected children (42.22%) suffer from frequent fever, which is probably the symptoms of the existing undiagnosed infections.

Table -3: Incidence of Infections and Infestations among all the children (110). (WATERLOW CLASSIFICATION)

Category	Infection %		Infestation %	
	Male	Female	Male	Female
Normal	0	2.3	0	3
Wasted	27.5	22.8	22.5	27.14
Stunted	5	1.4	7.5	4.3
Wasted and Stunted	17.5	7.14	5	4.3

In the table-3 prevalence of infections and infestations among all the 110 slum children surveyed are given. Here children are classified according to Waterlow classification. From the table it can be seen that there is no incidence of infections or infestations among the normal boys. Among the normal girls infection rate is 2.3% and infestation rate is 3%. Infection and infestation rates are highest among the wasted boys and girls.

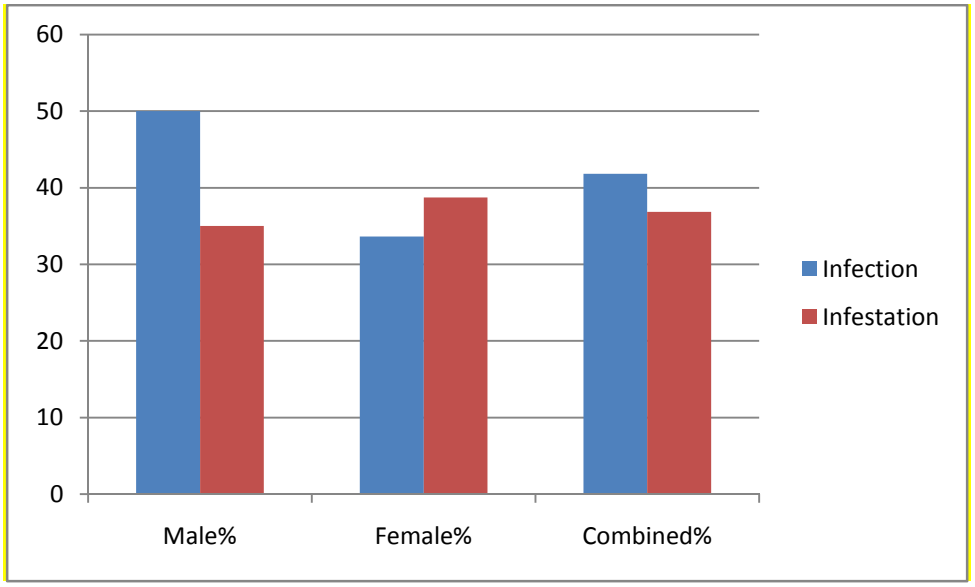

Figure-4: Incidence of Infections & Infestations Among the Malnourished children. (WATERLOW CLASSIFICATION)

In the figure-4 prevalence of infections and infestations among the 88 malnourished slum children identified by Waterlow classification are given. 50% of the malnourished boys are infected and the infestation rate among them is 35%. Among the malnourished girls the infection and infestation rate is 33.64% and 38.74% respectively. By sexes Combined 41.82% malnourished children are infected and 36.87% are infested. Table-7: Incidence of Infections and Infestations among All the Children (110).

Table-4: Incidence of Infections and Infestations among All the Children (110). (GOMEZ CLASSIFICATION)

Category	Infection %		Infestation %	
	Male	Female	Male	Female
Normal	0	0	0	0
Mild malnutrition	2.5	4.28	2.5	2.85
Moderate malnutrition	32.5	24.28	37.5	24.28
Severe malnutrition	5	12.85	2.5	7.14

In the table-4 prevalence of infections and infestations among all the 110 slum children surveyed are given. Here children are classified according to Gomez classification. From the table it can be seen that there is no incidence of infections or infestations among the normal boys and normal girls. Infection and infestation rates are highest among the moderately malnourished boys and girls.

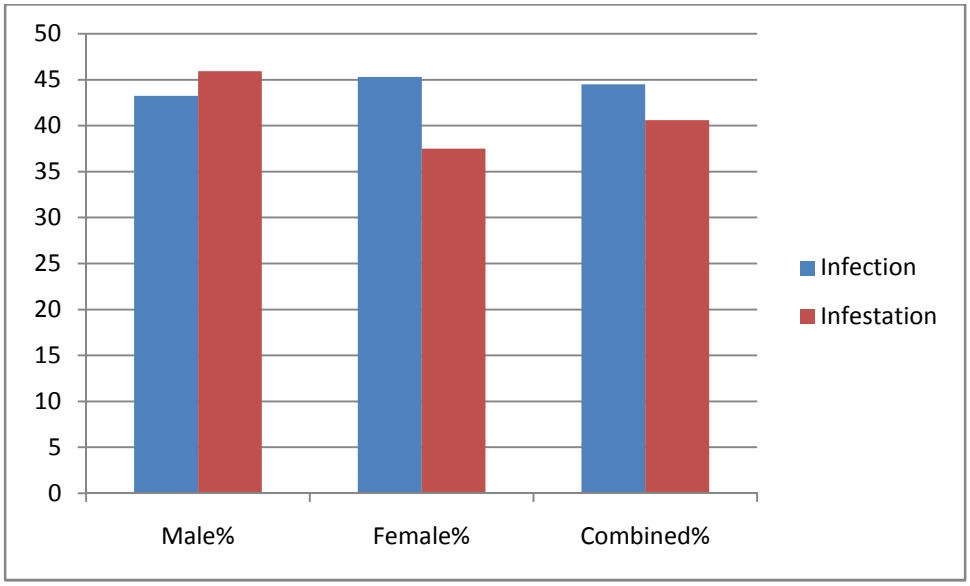

Figure-5: Incidence of Infections & Infestations among the Malnourished Children. (GOMEZ CLASSIFICATION)

In the Figure-5 prevalence of infections and infestations among the 101 malnourished slum children identified by Gomez classification are given. 43.24% of the malnourished boys are infected and the infestation rate among the malnourished boys is 45.94%. Among the malnourished girls the infection and infestation rate is 45.31% and 37.5% respectively. By sexes Combined 44.5% malnourished children are infected and 40.6% are infested.

4. DISCUSSION

Health and nutritional problems of children in developing countries are related to various factors including inadequate food intake and repeated infections. Approximately 5.6 million children die annually due to malnutrition and almost 2.7 million deaths reported less than five years of age are due to severe acute malnutrition [8].

Under nutrition impedes metabolic processes in the body and also decreases immunity which leads to severe infections [9]. In developing countries main causes of morbidity and mortality in malnourished children are diarrhea, pneumonia, measles, malaria and HIV infections and fifty percent of these children also have micro nutrient deficiencies [10].

Association of malnutrition and infections in children is an important health issue leading to increase fatal outcome. It is estimated that globally 50.6 million children under five years of age are malnourished and nearly 90% of these children are from developing countries [11]. Majority of undernourished children admitted in the hospital have various types of infections, although overt signs are difficult to detect compare to a well nourished child [12].

The nutritional status of the 110 slum children using the indicator weight for height and height for age of Waterlow classification shows that greater part of the children are wasted (52.72%). 15.45% of the children are wasted and stunted. 15% of the children are both wasted and stunted. Using the indicator-weight for age of Gomez classification it was found that 67.27of the children is moderately malnourished while only 8.18% of the children were found to have normal weight for age.

Of the total 110 slum children finally an average of 94 were found to be underweight using the two indicators. This means that about 85 % of the children were malnourished. The incidence of malnutrition interlinked with infection and infestation is 44.5% and 40.6% respectively. Of the malnourished boys 43.24% were infected and 45.94% were infested. Among the malnourished girls the infection and infestation rate was 45.31% and 37.5% respectively as judged by Gomez classification. Using the indicator-Warterlow classification, 50% of the malnourished boys were infected and the infestation rate among the malnourished boys was 35%. Among the malnourished girls the infection rate was 33.64%, infestation rate was 38.74%. Totally 41.82% malnourished children were infected, 36.87% were infested.

From the two classifications finally the result expresses that 43.16% malnourished children were infected and 38.736% malnourished children were infested. As compared with the malnourished children there is almost no or little incidence of infections/infestations among the normal children.

Among the infections the most prevalent are-cough (17.27%), skin abscess (14.54%), diarrohea (13.63%). Tonsillitis (8.18%) and respiratory distress (15.45%) are also very common. Some children had other associated infections like measles, chickenpox and enteric fever. After careful screening, we observed that the frequency of intestinal parasites is very high in this region. Among the 110 slum children studied, 41 children (37.27%) were found to be infested with intestinal parasites.

This study, small though, confirms the very high rate of helminthic infestations in our population as a whole and in children in particular. Commonest parasite was Entrobins vermiculams. These children were found to be moderately malnourished with distended abdomen. Their mother noticed worms passing with their child's feces.

These children with a high frequency of worm infestation had a fair presence of anaemia.The slum people do not wear shoes while working in the field. As these people usually had low-income level, and thus did not afford to have toilet facility, they usually defecate in the open field, normally near to their working places. Children also have habit of playing on ground field. All these reasons contribute to the high prevalence of infestations among the slum children. In view of the above findings, it is highly recommended that measures to reduce worm infestation should deserve high priority because of the known harmful effects of these worms. These children of school going age are very vulnerable to infections and infestations with their subsequent systemic complications. The above along with malnutrition and iron deficiency may very well be contributing to a low IQ level and stunted physical and mental wellbeing of these children.

REFERANCES

1. UNICEF. The State of the World's Children Report 2012. Nutrition. New York. 2012:19.

2. Reuters. Better nutrition could save millions of kids—study. 17 June 2004.

3. Mu¨ller O, Garenne M, Kouyate´ B, Becher H. The association between protein-energy malnutrition, malaria morbidity and all-cause mortality in West African children. Trop Med Int Health. 2003;8:507–511.

4. Indian Pediatrics – Environmental Health Project Special Article Series, Indian pediatrics. 2004;41:682-696.

5. WHO (World Health Organization Working group). Use and interpretation of anthropometric indicators of nutritional status. Bulletin of the World Health Organization. 1986;64:929-941.

6. Goek LK. Update on the Prevalence of malnutrition among Children in Asia. J Nepal Med. College. 2003;5:113-122.

7. Jelliffe, Derrick B, Patrice Jelliffe. Community Nutritional Assessment: With Special Reference to Less Technically Developed Countries. Oxford Medical Publications. Oxford: Oxford University Press. 1989:13-30.

8. Heikens GT, Manary M. Wasting disease in African children: The challenges ahead. Malawi Med J. 2009;21(3):101-105.

9. Sekander HKM, Rayhan I. Factors causing malnutrition among under five children in Bangladesh. Pak J of Nutr. 2006;5(6):558-562.

10. Black RE, Morris SS, J B Ryce. Where and why are 10 million children dying each year? The Lancet. 2003;361:2226- 2234.

11. World Health Organisation (WHO). Evaluation of the malnourished children, management of severe malnutrition; a manual for physicians and other senior health workers, WHO Geneva. 2002;4-5.

12. Faruque AS, Ahmed AM, Ahmed T, Islam MM, Hussain MI, Roy SR, Alam N, Kabir I, Sack DA. Nutrition: basis for healthy children and mothers in Bangladesh. J. Health popul Nutr. 2008;26(3):325-339.