

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

Md. Sabir Hossain¹, Nayla Binte Iqbal², Md. Hafizur Rahman², Md. Tanvir Sarwar², Asad Ud- Daula², Md. Fuad Hossain³ and Md. Ibrahim Khalil^{1*}

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

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

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

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. Multivariate models were developed 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.

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.

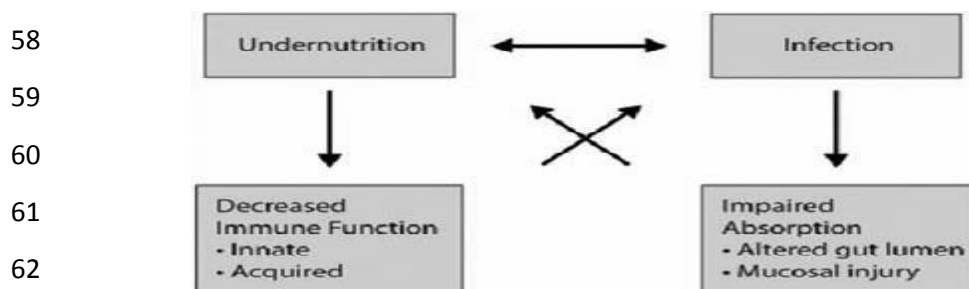
Results: Of the total 110 slum children 67.27% were found moderately malnourished, 12.72% were severely malnourished and 11.81% were mild malnourished. It also found that a greater part of the children were wasted (52.72%) and 15.45% of the children were both wasted and stunted. In this study 45 children (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.

41 **Conclusion:** The analysis proved that the factors which predispose the host to malnutrition also
 42 predispose to infection, thus establishing the vicious circle of infection-malnutrition-infection. The analysis
 43 also revealed that intestinal parasitic infestations contribute significantly to poor growth and malnutrition in
 44 children.

45 **Key words:** malnutrition, infection, infestation, slum

46 1. INTRODUCTION

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



63 **Figure-1: Interactions between malnutrition and infection.**

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

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

80 Malnutrition and intestinal parasitic infections or infestations are common among children in poor
 81 communities in developing countries. An estimated global infection rate for some parasites has primarily
 82 been attributed to the appalling unhygienic and environmental condition, poverty and over dispersion of
 83 parasites within the human communities. The most common mode of spread of roundworm from the
 84 contamination of food item e.g. uncooked vegetables, fruits and meat. Parasitic infestations in children

85 fewer than 5 years of age are especially problematic because they have negative lifelong health
86 consequences. These infections can contribute to malnutrition, which in turn can result in delayed growth
87 and malnutrition as well as impaired cognitive growth [5]. Hookworm infection is generally as one of the
88 more serious of helminthes infections because of its debilitating association with anemia due to blood loss
89 from the intestines [6].

90 **2. METHODOLOGY**

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

96 Among several types of study design a cross sectional study was conducted. It includes their economic
97 and socio-demographic data, cultural practice, food habits, food beliefs and data of their physical
98 condition.

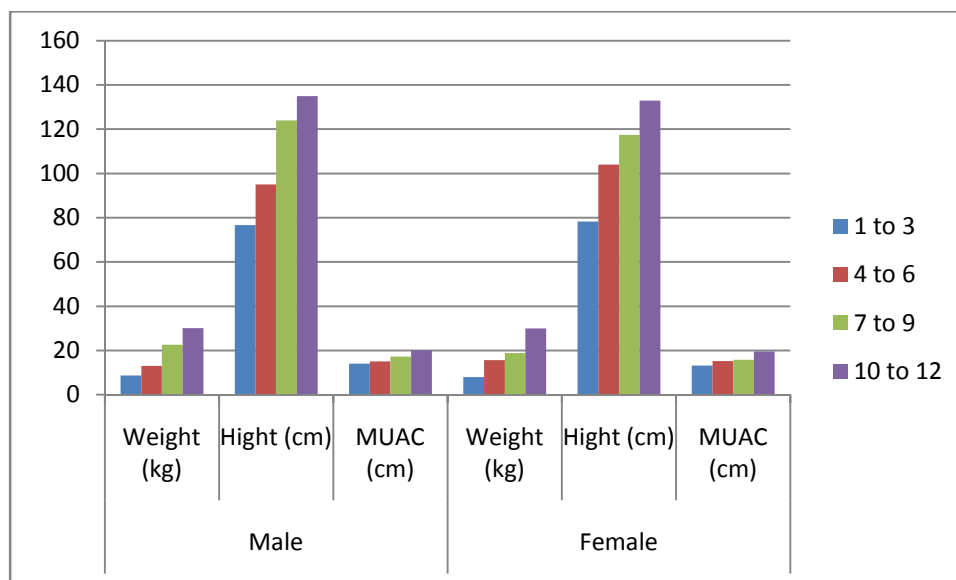
99 110 children (40 males and 70 females) with malnutrition interlinked with infections or infestation and age
100 range 12 months to 12 years were studied. A detailed physical examination and dietary history of children
101 with malnutrition was done and the various infections or infestations associated with malnutrition were
102 evaluated by detail history, clinical examination.

103 The Study Instrument was questionnaire and some standard technique of anthropometric Measurements
104 [7]. A questionnaire was developed to obtain relevant information on anthropometric data, dietary
105 information, health information, socio-economic condition. Two data collection processes were used: (1)
106 interviews with the main householder of each dwelling and with the main career of each child aged under
107 12 years. (2) Examining each eligible child and taking of their measurements. All dwellings in each
108 community were included in the housing survey. Over 20 infrastructure items in and around the dwelling
109 were examined in the survey.

110 Height and weight were measured using standard techniques. 24-hour recall method was used for
111 obtaining data on nutrient intakes. Nutritional status was determined by anthropometric measurement
112 performing standard methods (NCHS), Gomez Classification and Water Low classification.

113 **3. RESULTS**

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



116

117 **Figure-2: Mean weight, height and MUAC of the study children by age and sex.**

118

119 **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(1 st degree)	5(12.5%)	8(11.43%)	13	11.81
61-75%	Moderate malnutrition(2 nd degree)	29(72.5%)	45(64.28%)	74	67.27
<60%	Severe malnutrition (3 rd degree)	3(7.5%)	11(15.71%)	14	12.72

120

121 Table-1 indicates the nutritional status of the 110 slum children using the indicator weight for age of
 122 Gomez classification. It shows that greater part of the children is moderately malnourished (67.27%). The
 123 next highest category is severely malnourished (12.72%) children. Mild malnutrition is 11.81%. Only
 124 8.18% of the children are found to have normal weight for age.

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

Category	of	Number	Percentage
----------	----	--------	------------

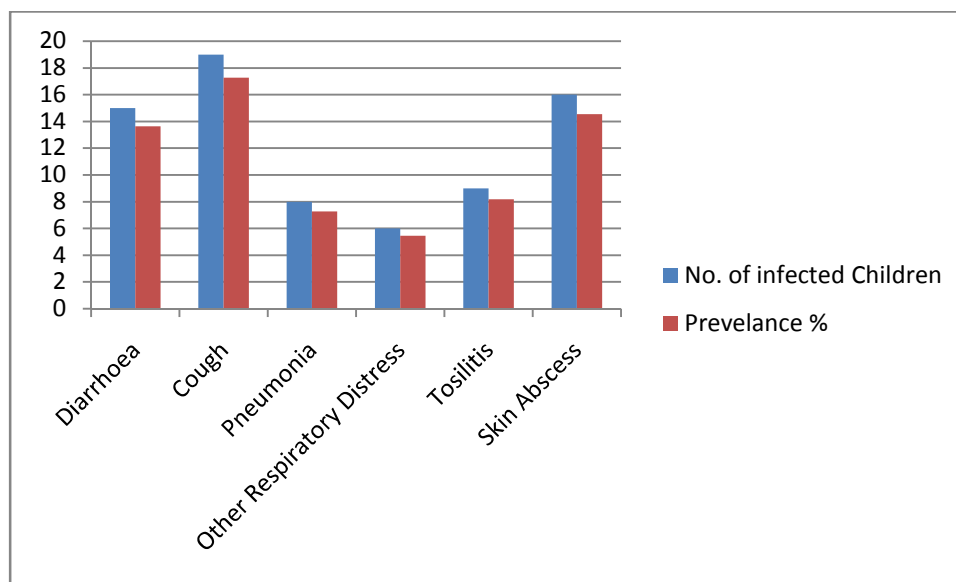
nutritional status	Male	Female	Total	
Normal	3(7.5)	19(27.14)	22	20
Wasted	17(42.5)	41(58.57)	58	52.72
Stunted	8(20)	5(7.14)	13	11.81
Wasted and Stunted	12(30)	5(7.14)	17	15.45

126

127 Table-2 indicates the nutritional status of the 110 slum children using the indicator weight for height and
 128 height for age of Water low classification. It shows that greater part of the children is wasted (52.72%).
 129 20% of the children are found here to be normal. 15.45% of the children are wasted and stunted. The
 130 percentage of only stunted children is 11.81%. 15% of the children are both wasted and stunted.

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

136 Among the 110 slum children studied, 41 children (37.27%) were found to be infected with intestinal
 137 parasites. Present study included 110 slum children, 70(63.63%) were girls and 40 (36.36%) were boys.
 138 45 children (40.9%) out of 110 were found to be infected with one or more of the infections listed in table.
 139 The different types of detected infections were indicated in table 1.



140

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

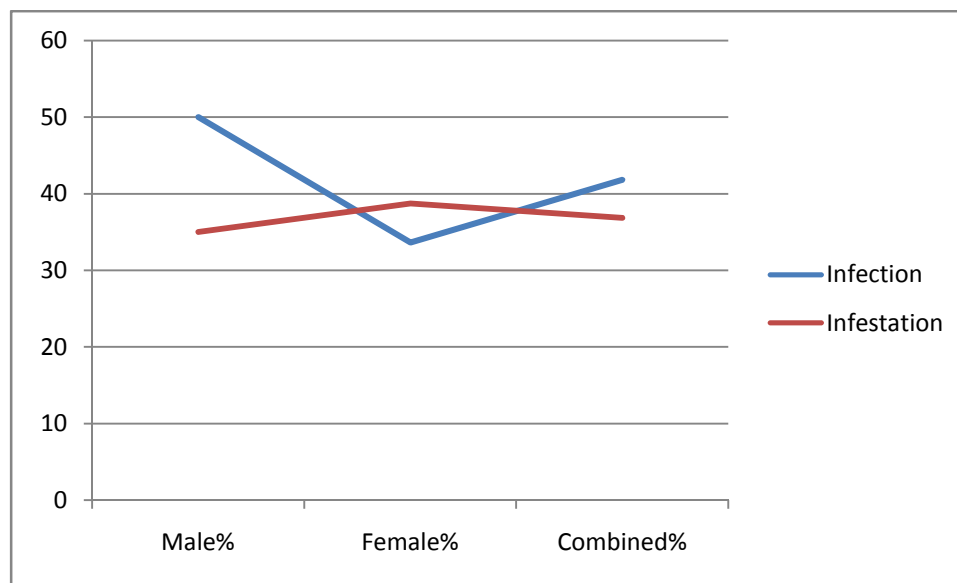
142 During the survey period the most common type of infections observed and confirmed by taking history
 143 are listed in the Figure-3. Among these infections the most prevalent are - cough (17.27%), skin abscess
 144 (14.54%), diarrhea (13.63%). Tonsillitis (8.18%) and respiratory distress (15.45%) are also very common.

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

147 **Table -3: Incidence of Infections and Infestations among all the children (110). (WATERLOW**
 148 **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

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



154
 155 **Figure-4: Incidence of Infections & Infestations Among the Malnourished children. (WATERLOW**
 156 **CLASSIFICATION)**

157 In the figure-4 prevalence of infections and infestations among the 88 malnourished slum children
 158 identified by Waterlow classification are given. 50% of the malnourished boys are infected and the
 159 infestation rate among them is 35%. Among the malnourished girls the infection and infestation rate is
 160 33.64% and 38.74% respectively. By sexes Combined 41.82% malnourished children are infected and
 161 36.87% are infested. Table-4: Incidence of Infections and Infestations among All the Children (110).

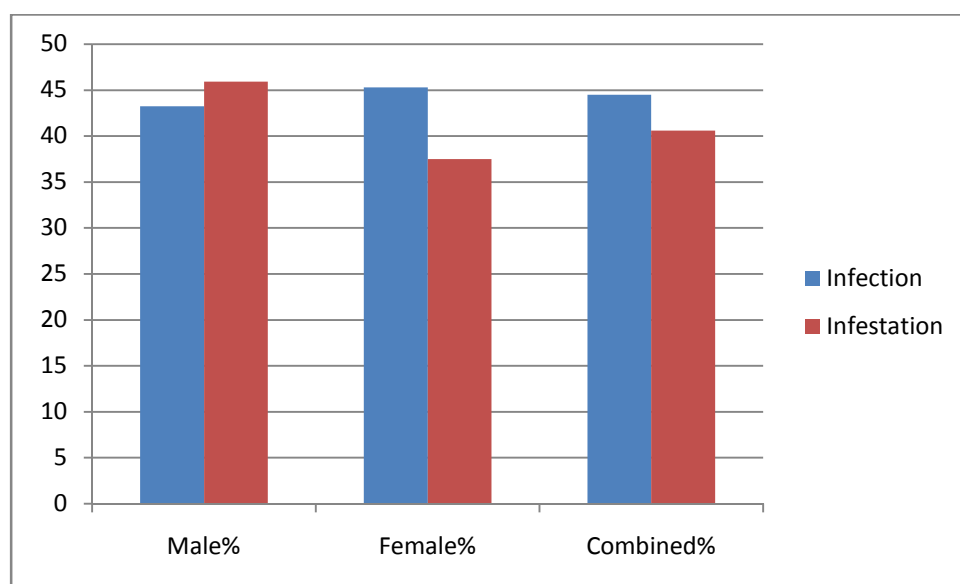
162 **Table-4: Incidence of Infections and Infestations among All the Children (110). (GOMEZ**
 163 **CLASSIFICATION)**

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

164

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



169

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

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

177 **4. DISCUSSION**

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

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

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

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

196 Of the total 110 slum children finally an average of 94 were found to be underweight using the two
 197 indicators. This means that about 85 % of the children were malnourished. The incidence of malnutrition
 198 interlinked with infection and infestation is 44.5% and 40.6% respectively. Of the malnourished boys
 199 43.24% were infected and 45.94% were infested. Among the malnourished girls the infection and
 200 infestation rate was 45.31% and 37.5% respectively as judged by Gomez classification. Using the
 201 indicator-Waterlow classification, 50% of the malnourished boys were infected and the infestation rate
 202 among the malnourished boys was 35%. Among the malnourished girls the infection rate was 33.64%,
 203 infestation rate was 38.74%. Totally 41.82% malnourished children were infected, 36.87% were infested.

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

207 Among the infections the most prevalent are-cough (17.27%), skin abscess (14.54%), diarrhoea
 208 (13.63%). Tonsillitis (8.18%) and respiratory distress (15.45%) are also very common. Some children had
 209 other associated infections like measles, chickenpox and enteric fever. After careful screening, we
 210 observed that the frequency of intestinal parasites is very high in this region. Among the 110 slum
 211 children studied, 41 children (37.27%) were found to be infected with intestinal parasites.

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

216 These children with a high frequency of worm infestation had a fair presence of anaemia. The slum people
 217 do not wear shoes while working in the field. As these people usually had low-income level, and thus did
 218 not afford to have toilet facility, they usually defecate in the open field, normally near to their working
 219 places. Children also have habit of playing on ground field. All these reasons contribute to the high
 220 prevalence of infestations among the slum children. In view of the above findings, it is highly
 221 recommended that measures to reduce worm infestation should deserve high priority because of the
 222 known harmful effects of these worms. These children of school going age are very vulnerable to
 223 infections and infestations with their subsequent systemic complications. The above along with
 224 malnutrition and iron deficiency may very well be contributing to a low IQ level and stunted physical and
 225 mental wellbeing of these children.
 226

227 REFERENCES

- 228 1. UNICEF. The State of the World's Children Report 2012. Nutrition. New York. 2012:19.
- 229 2. Reuters. Better nutrition could save millions of kids—study. 17 June 2004.
- 230 3. Mu'ller O, Garenne M, Kouyate´ B, Becher H. The association between protein-energy malnutrition,
 231 malaria morbidity and all-cause mortality in West African children. *Trop Med Int Health*. 2003;8:507–511.
- 232 4. Indian Pediatrics – Environmental Health Project Special Article Series, Indian pediatrics. 2004;41:682-
 233 696.

- 234 5. WHO (World Health Organization Working group). Use and interpretation of anthropometric indicators
235 of nutritional status. *Bulletin of the World Health Organization*. 1986;64:929-941.
- 236 6. Goek LK. Update on the Prevalence of malnutrition among Children in Asia. *J Nepal Med. College*.
237 2003;5:113-122.
- 238 7. Jelliffe, Derrick B, Patrice Jelliffe. *Community Nutritional Assessment: With Special Reference to Less*
239 *Technically Developed Countries*. Oxford Medical Publications. Oxford: Oxford University Press. 1989:13-
240 30.
- 241 8. Heikens GT, Manary M. Wasting disease in African children: The challenges ahead. *Malawi Med J*.
242 2009;21(3):101-105.
- 243 9. Sekander HKM, Rayhan I. Factors causing malnutrition among under five children in Bangladesh. *Pak*
244 *J of Nutr*. 2006;5(6):558-562.
- 245 10. Black RE, Morris SS, J B Ryce. Where and why are 10 million children dying each year? *The Lancet*.
246 2003;361:2226- 2234.
- 247 11. World Health Organisation (WHO). *Evaluation of the malnourished children, management of severe*
248 *malnutrition; a manual for physicians and other senior health workers*, WHO Geneva. 2002;4-5.
- 249 12. Faruque AS, Ahmed AM, Ahmed T, Islam MM, Hussain MI, Roy SR, Alam N, Kabir I, Sack DA.
250 *Nutrition: basis for healthy children and mothers in Bangladesh*. *J. Health popul Nutr*. 2008;26(3):325-
251 339.