A Study of Nutritional Status of Preschool Children in Densely Populated Urban Area of Bangladesh

A dissertation
for partial fulfillment of the requirements for obtaining

Master of Philosophy in Nutrition (M. Phil).

Submitted by

Md. Taherul Islam Khan
Registration NO. 471/97–98.
M. Phil in Nutrition
Session: 1997 – 98.

Institute of Nutrition and Food Science
University of Dhaka, Bangladesh
2003.

CERTIFICATE

This is to certify that the thesis entitled " A Study of Nutritional Status of Preschool Children in Densely Populated Urban Area of Bangladesh" is a record of original research carried out in the Department of "Nutrition and Food Science", Dhaka University by Md. Taherul Islam Khan under my supervision. I further testify that all data presented in this thesis are based on his own observations. It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree.

Prof. Dr. Golam Mowlah
Supervisor and Professor
Department of Nutrition and Food Science
University of Dhaka
Dhaka-1000, Bangladesh.

April, 2003.

DECLARATION

This is to certify that the thesis entitled " A Study of Nutritional Status of Preschool Children in Densely Populated Urban Area of Bangladesh" is a record of my original research work carried out in the Department of "Nutrition and Food Science", Dhaka University under the supervision of professor Dr. Golam Mowlah. The assistance and help rendered by research fellows during the course of investigation and the source of literature have duly been acknowledged.

Md. Taherul Islam Khan
Department of
Nutrition and Food Science
University of Dhaka
Dhaka-1000.

April, 2003.

D. Practice on Nutritional Aspects

1. **What do you drink?**
   [1] Tap water [2] Boiled water [3] Pond water [4] Tube well water
2. **Which kind of toilet do you use?**
   [1] Kaccha latrine [2] Sanitary latrine [3] No fixed place.
3. **How do you wash your hands after coming from toilet?**
   [1] With water only [2] With mud and water
   [3] With ash and water [4] With soap and water.
4. **Where do you deposit house hold waste?**
   [1] Any where [2] Out side the house [3] A fixed place.
5. **What do you do for your children before taking foods?**
   [1] Wash hands [2] Don't wash hands [3] Sometimes wash hands
6. **Do you always cover your foods?**
   [1] Yes [2] No
7. **Where do you store salt?**
   [1] In a pot made of clay [2] Plastic pot [3] In open place
8. **Which kinds of salt do you use for cooking?**
   [1] Iodized salt [2] Non-iodized salt [3] Any salt.
9. **Do you store your salt beside oven (chula)?**
   [1] Yes [2] No
10. **Do you use oil while cooking vegetables?**
    [1] Yes [2] No
11. **Do you give your child to eat coloured vegetables?**
    (e.g Pumkin, Carrots, Tomatos etc.)
    [1] Yes [2] No
12. **Do you give your child to take seasonal fruits?**
    [1] Yes [2] No

Name of the interviewer : .....

Date of interview:.....

ACKNOWLEDGEMENT

All praises belong to almighty Allah, the Beneficent the Merciful.

It is my pleasure to express my heartfelt gratitude and deepest sense of indebtedness and respect to my honorable guide Professor Dr. Golam Mowlah, Institute of Nutrition and Food Science, University of Dhaka, for his guidance, suggestions, constructive criticism and affectionate advice to complete the study.

I am sincerely grateful to Professor Dr. Quazi Salamatullah, Professor Dr. Abdul Malek, Professor Dr. Aleya Mowlah, Dr. Akther-Uz-Zaman of the Institute of Nutrition and Food Science, Dhaka University, for their encouragement and constructive advice.

I would like to offer special gratitude and thanks to Dr. Md. Abdul Mannan, MBBS, DCH, M. Phil (Nutrition), currently Ph. D student in INFS for his help.

I gratefully mention the name of Md. Shafiqul Islam, Senior Data Entry Assistant, Department of Mathematics, BUET for his generous help and co-operation in computing and analyzing the data with great care and patience.

I Also offer special gratitude to my wife Tania-Al-Beruni for her co-operation and inspiration.

I express many thanks to my well wishers and my classmates who assisted me in procuring literatures, reference documents and inspiration for the successful out come of the study.

ABSTRACT

Majority of the malnourished children are belonging to below 5 years of age. Among them preschool children (from 24 to less than 60 months of age) contribute the greater portion and they suffer from nutritional diseases like protein energy malnutrition, anaemia, vit. A deficiency, worm infestations, respiratory tract infections, diarrhoea, various skin diseases etc. This study was a cross sectional study conducted in two densely populated areas of Dhaka city namely Sakhari Bazar and Kamrangir Char. 305 preschool children were studied of whom 165 were male and 140 were female. The mothers were the respondents and they were 250 in number. Data were collected from August 2000 to January 25th, 2002. Maximum respondents (63.2%) were housewives and the class I to class V level educated respondents were highest (32.0%) in this study. Average family income of the respondent was Tk. 4431.50 ± 1897.00 per month and mean family size was 6 in number. Most of them (62.5%) lived in brick houses and majority (78.4%) used sanitary latrine and 87.4% used tap water but maximum of them (73.2%) used unboiled drinking water. Nutritional status was determined anthropometrically, biochemically (Blood Hb and Urinary iodine level) and by examination of stool for worms. Prevalence of underweight (W/A), wasting (W/H) and stunting (H/A) were 67%, 18.7% and 59% respectively. By taking weight for age (W/A) indicator, 32.8% preschool children were considered as normal. According to MUAC measurements, 18.7% were malnourished using the cut off point 13.5 cm. Anaemia prevalence (Hb <11 g/dl) was 71.35% and mean haemoglobin level was 10.29 g/dl(±1.78). Prevalence of anaemia was highest (81.82%) in the age group of 35–39 months. The 71.15% of preschool children were worm infested and 22.1% were iodine deficient using the cut off point <10 μg/dl. The major diseases of preschool children were respiratory tract infections (69.8%) and diarrhoea (65.4%). The 95.6% of the respondents showed positive attitude on breast feeding up to two years and 78.4% of the mothers breast fed their preschool children up to two years regularly. The 59.7% families used family planning methods and they were more literate and their preschool children were comparatively well nourished.

Dedicated to My

Late father.

CONTENTS

Chapter : Three

Results

Chapter : Four

Chapter : Five

List of Tables

List of Figures

List of Abbreviations

INFS	:	Institute of Nutrition and Food Science
WHO	:	World Health Organization
UNICEF	:	United Nations International Children's Emergency Fund
BBS	:	Bangladesh Bureau of Statistics
FAO	:	Food and Agricultural Organizations
et al.	:	et allies
Etc.	:	et cetera
gm	:	Gram
Kg	:	Kilogram
M	:	Meter
nm	:	Nanometer
ml	:	Milli litre
µg	:	Micro litre
dl	:	Deci litre
%	:	Percent
W/A	:	Weight for Age
W / H	:	Weight for Height
H / A	:	Hight for Age
SD	:	Standard Deviation
<	:	Less / Smaller than
>	:	Greater / More than
m mol	:	Milli mole
Hb	:	Haemoglobin
L	:	Litre
g / L	:	Gram per litre
No.	:	Number
MUAC	:	Mid Upper Arm Circumference

Tk.	:	Taka
yrs	:	Years
cm	:	Centimeter
Kcal	:	Kilo Calorie
mg	:	Milligram
Vit	:	Vitamin
wt	:	Weight
ht	:	Height
Fig	:	Figure

CHAPTER - ONE

INTRODUCTION

Bangladesh is a developing country and one of the most densely populated countries of the world with respect to its area. About 85% of the people of this country live in low socio-economic condition and none of the basic needs like foods, clothing, shelter, medical care and education is fulfilled, living either in the village or urban area[18]. Most of the landless people from the rural areas are constantly migrating to the urban spots with a view to earn their livelihood. These type of people live with poor food, clothing, health and housing and lack of primary health care facilities, general medical services and education, lack of awareness about proper hygiene[5]. As such, they suffer from many diseases and become malnourished.

Bangladesh have one of the highest rates of malnutrition in the world, affecting the health and educability of the children and the productivity of its adult population[12]. Malnutrition in Bangladesh is reducing the country's development potential. The Government of Bangladesh recognizes nutrition as one of its priority basis. The GOB bases its vision to realize its commitment to nutrition as a basic human right and to reduce malnutrition to the extent that it ceases to be a public health problem by 2010[3].

Malnutrition is a major public health problem in Bangladesh. Majority of these cases are under five children and whom preschool children contribute the greater portion who are suffering from it[27]. Among those who survive, a background of poor nutrition contributes to chronic debilitating health and impaired function both intellectually and physically[2]. Malnutrition may be due to improper or inadequate food

supply, poor dietary habits, worm infestation, food faddism, emotional state and also metabolic abnormalities[21]. Therefore, a precise evaluation of nutritional status is difficult. Severe nutritional disturbances are readily apparent but mild disturbances may be overlooked, even after careful physical and laboratory examinations. The diagnosis of malnutrition rests on accurate dietary history, evaluation of deviations from average height, head circumference and past rate of growth, on comparative measurements of mid upper arm circumference and skin fold thickness and on clinical and other laboratory investigations [3].

Malnutrition has been recognized as one of the major causes of morbidity and mortality among the preschool children. It impairs intellectual development and is one of the contributory factors to the generally poor academic performance in poor and densely populated communities[22]. Poor socio-economic condition, medical and metabolic diseases and lack of proper knowledge about nutrition are the major causes behind it[10]. Many deep rooted beliefs, customs and practices, food taboos and ignorance play important role for causation of malnutrition. The average intake level of qualitative food by urban people is also much less than their requirements[23]. Children and women are among the deprived sections of the population. Inadequate intake of nutrients, poor hygiene and overcrowding are responsible for wide spread nutritional deficiency related disorders among the preschool children [4]. Some of the pictures are about 84% of 0–5 years children are suffering from some degree of malnutrition[3]. Per capita calorie intake is about 1808 Kcal/day (FAO) but recommendation is 2273 Kcal/day[11]. In Bangladesh 50% of the babies are born with low birth weight due to malnutrition of mothers[3].

The national survey in 1995 – 96 revealed that among the children from 6–71 months, 26.6% were normal and 73.4% children were malnourished. Among the malnourished children, 9.2% children were stunted but not underweight, 13% were underweight but not stunted and 51.2% were both stunted and underweight[9].

In Bangladesh, 25% to 50% of the children die before their fifth birth day and more than 50% of these deaths are related directly or indirectly to malnutrition[20]. Though there are a lot of factors, which lie behind the cause of malnutrition. Poor socio-economic structure is at the pivotal point of all of them. It has been observed that due to economic pressure, an influx of people are migrating to urban areas and generally they live in densely populated urban and slum areas for survival and economic purpose[28]. For few studies, it has been observed that in the slum and overcrowded urban area deficiency of vitamin C, Folic acid, Zinc, Various vitamin B complex and worm infestation are highly prevalent and child death rate is extremely high (in 32% families)[5]. For these reasons child death rate is extremely high in these communities.

The density of population is extremely high in Sakhari Bazar under kotwali thana and Kamrangirchar under Lalbagh thana due to influx of population in this old city, which cause further deterioration of health and hygienic condition and pose poses for proper nutrition. The educational picture in these areas are very low and the respond to health education and motivation remaining at a moderate level[4].

Various direct and indirect methods for assessment of nutritional status of individuals and communities are available. These include clinical, biochemical, dietary and socio-economic. Simple anthropometric measures such as stature, weight, height and arm circumference, which

are relatively simple and less costly, can provide objective children where growth is rapid, and among which, protein energy malnutrition occurs most commonly[53]. In most developing countries where the physical growth of young children is so commonly threatened by the interaction of dietary deficiencies and infectious diseases. Anthropometric measure have been extensively used for identification and classification of children suffering from protein energy malnutrition[56].

In developing countries preschool children generally suffer from nutritional diseases like protein energy malnutrition, anaemia and vitamin A deficiency, worm infestations, respiratory tract infection, diarrhoea, various skin diseases. The highest rates of prevalence among the children are observed Diarrhoea and Fever (35 per thousand) followed by Cold/URTI (33 per thousand)[15]. Among children, prevalence of combined immunisable diseases was estimated to be 23 per thousand children. In addition scabies (16 per thousand) and malnutrition are also reported at higher proportions among the children under 5 years of age[37].

Protein energy malnutrition (PEM) is regarded as spectrum of disease arising from an inadequate diet. It occurs characteristically in under 5 children where the diet is poor in protein and energy. At one end, marasmus is due to a continued restriction of both dietary energy and protein, as well as other nutrients. At the other end, kwashiorkor is due to a quantitative and qualitative deficiency of protein but in which energy intake may be adequate[24]. These two syndromes are the extremes deficiencies of minerals and vitamins coexists. Children with sub-clinical PEM can, however be detected by growth retardation. A great majority of young children who belongs to the poor income group in the developing countries are malnourished. They suffer from various grades of

protein energy malnutrition ranging from mild degrees of growth retardation to the very severe forms of kwashiorkor or marasmus[36]. The major etiological factors contributing to protein calorie malnutrition in different countries of South-East Asia are similar and may be considered to fall under the following headings:

(i) Lack of calorie and protein rich food for the feeding of infants and children due to socio-economic and agronomical factors.

(ii) Faulty feeding habits arising from ignorance, prejudices and superstitions.

(iii) Poor environmental condition leading to superimposition of additional stress in the nature of infections and infestations[34].

Malnourished children are more susceptible to infection[13]. It is the interaction of inadequate dietary intake and repeated infections that is responsible for the severe impairment of growth and development during the preschool years among the lower income population of nearly all developing countries[57]. Development of the brain and central nervous system may suffer some permanent impairment when severe malnutrition occurs at a very early age for this reason[50].

Many investigators found that malnourished preschool children suffer from higher prevalence and a larger duration of diarrhoea which causes a higher risk of mortality and morbidity[39].

Preschool children in the low income area of South East Asia are at the highest nutritional risk. Nutritional status or grading of PEM of preschool children depend on the various factors such as the age and education level of the parents, household income, number of children in the family,

Iron deficiency anaemia is a major health problem in India and about 52% of preschool children were found to be anaemic[41].

The Nutrition survey of Bangladesh (1975 – 76) indicated that 82% of the children (0–4 years) were anaemic with a mean haemoglobin value of 9.7 g/dl. Average haemoglobin level in children (0 – 4 years) of neighboring Thailand (1962) was 11.2 g/dl which is significantly higher than our values[30].

Nutrition survey of Rural Bangladesh (INFS 1983) revealed that, the mean haemoglobin level in children of 0 –4 years were 10.2 g/dl. This study also showed that, 73% of children of 0 –4 years age group were anaemic in 1981 – 82 as against 82% in the preceding survey[20].

Nutritional status of Bangladeshi women is equally alarming. About 45% of women of reproductive age have a Body Mass Index (BMI) of 18.5, indicative of chronic energy deficiency. High prevalence of malnutrition among women has significantly contributed to high incidence of low birth weight at an astonishing level of 30–50%. Low birth weight babies become malnourished children, adolescent girls and eventually will bear low birth weight babies[88]. The study also revealed that iron deficiency anaemia is found in 50% of pregnant women and 45% of non pregnant women[89]. However, prevalence of IDD has been significantly reduced through universal salt iodization from 69% in 1993 to 43% in 1999 according to National IDD survey 1999.

In Bangladesh the prevalence of night blindness due to vit. A deficiency is 1.18% among the preschool children. In Nutrition survey of Rural Bangladesh (INFS 1977, 1983) percentage of night-blind children in 2-

4 years age were 0.6% and 1.3% respectively[33]. Other signs of vitamin A deficiency were also present, as well as prevalence of xerosis conjunctivae was at a high rate in these survey (INFS 1977, 1983). Factors affecting nutritional status of children are not only food availability and accessibility or health services availability but also perhaps most importantly gender disparity, behavioral patterns and caring practices at household level. Malnutrition has a significant effect not only on the individual member's welfare but also on the Bangladesh economy. If the current situation continues, Bangladesh will lose $ 22.9 billion in ten years that can only be averted through comprehensive nutrition program[3].

Many study was carried out to estimate the nature and extend of malnutrition in Bangladesh in different categories of people, where Bangladesh Bureau of Statistics (BBS) has been conducting nutrition surveys of preschool children since 1985 – 86[9]. The first Child Nutrition Survey (CNS) was conducted in 1985 – 86, the second in 1989 – 90, the third in 1992 and the fourth in 1995–96. BBS selected data from all over Bangladesh, i.e from 5 divisions and 64 districts. Only 814 sampling units were selected from urban areas. There was no specific cross sectional study of urban areas.

The BBS Child Nutrition Survey only covered the children of age group 6–71 months for all over Bangladesh. However no study was conducted basically with only preschool children i.e. 2 to 4+ years of age from densely populated urban area. Although scattered studies were performed on the nutritional status and aspects of preschool children, sufficient published informations are not yet available in this field covering wide range of population groups of urban densely populated area.

The present study is undertaken not only to estimate the nutritional status of preschool children but also to assess how the overcrowded and densely populated environment hamper the health and growth of children. The study include a cross sectional study among the preschool children of old city of Dhaka in Kotwally thana and Lalbagh thana respectively. An effort is made in the study to assess nutritional status, clinical aspects of deficiency diseases and socio-economic informations of preschool children. The mothers and the children aged between 24 to less than 60 months were considered in this study.

Literature Review

Nutrition is a process where by living organisms utilize food for maintenance of life, growth, the normal function of tissues and organs, and the production of energy[44]. Nutrition is a production of health. The future of the country depends on its new generation 'The children'. For them to grow into healthy laid adult need a food start in life and remain well nourished and health. Malnutrition is a term widely used to mean faulty or poor nutrition in all of its aspects or over consumption of foods[45].

Malnutrition is a pathological state due to prolong deficiency of essential nutrients at the cellular or basic level. It indicates itself by physiological, psychological and biochemical abnormalities. Nutritional status, intern, is the state of the body that affect at cellular level produced by the process of eating, digestion, absorption, distribution and metabolism of food materials[46]. It is more common and obvious in infants and young children than in adults as they require extra food for growth and families may not be aware of the special needs of the infants, or may not know how to prepare the supplementary food or it may be due to poverty.

Malnutrition, combined with infection, is the major cause of death of millions of children and is responsible for the retarded growth and development of 'even' greater members[23].

Childhood malnutrition remains highly prevalent among preschool children in less developed countries[15].

In Asia, particularly the children of South-Asia, where almost half of world's malnourished children live, are affected most[73]. According to the WHO, 30-40% of all children under 5 years of age are malnourished in these less developed countries[74]. In many developing countries, the

prevalence of growth retardation increase with age during infancy and early childhood[75]. Child health situation is in a very poor shape in Bangladesh. 81.3% of infants aged 6-71 months suffer from various degrees of malnutrition, of which 11.1% and 24.9% are severely malnourished respectively[76]. According to UNICEF, the situation of infant, child and maternal malnutrition in Bangladesh is among the worst in the world. The report also showed that about 10-20% of preschool children had third degree of malnutrition and a further 50-60% were affected by moderate malnutrition[77]. In Bangladesh the neonatal, infant and under five mortality rates are 80, 94 and 122/1000 live births respectively. This childhood mortality is primarily due to malnutrition, diarrhoeal diseases, acute respiratory infections, neonatal tetanus and measles[79]. Executive summary of World Bank reported that recent positive changes levels of malnutrition in Bangladesh remain to be the highest in the world. 58% of under five children are underweight and 51% are stunted, nearly 50% of women suffer from chronic energy deficit, low birth weight incidence is at 45%, perhaps the highest in the world[78]. A study shows that malnutrition was exceptionally prevalent in children (68.5% stunted, 31,2% wasted and 73.2% underweight) for exceeding WHO criteria for very high level of malnutrition. Severely stunted, wasted and underweight children were 37.8%, 5.7% and 39% respectively and moderately stunted, wasted and underweight children were 30.7%, 25.5% and 34.2% respectively[11].

Analysis of relevant socio-economic and demographic variables reveals that "poverty" is the central point of all direct and indirect cause of malnutrition. In several studies socio-economic factors have been found to influence the nutritional status of the children[10]. Brown et al in 1986 found that children in the low-income area of South East Asia are at highest nutritional risk[48].

A study on nutritional status of preschool children reported that nutritional status or grading of PEM of preschool children depend on various factors such as the age and educational levels of the parents, household income, number of children in the family, duration of breast feeding and completion of immunization for their children against infectious diseases[79].

Mbago in 1991 studied children (1-4 years) in low income urban area in Tanzania and concluded that there is a close relationship between maternal education and nutritional status of children[49].

Malnutrition has been recognized as one of the major causes of morbidity and mortality among the children[3]. A great majority of young children who belong to the poor income group in the developing countries are malnourished. They suffer from various grades of protein energy malnutrition ranging from mild degrees of growth retardation to the very severe forms of kwashiorkor or marasmus. Malnourished children are more susceptible to infection[13]. For preschool children in the less previleged groups of developing countries, whether the apparent clinical result in nutritional or infectious disease, both malnutrition and infection are usually involved[9].

Another study observed that malnutrition (W/A<70%) was significantly associated with the risk of development of persistent diarrhoea in North Indian children[80]. Tomkins in 1981 reported that thin children are likely to have more frequent diarrhoea and Briend et al. in 1989 reported that short children may also experience higher incidence of diarrhoea[81].

Other investigators found that undernourished children suffer from higher prevalence and a large duration of diarrhoea[82,83,84] but also had a higher risk of mortality after diarrhoea. Not only in this retardation in physical growth not made up in subsequent years, but development of brain and central nervous system may suffer some permanent impairment when severe malnutrition occurs at a very early age for this reason[14].

In Nutrition Survey (BBS 1997) made some important findings regarding nutritional status of our children. As it revealed, amongst the under 5 children, 16.6% were acutely undernourished, 12% were both stunted and wasted, 4% were wasted but not stunted, 74% had chronic undernutrition and 11.82% had both acute and chronic undernutrition. These survey findings indicate that major portion of our children unider-5 years were malnourished as categorized single or multiple standards[12].

Nutrition Survey of Rural Bangladesh, 1981-82 revealed some important findings on child nutrition. In this survey, some six percent of the children (0-11 years) was found to be normal, 20% was observed to have suffered from first degree malnutrition, 51% from second degree and 23% from third degree malnutrition. This survey also revealed that nutritional status of children, especially 0-5 years old children, was poor. Amongst the under 5 children, 57% were stunting, 20% were wasting and 13% were both stunting and wasting[20].

On the other hand Bangladesh Bureau of Statistics (BBS) conducted three National level Child Nutrition Survey during the years of 1985-86, 1989-90 and 1992. In the first survey on 1985-86, it was observed that more than 56.1% of the children in Bangladesh among 6-71 months of age were wasted[51-52].

According to Second Child Nutrition Survey of Bangladesh (1989- 90), the nutrition situation of Bangladeshi children using Gomez classification, 6.8% suffered from third degree malnutrition. Another 47% can be categorized as suffering from second degree malnutrition, while only 6.6% can be considered normal in terms of their nutritional status[40].

Child Nutrition Survey of Bangladesh (1992), also revealed the following findings: taking height for age and weight for height into consideration only 31% of all children between 6-71 months of age could be classified as not malnourished. The remaining 69% of the children are

victims of malnutrition of one kind or the other. In this survey the total prevalence of stunting, wasting and underweight were 64.2%, 16.7% and 68.3% respectively and the prevalence of malnutrition is higher among the female children[53].

Nutritional Blindness Survey (HKI, 1985) reported that among 6-72 months age Children, about half (49.5%) were stunted (<90% H/A) and more than one tenth (11.3%) were wasted (<80% W/H). Measured by MUAC indicator, 13.4% children were severely malnourished (<12.5 cm)[33].

According to World Bank document, 1993, Bangladesh has the severest malnutrition problems in the world, because 68% of the children under 5 years are highly or moderately underweight, 64% of them are severely or moderately stunted and 17% are suffering from wasting[85].

Another study find out the prevalence of morbidity among normal and malnourished children (0-5 years) in an urban slum of Dhaka city. Prevalence of morbidity among the malnourished children was found to be higher than the normal children living in same conditions[42].

Hassan and Barua in 1989-90 studied the nutrition profile of orphans living in the Dhammarajika orphanage of Dhaka city. Most of the orphans under the study were found nutritionally normal by any nutritional status criteria. Only a few of them was found to have suffered from mild or moderate degree of under nutrition. This implies that organized feeding and better hygienic condition can improve the nutritional status of the orphans who are otherwise believed to be malnourished[43].

Begum and Haque in 1992 studied on health and nutritional status of children in rural Bangladesh. In this study they found that only 25.89% girls and 21.21 % boys had normal nutritional status. While 30.36% girls and 12.36% boys were within the range of 70-80% of the Harvard standard & 43-75% girls and 58.42% boys were within 81-90% of the above standard[44].

Hassan and Ahmed in 1993 studied the nutritional status of 1108 children of the city of Dhaka. Nutritional status of children aged 0-12 years was assessed by measuring weight for age, weight for height and height for age from 11 locations. Only 12% of children were found to have normal weight for age and 58% was considered as suffering from malnutrition of second and third degree. The weight for height was normal in 39% and 21% were considered as wasted. Almost 47% were stunted and the percentage of stunted children increased with age. When stunting and wasting are combined, 47% of the children could be considered normal and 12% had severe malnutrition[32].

Kamal et al in 1997 studied the nutritional status of 2-5 years children in a slum of Jurain of Dhaka city. According to Gomez classification, 14.7% children were normal and 85.2% were malnourished. In the malnourished group, 40.6% were 1st degree, 36.7% 2nd degree and 7.8% were 3rd degree. According to Water low classification, 50% were normal and 50% were malnourished. In the malnourished group, 39.7% were stunted, 5.3% wasted and 4.9% were both stunted and wasted[47].

In 1985-86, a nutrition survey was carried out in the city of Dhaka with samples from the poor, the middle class, the upper middle and the rich. Anthropometric measurements of height and weight of under 12 children were recorded during the course of the survey to determine the nutritional status of the urban children, to assess the prevalence of malnutrition among them and to identify the children at risk[86].

Jahan and Hassan in 1994 studied the nutritional status of children among the 100 households in a village of Narayangonj district between 1988-89. The study, indicated that the children were mostly deficient in calorie (54%),' protein (44%), vitamin A (77%) and vitamin B_2 (73%). About 70% children were either wasted or stunted or both. Almost all of them (98%) were found to suffer from various degree of malnutrition, 49% of the children were anemic and disorders were more severe than those of 1981-82 Nutrition Survey[48].

The prevalence of malnutrition among under 5 children in Brazil decreased by more than 60% between 1975 and 1989[49].

A community based survey of the nutritional status of the under 5 children was conducted by Coetzee and Ferrinho in 1994. A cluster sampling technique was used. The weight and height of 426 children were measured. Compared with clinic-based growth monitoring data, it indicated a high percentage of stunting but not acute malnutrition[13].

In a cross sectional survey carried out among 4320 under 5, children in South West Uganda indicated that various socio-economic and environmental factors were related to poor nutritional status[87].

Another study shows incidence of stunting (chronic long term malnutrition) among Bangladeshi children which showed female children (57.6%) were more stunted than male children (54.8%). Prevalence of wasting (acute malnutrition) by age group, area and sex showed female child (12-23 months, 2.4% and 24-25 months, 11.6%) were more wasted than male[54].

A BBS report on child death rate per thousand children of aged I to 4 years showed that mortality rate is higher among female children (16.2%) than male children (13.0%)[55].

In Pakistan, a 1989 analysis showed that 61 percent of girls under the age of five were malnourished, compared with 52 percent of boys in the same age group[48].

A report in Bangladesh conducted among 6 months to 6 years children also showed that girls (51.3%) were more stunted than boys (50.8%)[88].

A Bangladesh Bureau of Statistics report (1993) showed 14% of female children were malnourished in comparison with only 5% of male children. The percent of stunted girls (57.6%) and boys (54.8%), wasted girls (9.5%) and boys (6.8%) and arm circumferences were low, 17.6% for girls and 11.5% for boys[89].

A report published on prevalence of under nutrition in children under 5 (6-59 months) in developing countries showed that in Bangladesh children are 65.5% underweight, 64.6% stunted, 15.5% wasted and 0.3% over weight among 1,914 children[90].

A study among low-income urban primary school children in Dhaka city showed that nutritionally normal children secured higher marks compared to 'Malnourished children of that school. The nutritional status was measured by both the weight for age and weight-for-height indicators[60].

The nutritional status of 190 children (3-6 years) living in Bestirs, a typical urban shack settlement north of Durban, was assessed anthropometrically. In addition the following biochemical values were determined: vitamin A, vitamin E, calcium, magnesium, phosphorous, albumin, haemoglobin, serum iron ferritin and percentage of transferring saturation. Malnutrition was evident in 13% of the children who were underweight and 27% who were stunted. Some 44% of the children had low serum retinol levels (<20 μg/dl) and 21% of the children were anemic (Hb level <11 gm dl)[91].

A study reported relationship between the intensity of parasitic infection and anaemia. The Nutritional Survey of Rural Bangladesh 1975-76 revealed that 82% of the 0-4 years children were anaemic with a mean Hb value of 9.7 gm/dl. Average Hb level in children (0-4 years) of neighboring Thailand was 11.2 gm/dl[30].

Nutritional Survey of Rural Bangladesh revealed that the mean Hb level in children of 0-4 years were 10.2 gm/dl. The study also showed that 73% of the children of 0-4 years age group were anaemic in 1981-82 as against 82% in the preceding survey. Incidence of anaemia gone down by above 9% in 1981-82, over that of 1975–76. Mild anaemia is associated with vitamin A deficiency[64].

A study showed that the nutritional status of urban children based on biochemical parameters. It was found in the study that almost all the children were anaemic, but their serum iron and ferritin levels were satisfactory. Folate and vit-B_{12} levels were low. Deficiency of these water soluble vitamins may be a cause of anaemia. 15% of the children had biochemical evidence of vit-A deficiency[65].

Another study on the iron deficiency anaemic children aged 0-12 years was carried out to find out its extent and severity. It was observed that family income and food habit had significant influence on Hb level and serum iron concentration of children. About 63% of total cases were found to be iron deficient. This respective study reveals a complex interaction between socioeconomic condition and iron deficiency anaemia[66].

Intestinal parasitic infections are distributed throughout the world with high prevalence in developing countries. Intestinal parasitic infections are closely associated with under nutrition, poor personal hygiene and environmental sanitation. A WHO /World Bank pilot project on the control of intestinal parasites had been commenced in Bangladesh in 1991-93[92].

A study shows that prevalence of anaemia among children of which 15.62%, 25.26% and 13.0% were severe, moderate and mildly anaemic respectively. Prevalence of anaemia was found highest in the female children. Clinically prevalence of iron, folic acid, vit-C, Zinc, vit-A. copper, vit-B_6 and vit-B_{12} deficiencies, anaemia due to worm infestation were found in 43.48%, 8.21%, 4.35%, 3.86%, 2.41%, 1.93%, 1.45% and 8.70% of the children respectively. Anaemia due to malignancy was found incidentally in 8.7% children during this study. Stool examination of this study revealed that 18% of the children were infected with Ascaris lumbricoides, the incidence of hook worm and protozoal infections was observed in the same. Rest of the cases were found free of worms. Parasitic infestation are active synergisticants to cause the high prevalence of anaemia in Bangladesh[93].

Iodine deficiency disorders are another global health phenomena. Over 12% of the world's population are iodine deficient[68]. Approximately 800 million people in developing countries live in an iodine deficient environment. Over 190 million suffer from goitre. More than 3 million are cretins and millions more suffer from some intellectual deficit secondary to iodine deficiency[69].

According to the latest estimates, some 1.57 billion people world wide are at risk of IDD. South East Asia shares the largest rates of prevalence of IDD, with an estimated 486 million at risk and 176 million having goitre[7].

Many countries in South East Asia have a significant health problem of IDD. In Bhutan, the goitre prevalence (%) among men and women in Northern and Southern part are 18.4, 28.5, 32.5, and 45.9, respectively. In India, 150 million people are at risk from IDD of which <54 million have goitre. In Sri Lanka, according to survey in 1986-87, the goitre prevalence is over 10% in a large part of that country and about 66% of the total population of Srilanka live in the goitre endemic area. In Nepal (Trishuli), the goitre rate was found to be 55% in 1976. In Thailand regarding the survey conducted in 1991, the goitre prevalence is 15.1% in Northern provinces and 60.2% in Northeast provinces. In Indonesia, the total goitre rate was 32.2% according to the survey carried out with in 1980-82[94].

A report in 1992 by World Health Assembly reveals the percentage of population affected by goitre in the WHO region countries were Africa (13.2%), America (9.6%), Europe (14.8%), South East Asia (26.8%). Western Pacific (21.5%)[71].

The Nutrition Survey of the East Pakistan (1962-64) showed for the first time the presence of high endemicity of goitre in our population. The Second Nutrition Survey carried out in 1975-76 in rural Bangladesh also confirmed widespread prevalence of goitre all over the country but did not give details of district-wise prevalence[26].

Concerning the findings of the above two nutrition surveys, a goitre survey was carried out in the country conducted by the Institute of Public Health Nutrition (IPHN) in 1981-82 to assess actual national goitre prevalence. In that survey total goitre prevalence was found to be 10.51%[72].

Only goitre was assessed in that survey, no data on cretinism or other indicators of iodine deficiency (e.g. mainly iodine level in the urine) were collected. The first National IDD Prevalence Survey (goitre, cretinism, urinary iodine level) was conducted by a Dhaka University team in 1993. The results indicated that 47.1% (grade 1+2) of goitre with cretinism in the country to be 0.5%. The median urinary iodine level in the study population was 3.4 μg/dl in the hilly zone, 5.1 μg/dl in the flood prone zone and 7.4 μg/dl in the plain zone. Furthermore, 68.9% of Bangladeshi population have biochemical iodine deficiency (urinary iodine <10 μg/dl). It was concluded that IDD situation is severe in Bangladesh[9].

Another study was conducted on goitre prevalence among the school children of Dhaka University campus in early 1995. The goitre prevalence was found to be 34.70% (grade 1, palpable 3.9 1 % + grade 2, visible 0.79%), with 32.23% in male students and 38.68% in female students. Among the three schools of Dhaka University area, the prevalence of goitre was found to be 53.04% in Nilkhet High School, 26.94% in Udayan Biddalaya and 31.08% in University laboratory School. In all cases, the prevalence of goitre was higher in females. The overall median urinary iodine level was 10.1 μg/dl (male 10.7 μg/dl, female 9.9 μg/dl) and 40.9% respondents where biochemically iodine deficient (males 40%, females 42.6%) having urinary iodine level less than 10.0 μg/dl. This indicates that female subjects are more deficient in iodine. Distribution analysis of respondents according to iodized salt intake shows that, 44.79% take iodized salt, 39.12% do not take iodized salt and the remaining 16.09% do not know whether they take iodized salt or not[73].

A major part of the world population have been reported to have low food intake of about 2000 kcal per person per day in the developing countries[74]. In Bangladesh, not only low dietary intake but also ignorance about food is one of the vital causes of malnutrition. Majority of our population is illiterate. They have no knowledge about nutritive value of food. For this reason, usually they cannot take balanced diet resulting malnutrition and ultimately attacked by various nutritional deficiency diseases. This situation is worst among slum and densely populated dwellers of our country[13].

OBJECTIVES OF STUDY

General Objective

To understand mothers nutritional knowledge and nutritional status of preschool children living in densely populated area of Dhaka city.

Specific objectives

1. To determine the level of knowledge of mothers living in densely populated area of Dhaka city regarding nutrition and dietary practices.

2. To determine the prevalence of malnutrition with special reference to protein energy malnutrition (PEM) and nutritional anaemia among the preschool children.

3. To investigate the morbidity pattern of the preschool children.

4. To assess the socio-economic status of the respondent households.

5. To assess the nutritional status by anthropometry and laboratory examination of preschool children of respondent households.

6. To find relationship of nutritional status of preschool children with nutrition education of the mothers and the economic conditions of the family.

7. To provide appropriate recommendation for nutritional improvement of preschool children residing in densely populated area of Dhaka city.

Operational Definitions

Respondents

The persons who were interviewed called the respondents.

Preschool Children

The children of the study constituted available children households having aged from 24 months to less than 60 months of both sex.

Nutrition

Nutrition is a science of food, the nutrients and other substances their in, their action, interaction and balance in relation to health and diseases and the process by which the organism ingests, digests, absorption, transports, utilizes and excretes food substances.

Malnutrition

An impairment of health resulting from a deficiency, excess or imbalance of nutrients.

Food

It is a composite mixture of substances which when consumed performs certain functions in the body.

Food Security

The nutritional status of children was positively related to several measures of household food security, for example, farm size, household income, per capita income and household expenditure. Household expenditure produced the best fit to the data. The contribution of the factor to nutritional status was however small. As household expenditure increased

3.14 (e = 3.14) times, the nutritional status by HAZ improved by 0.13 and by WAZ improved by 0.18 points only.

Nutrition Education

Specialized health education programme for an individual or group of individuals aimed to adopt appropriate health and dietary practices through various learning process.

Knowledge

Knowledge means those items of fact and procedure by which an individual learn what to do in a given situation and enough about why it is done to make the procedure meaningful in so far as he/she is able to understand it.

Attitude

Attitude is the behavioral outlook or perception of an individual who thinks that or these to be justified or best opinion in any specific situation.

Practice

Any procedure following regularly, a habit of doing anything or performance. In this study, practice deals with onset of breasting, intra households food distribution pattern, preferential food distribution among preschool children etc.

Nutritional Status

It is a condition of physical health of an individual resulting from consumption and utilization of food in the body.

Nutritional Assessment

It is the process where by the state of nutritional health of an individual or a group of individual is determined.

Z-Scores

A method of comparing a child's nutritional status with normal and well-fed children using the internationally accepted NCHS references tables. Under nutrition is defined as a Z-score, which is less than –2SD. Height (or length) and weight of children are compared with a reference standard, and are expressed as % deviations or as standard deviation scores (Z scores) of the reference medians. Now a day, NCHS references are used as standard. Although –2SD score corresponds approximately to 80% of the median weight-for-height and 90% of the median height-for-age, the relative proportions of children diagnosed as malnourished by using percentages of medians as cut-off points somewhat changes with increasing age of children. For this reason the World Health Organization (WHO) and other scholars recommend that analysis presentation of anthropometric data should be made as categories of Z scores of reference median height-for-age, weight-for-age, and weight-for-height rather than as percentages of the median. The distributions of height-for-age, weight-for-age and weight-for-height Z score are very close to standardized Gaussian (Normal) distribution which has many important properties. The proportion below –2Z scores is 2.5% and below –3Z scores is about 0.1%. So the proportion of children below a cut-off point in a population can be compared with the expected proportion in the reference population.

Weight

Weight is the most commonly used anthropometric measurement for identification of PEM. However, a single weight measurement is a static estimate of the dynamic process of growth at one point of time. PEM is best indicated by growth failure in children which can be detected by serial measurements of weight. Interpretation of weight measurement on

single occasions should be made with caution and preferably in combination with other measurements, especially the height (or length) in all age groups.

Height

Height is a more stable growth parameter than weight. Diminished stature is a reflection of chronically inadequate nutrition. Unlike weight, once attained, height cannot decrease with malnutrition, and a reasonably long period on deficient diet is necessary before linear growth is affected. The usefulness of linear measurement (height or length), as a long-term indicator of growth or its failure is now widely recognized.

Underweight

The term is used in the text as shorthand to mean "The level of under as assessed by prevalence of Wt./Age <–2 Z score." Under-weight indicates a deficit in body weight compared to the expected weight for the same age, which may result either from failure in growth or loss of body weight due to infections.

Stunting

Linear growth is a more stable indicator of nutritional status, and stunting indicates reduced linear growth (height or length) compared to the expected growth in a child of same age. Stunting is usually the end-result of chronic and less severe inadequate nutrition. They are at a greater risk to future complications. It has been suggested that the substandard stature of adults in poor socio-economic groups in developing countries may have its origin in their early childhood, and that one of the consequences of stunting is the impairment of working capacity. The term is used in the text as shorthand to mean "the level of undernutrition as assessed by the prevalence of Ht./Age <–2 Z score."

Wasting

The term is used in the text as shorthand to mean 'The level of undernutrition as assessed by the prevalence of Ht./Wt. <–2 Z score."

Prevalence

Prevalence has been defined as, "The total number of all individuals (old and new) who have an attribute or disease at a particular time divided by the population at risk having the attribute or disease at this point in time or midway through the period." Prevalence depends upon 2 factors. (a) Incidence and (b) Duration of illness.

Anaemia

Anaemia may be defined as reduction in the concentration of haemoglobin (Hb) in the peripheral blood below the normal for the age and sex of the patients with or without change in PCV with consequent impaired delivery of oxygen to the tissues.

Iodine Deficiency Disorders

The various physiological problems that arose in iodine deficiency are collectively known as IDD stands for the term "Iodine Deficiency Disorder." The disorder includes goitre, mental retardation, squint, dwarfism and other psychomotor impairment.

Mid Upper Arm Circumference (MUAC)

The mid upper arm circumference (MUAC) gives a rough composite gauge of protein (muscle) and fat (energy) stores. It is very similar in well nourished children between 1-5 years (12-59 months) and correlates approximately with changes in body weight in malnourished children. Since MUAC changes very little from 1-5 years of age it can be used as an

age-independent measurement. Low arm circumference has been shown to be a sensitive indicator of risk of death in children. MUAC is now being increasingly used in identifying children with PEM.

Health environment

Children having no diarrhea in last 2 weeks of interview, having no measles in last 3 months of interview, and having no severe cough in last 2 weeks of interview, have lower prevalence of malnutrition than the otherwise.

- The nutritional status of children showed significantly positive relationship with the ownership of hygienic latrines and significantly negative relationship with the attack by diarrhoea, fever and cough. The relationships with the other variables are either insignificant or theoretically inconsistent.

- For households owning hygienic latrines the nutritional status by HAZ increased by 0.25 and by WAZ increased by 0.13 points.

- For each episode of diarrhoea the nutritional status by HAZ decreased by 0.21 and by WAZ decreased by 0.15 points.

- For each episode of prolonged fever and cough the nutritional status by HAZ decreased by 0.14 and by WAZ decreased by 0.23 points.

CHAPTER - TWO

METHODS AND MATERIALS

2.1 Study population:

The study was conducted purposively among 250 mothers having children (both boys and girls or any one) aged 2 years to 4+ years (less than 5 years). In order to assess nutritional status of the children, women who had at least one preschool child were included in the study. The respondent women belonged to Dhaka city living in densely populated area.

2.2 Study locations:

Study area included two densely populated areas of Dhaka city namely Kamrangir char and Sakhari Bazar under Lalbagh thana and Kotwaly thana of Dhaka district.

2.3 Study period:

The data were collected during the period of August 2000 to January 25th, 2002.

2.4 Development of study questionnaire:

A standard questionnaire was developed in accordance with the study objectives to obtain relevant information regarding dietary practice, socio-economic status, such as educational background, occupation, monthly family income, family size, expenditure on food and number of children. Relevant informations were included on the sex biased nutrition related behaviour such as intrahousehold food distribution to boys and girls on selected food items. Anthropometric indices such as weight, height and MUAC (Mid Upper Arm Circumference) were included in the questionnaire to obtain data from the households who had both male and female children between 2 years to 4+ years.

2.5 Questionnaire design and Field trial:

Before starting the final survey, the initial questionnaire was pretested among respondents in another area who were unware about the study. Then it was modified as required and finalized for collection of data from the selected study population. The finalized questionnaire is given in Appendix -1.

2.6 Pronouncement of consent:

The purpose of the study was explained to each respondent mother. After having permission from them, the data were collected.

2.7 Sample size and selection of samples:

Two hundred and fifty women were selected who had the children aged from two years to four plus. Their responses were recorded in the questionnaire. Data were also taken for anthropometric measurements. Among all the children (305) there were 165 boys and 140 girls. But all the children did not participate in stool, urine collection and blood haemoglobin (Hb) estimation. Only 192 preschool children co-operate in blood collection, 208 co-operate in stool collection and 163 co-operate in urine collection.

2.8 Collection of Anthropometric data:

2.8.1 Weight

A bathroom scale (Kubota, Japan) and a Salter (England) scale was used to record weight of the children. Salter scale was used for those children who were two years of age and bathroom scale was used for the children who were above the age group. The balance was standardized regularly before use. The weight was recorded on standing position in the weighing machine on bare foot and with light clothes. The arms were made to hang loosely at the body sides.

2.8.2 Length or height.

Length or height of the subjects were measured bear footed with a wooden height scale. The length board was set on the ground. Then the subject stood supporting the length board or lay upon the length board.

2.8.3 MUAC (Mid Upper Arm Circumference)

It was measured using specialized tape designed for the purpose. The left arm was made hanging freely while the upper portion was measured by a measuring tape placing it gently and firmly around the mid point between acromion of the scapula and olecranon of the ulna avoiding compression of the soft tissues.

2.8.4 Age

It was recorded from the memory of the mothers or from the birth certificates in case of preschool children. Also ages were recorded from the immunization cards as produced by some mothers.

2.8.5 Anthropometric indices

Weight-for-age, height-for-age and weight-for-height of the subjects were calculated and compared with the National Centre for Health Statistics (NCHS) reference median.

2.8.6 Weight for Age (W/A)

Weight for Age of the subjects were calculated from the body weight and standard weight of the subjects in that age using the following formula-

$$\text{Weight / Age} = \frac{\text{Actual wt. of the children}}{\text{Standard wt. of the children for that age}} \times 100$$

2.8.7 Height for Age (H/A)

Height for Age of the subjects were calculated from the height and standard height of the subjects in that age using the following formula -

$$\text{Height / Age} = \frac{\text{Actual ht. of the children}}{\text{Standard ht. of the children for that age}} \times 100$$

2.8.8 Weight for Height (W/H)

Weight for Height of children were measured from the body weight and standard weight in that height using the following formula -

$$\text{Weight / Height} = \frac{\text{Actual wt. of the children}}{\text{Standard wt. of the children for that ht.}} \times 100$$

2.8.9 Underweight

The most commonly used classification of malnutrition is the well known Gomez classification in which children are categorized into the first, second and third degrees of malnutrition on the basis of percentage deviation from the reference median, using arbitrary cut off points as described below:

	% of standard
Normal	: 90 – 110%
1st degree	: 89.9 – 75%
2nd degree	: 74.9 – 60%
3rd degree	: less than 60%

2.8.10 Wasting and stunting as percent (%) deviation from reference median

A deficit in weight for age does not give any indication whether a child is currently on a deficient diet or he/she has a history of past malnutrition. In order to over come this difficulty, Water low proposed a two-way classification which takes into accounts both height and weight

of the child. If the child is under weight for his / her height then he/she is currently on a deficient diet and is classified as wasted. On the other hand, the child is classified as stunted on the basis of percentage deviation from the reference median as described below:

Wasted	:	weight for height less than 80% of median.
Stunted	:	height for age less then 90% of median.
Wasted & stunted	:	Height for age less than 90% of median & Weight for height less than 80% of median.

2.8.11 Wasting, stunting and underweight as standard deviation score (Z-scores).

In undernourished population -2SD weight for height corresponds approximately 80% of the median weight for height and 90% of the median height for age. The relation proportions of children diagnosed as malnourished by using a cut off point of 80% or below of median score which changes with increasing age of children. For this reason, weight for height and height for age are now expressed as multiples of standard deviation of the reference population. Children with scores of –2SD or below the reference are classified as malnourished. Severe and moderate stunting, wasting and under weight are distinguished as follows:

Stunting:	**height for age (-2SD or below)**
Severe	: – 3SD or below.
Moderate	: – 2SD to –2.99SD.
Wasting	: **Weight for height (-2SD or below)**
Severe	: – 3SD or below.
Moderate	: – 2SD to – 2.99SD.
Underweight	: **weight for age (–2SD or below)**
Severe	: – 3SD or below.
Moderate	: – 2SD to –2.99SD.

Mid Upper Arm Circumference (MUAC)

Using arbitrary cut of points, children with MUAC less than 12.5 cm were classified as malnourished and those with MUAC between 12.5 cm and 13.4 cm as borderline cases among children below 60 months of age.

2.9 Blood Collection

20 μ litres of blood was drawn from the tip of the index finger of the subject by pricking with sterile blood lancet. This 20 μ litres blood was transferred to 5 ml reagent for haemoglobin estimation.

2.9.1 Analytical method

2.9.1.1 Estimation of Haemoglobin:

Haemoglobin was estimated by Cyanmethaemoglobin method (Van Kampen and Zijlstra, 1961, ICSH 1967) using a commercially available kit (Boehringer Mannheim, Germany).

Reagents:

Reagent 1: Potassium Hexacyanoferrate (III) solution (stock)

Reagent 2: Potassium cyanide solution (Stock).

Preparation of working reagent:

Contents of reagent I and reagent 2 were mixed and the volume was made 1000 ml with redistilled water. This solution contained phosphate buffer: 3.0 mmol/1 (p^H 7.2); potassium hexacyanoferrate (III) 0.6 m mol/1: potassium cyanide: 0.75 m mol/1: detergent: 0.1 g/1.

Haemoglobin standard:

Commercially prepared haemoglobin standard (Boehringer, Germany) with different concentration (5, 10, 15 and 20 g/dl) was used and standard curve was prepared from the respective absorbance at 546 nm.

Procedure:

Five milliliters of working reagent was taken in a glass test tube and 20 µl of blood sample was added by haemoglobin pippet. It was then mixed well by a vortex mixer. The absorbance was read at 546 nm against the reagent blank in spectrophotometer 20 (PERKIN ELMEN).

2.10 Stool Collection

During the study period a total of 208 stool samples were collected from the subjects of the households. Stool samples were collected in clean and sterile plastic small pots. Those were brought to the laboratory and analyzed for worms examination.

2.10.1 Laboratory examination of worms

Microscopic examination:

The stool sample was examined under cover slip preparations. Floatation was done for ova of helminthes.

Cover slip preparations

Two to three suspensions were made on a slide, one or two with normal saline and one with Lugol's iodine. These were covered with cover slips.

Normal Saline: It was prepared by adding 8.5g of sodium chloride in 1000 ml. distilled water.

Lugol's Iodine: Iodine 1 gm, Potassium iodide 2 grams and distilled water 100 ml. Potassium iodide and iodine were mixed in a mortar and then washed in a bottle with distilled water. The volume was made up to 100ml with distilled water. The solution should not be used for more than two weeks.

2.11 Urine Collection

During the study period a total of 163 urine samples were collected from the subjects of the households. Urine samples were collected in cleaned dried plastic pots. Those were carried in cartoons and brought to the laboratory where those were stored at -20^0 C. Those were kept at room temperature one day before the urine samples analyzed for iodine.

2.11.1 Biochemical estimation of iodine

Urinary iodine was assessed by the wet digestion method adopted by Gutekunst et al. At a time 30 samples, along with 5 standards of different concentrations and one blank were digested. De-ionized water was used as blank. The results were expressed as μg of iodine per dl of urine.

Apparatus and accessories

Equipments that have been used were test tubes, reagent flasks, bottles, pipettes, pipette filter, measuring cylinder, stop watch, heating block, spectrophotometer, laboratory balance and digestion chamber with fume hood.

Reagents

Reagents that have been used were:

1. Potassium chlorate ($KC1O_3$) dry powder
2. Perchloric acid ($HC1O_4$) 70%
3. Arsenic trioxide (As_2O_3) dry powder
4. Sodium chloride (NaCl) dry powder
5. Conc. sulphuric acid (H_2SO_4)
6. Ceric ammonium sulphate ($Ce[NH_4]_4, 2H_2O$)
7. Potassium iodide: dry powder.

Reagents preparation

a. Chloric acid solution :

In a 200ml Erlenmeyer flask, 500g of $KClO_3$, was dissolved in 910ml de-ionized water and was heated until it was dissolved. Then in it 37ml of 70% $HClO_4$ was added slowly (for about 15 minutes) with constant stirring. After cooling, it was stored in refrigeration for overnight. Next day it was filtered with filter paper (Whatman # 1).

b. 5 N Sulphuric acid :

Concentrated sulphuric acid, 139ml was added slowly in 1 litre volumetric flask containing about 700ml de-ionized water. Volumetric flask was placed in ice water. After adding the acid to water it was cooled and then the final volume was adjusted to I litre with de-ionized water.

c. Arsenious acid solution :

400ml sulphuric acid (5N) was added in a 200ml Erlenmeyer flask containing 20g As_2O_3, 50g NaCl and about 1 litre de-ionized water. It was then heated gently to dissolve the solute. After cooling the flask at room temperature, it was diluted to 2 litres with de-ionized water and then filtered.

d. 3.5 N Sulphuric acid :

Concentrated sulphuric acid, 97ml was added to about 800ml de-ionized water in one litre volumetric flask which was placed in ice water, and the final volume was made up to one litre with de-ionized water.

e. Ceric ammonium sulphate solution :

48g ceric ammonium sulphate was dissolved in 3.5N H_2SO_4, and the volume was made up to 100ml with de-ionized water.

Standard preparation

a. Stock standard :

168mg potassium iodide was dissolved in de-ionized water to a final volume of 1 litre de-ionized water (100μg I/ml). 10ml of stock solution was then diluted to the final volume of 1 litre to obtain a solution containing 1μg I/ml.

b. Working standard

A series of working standard solution containing 25μg I/dl, 20μg I/dl, 15 μg I/dl, 10 μg I/dl, 5 μg I/dl was prepared by the appropriate dilution of the 1 μg I/ml solution.

Principle of the method

Most available method of urinary iodine estimation include either digestion of urine in acid or ashing at high temperature. The basic principle of the urinary iodine estimation is measured by the catalytic action of iodide on the reduction of the ceric ion (Ce^{4+}) to the cerous (Ce^{3+}) coupled to the oxidation of arsenic, As^{3+} to As^{5+}. This reaction is known as the Sandell-Kolthoff reaction.

Reaction :

$$2Ce^{4+} + 2I^{-} \text{ ----------> } 2Ce^{3+} + I_2$$

$$I_2 + As^{3+} \text{ ----------> } As^{5+} + 2I$$

The ceric (Ce^{4+}) has a yellow colour but the cerous (Ce^{3+}) is colourless. The course of the reaction is followed by the disappearance of yellow colour as the ceric ion is reduced. With other reactants held stable speed of this colour disappearance is directly proportional to the amount of iodide catalyzing it. Sulphuric acid and chloride are both important

components of the reaction mixture. Here sulphuric acid increases the speed of the reaction and chloride stabilizes it by inhibiting oxidation of iodide to iodine.

In this procedure digestion of ashing is required to remove other substances, such as nitrate, thiocyanate of ferrous ion that might interfere by reducing or oxidizing the ceric or arsenic reactants.

Procedure in details :

1. At first each urine sample was mixed thoroughly due to the presence of sediment in some samples.
II. Then 200 μl of each urine sample was pipetted out in a cleaned test tube.

   For blank 200 μl of de-ionized water was used. In case of standard 200 μl from different working standards were pipetted out in 5 different test tubes.
III. Then 750 μl of chloric acid solution was added to each tube containing samples, blank, standard were mixed gently.
IV. All the tubes were then heated for 60 minutes in a heating block at 110-115^{0}c in a digestion chamber. During digestion, very little volume was changed.
V. After heating the tubes, they were cooled at room temperature.
VI. To each tube 3.5ml of arsenious acid was then added, mixed and stand for 15 minutes.
VII. To each tube 350 μl ceric ammonium sulphate solution was added with constant interval of 30 seconds between the addition in each tube.
VIII. Exactly 20 minutes after the addition of ceric ammonium sulphate to the first tube, the reading of it's absorbance was taken at 405nm in a

spectrophotometer. Zero absorbance was adjusted with de-ionized water. The reading of the rest of the tubes were taken at the same interval as that used for the addition of ceric ammonium sulphate (here used 30 seconds), so that the time between addition of ceric ammonium sulphate and reading was exactly 20 minutes for each tube.

Calculation

A standard curve was constructed by plotting iodine concentration on abscissa and log absorbance on ordinate (Fig. A). The concentration of the unknown was read from the standard curve.

Calculation based on the following equation:

$Y = c - mx.$

where, c = Intersection on x axis by standard curve.

m = slope of the standard curve.

x = log value of sample absorbance.

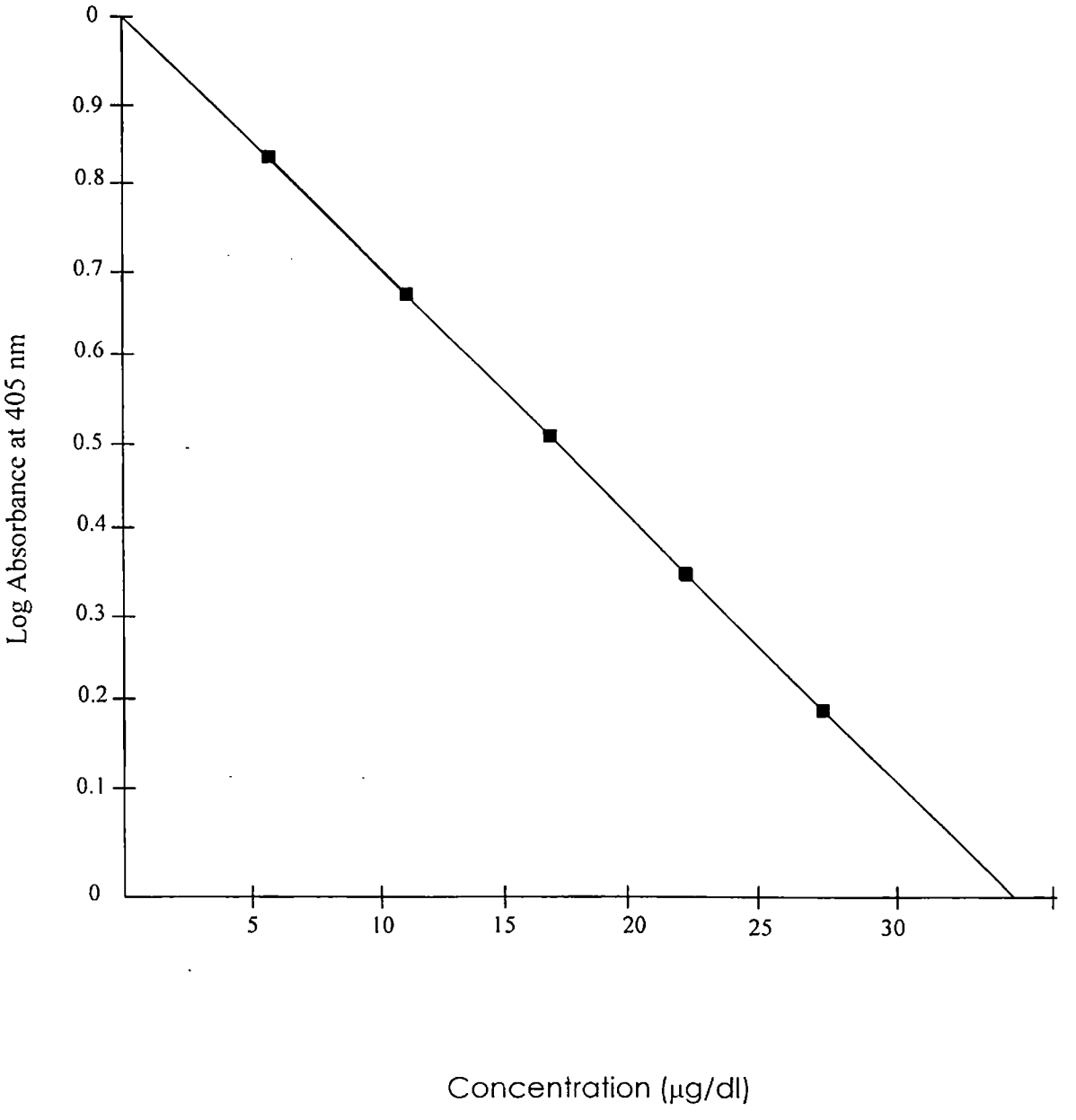


Figure A: Typical standard curve for estimation of urinary iodine.

CHAPTER - THREE

Results

A total of 250 households were included in this study. The study was undertaken to investigate the socio-economic status, knowledge, attitude, practice of food habits, health aspects, nutritional status (PEM), prevalence of anaemia, urinary iodine deficiency and dietary pattern of the households.

3.1 Socio-economic aspects

A total of 305 preschool children aged between 24 months to less than 60 months were studied. In this study age, sex, family size, expenditure on food, educational qualification of the mothers, types of houses, source of drinking water, types of latrine were studied.

Table : 1

Distribution of preschool children according to age and sex. (n = 305)

Age group (months)	Sex of the children		Total	Mean age ± SD
	Male	Female		
24-29 months	25 (48.08%)	27 (51.92%)	52 (17.05%)	
30-34 months	30 (53.57%)	26 (46.43%)	56 (18.36%)	
35-39 months	23 (53.49%)	20 (46.51%)	43 (14.10%)	
40-44 months	22 (50.00%)	22 (50.00%)	44 (14.43%)	39.93 ± 19.02
45-49 months	30 (54.55%)	25 (45.45%)	55 (18.03%)	
50-54 months	20 (66.67%)	10 (33.33%)	30 (9.84%)	
55<60 months	15 (60.00%)	10 (40.00%)	25 (8.19%)	
Total	**165 (54.10%)**	**140 (45.90%)**	**305 (100%)**	

Foot Note: Number in the parenthesis indicate percentage of the preschool children.

Table-1 Shows that among 305 preschool children 54.10% (165) were male and 45.96% (140) were female. Considering the specific age group, highest number (18.36%) of children were in the age group 30-34 months and lowest number (8.19%) of preschool children were in the age group of 55 – < 60 months of age. Mean age of the preschool children was 39.93 ± 19.02.

Table - 2

Distribution of preschool children according to family size. (n = 305)

Family size (member)	Number of preschool children	Percent	Mean ± SD
3 – 4	85	27.87%	
5 – 7	145	47.54%	6.04 ± 2.34
≥ 8	75	24.59%	
Total	**305**	**100.00%**	

Table - 2 Shows that, average family size was 6.04 ± 2.34 persons. Family size of 47.54% households were within 5 to 7 persons and 27.87% families had members within 3 to 4 persons. For 24.59% households, family size was ≥ 8 persons.

Table - 3

Percentage distribution of the parents by their educational level. (N = 250)

Educational Qualification	Father	Mother
Illiterate	38 (15.2%)	47 (18.8%)
Class 1 - V	66 (26.4%)	80 (32.0%)
Class VI - X	71 (28.4%)	73 (29.2%)
S. S. C	39 (15.6%)	33 (13.2%)
H. S. C	18 (7.2%)	11 (4.4%)
Graduate	15 (6.0%)	6 (2.4%)
Masters	3 (1.2%)	0
Total	**250 (100.00%)**	**250 (100.00%)**

Table - 3 Shows that highest percentage of mothers (32.0%) had only primary education level. In each family, fathers had more educational qualification than mothers. 15.2% fathers and 18.8% mothers had no formal education. No mothers found masters degree educational qualification. Only 1.2% fathers had masters degree educational qualification.

Table - 4

Distribution of the respondents and their husbands by occupation.
(N = 250)

Respondents	Respondents occupation		Husbands occupation	
	Number	Percent	Number	Percent
House wife	158	63.2%		
Maid servant	20	8.0%		
Garments worker	25	10.0%		
Driver			18	7.2%
Rickshaw puller			26	10.4%
Small business	22	8.8%	105	42.0%
Other business	10	4.0%	12	4.8%
Service holder	12	4.8%	55	22.0%
Unemployed			22	8.8%
Others	3	1.2%	12	4.8%
Total	**250**	**100.00%**	**250**	**100.00%**

Table - 4 Shows that maximum respondents (63.2%) were house wife and 36.8% were having any type of service holders. Similarly their husbands were doing various jobs. Maximum percentage (42%) of the respondents husbands had small business and more than one fifth (22%) were service holders.

Table - 5

Distribution of the house holds by their monthly income. (N = 250)

Income (Taka per month)	Number	Percent	Mean ± SD (Taka per month)
< 2000	30	12.0%	
2000 – 2999	28	11.2%	
3000 – 3999	52	20.8%	
4000 – 4999	35	14.0%	4431.5 ± 1897.09
5000 – 5999	48	10.2%	
6000 – 6999	42	16.8%	
7000 – 7999	11	4.4%	
> 8000	4	1.6%	
Total	**250**	**100.00%**	

Table - 5 Shows the monthly income of the households. The average household income per month was Tk. 4431.5 ± 1897.09. Monthly income of 20.8% households were within Tk. 3000 – 3999 and 16.8% households earned Tk. 6000 – 6999 per month. Income level of only 12.0% family was less than Tk. 2000 per month.

Table - 6

Distribution of households according to monthly expenditure on food.

Expenditure on food (Taka per Month)	Number	Percent	Mean ± SD (Taka per month)
< 2000	30	12.0%	
2000 – 2999	39	15.6%	
3000 – 3999	51	20.4%	
4000 – 4999	45	18.0%	4187.52 ± 1197.07
5000 – 5999	25	10.0%	
6000 – 6999	43	17.2%	
7000 – 7999	13	5.2%	
> 8000	4	1.6%	
Total	**250**	**100.00%**	

Table - 6 Shows that highest number of households (20.4%) spent Tk. 3000 – 3999 on food per month. 18.0%, 17.2% and 15.6% households spent Tk. 4000 – 4999, Tk. 6000 –6999 and Tk. 2000 – 2999 per month respectively. Expenditure on food for 12.0% households were less than Tk. 2000 per month. Negligible number (1.6%) of households spent more than Tk. 8000 per month on food.

Table - 7

Distribution of children according to supplementation. (n = 305)

Supplementary food given	Number	Percent
Yes	162	53.11%
No	123	40.33%
Sometimes	20	6.56%
Total	**305**	**100.00%**

Table - 7 Shows that more than half (53.11%) of the preschool children had supplementary food and 40.33% had not supplementary food at all. The rest (6.56%) were having supplementary food occasionally.

Table - 8

Percent distribution of respondents who could afford three good meals.

(N=250)

	Number	Percent	Total
Yes	182	72.8%	
No	23	9.2%	
Difficult	45	18.0%	
	250	**100.00%**	

Table - 8 shows that maximum households (72.8%) can afford three good meals from their monthly income for all the family members. 9.2% households can not afford three good meals of their monthly income and 18.0% households had difficulty in affording their three meals.

Figure : 1

Percentage distribution of the respondents who accepted family planning methods. (N=250)

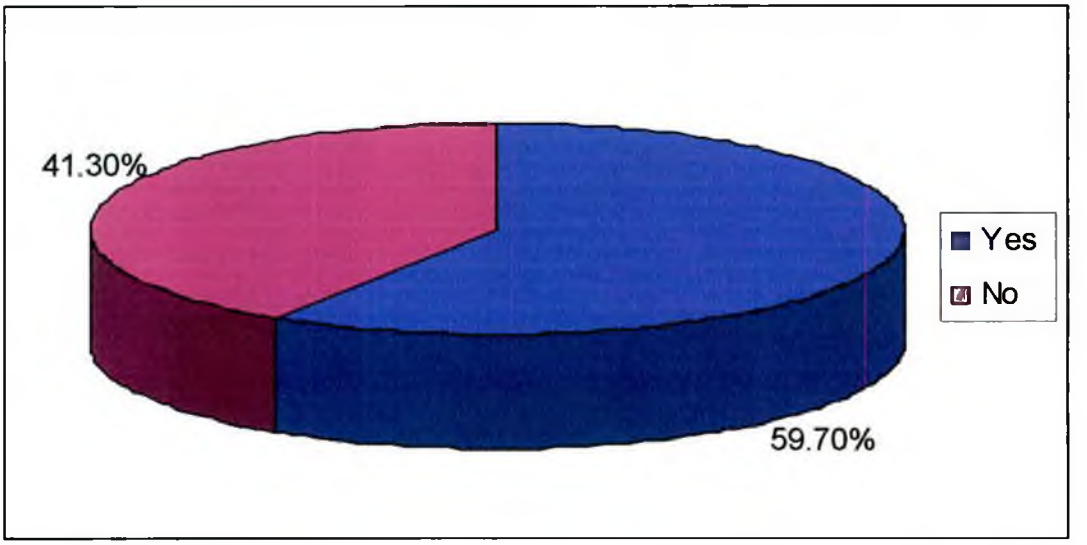


Figure : 1 Shows 59.70% of the respondents practiced family planning methods which reflects the awareness about health and family.

3.2 Knowledge of nutritional aspects

Table - 9

Distribution of the respondents by the number of their admitted preschool children by school attendance (n = 76)

Response	Admitted children at school (n = 76)	Attend school regularly (n=29)	Daughters attend school regularly (n=23)
Yes	58 (76.32%)	25 (86.21%)	21 (91.30%)
No	18(23.68%)	4 (13.79%)	2 (8.70%)
Total	**100.00%**	**100.00%**	**100.00%**

Table - 9 Shows that, more than three fourth percent (76.32%) preschool children (n = 76) were admitted at school. About 86.21% of that admitted children were regularly going to school and rest of (13.79%) were not regularly going to school. Among the students 91.30% were female children.

Table - 10

Percentage distribution of the respondents by nutritional knowledge about food. (N = 250)

Food staff	Percent			Total
	Correct	Incorrect	Don't know	
Energy giving food	79(31.6%)	16 (6.4%)	155 (62.0%)	100.00
Growth and body building food.	30 (12.0%)	45 (18.0%)	175 (70.0%)	100.00
Protective food	18 (7.2%)	39 (15.6%)	193 (77.2%)	100.00
Wheather vitamins found in abundance in vegetables	35 (14.0%)	87 (34.8%)	128 (51.2%)	100.00

Table - 10 Shows the nutritional knowledge of foods of the respondents. The concept of respondents were very well about energy giving food (31.6%). 34.8% of the respondents gave incorrect answer about vitamins. More than three fourth respondents (77.2%) had no knowledge about protective food.

Table - 11

Percentage distribution of the respondents by knowledge about health and sanitation. (N = 250)

Knowledge on	Percent			Total
	Correct	Incorrect	Don't know	
Proper birth weight	54 (21.6%)	107 (42.8%)	89 (35.6%)	100.00
Exclusive breast feeding	138 (55.2%)	87 (34.8%)	25 (10.0%)	100.00
Sanitary latrine	230 (92.0%)	18 (7.2%)	2 (0.8%)	100.00

Table - 11 Shows that only 21.6% of the respondents knew about the proper birth weight of their children. The majority respondents (92.0%) knew about hygienic sanitary latrine. More than half percent (55.2%) respondents knew the exclusive breast feeding.

Table - 12

Percentage distribution of the respondents by knowledge of deficient nutrients of preschool children. (N = 250)

Nutrients	Percent			Total
	Correct	Incorrect	Don't know	
Protein	58 (23.2%)	109 (43.6%)	83 (33.2%)	100.00
Vitamins	86 (34.4%)	133 (53.2%)	31 (12.4%)	100.00
Iodine	42 (16.8%)	77 (30.8%)	131 (52.4%)	100.00
Iron	128 (52.2%)	68 (27.2%)	54 (21.6%)	100.00

Table - 12 Shows that more than fifty percent (52.4%) respondents did not know about Iodine. 34.4% had conception on vitamins. More than fifty percent (52.2%) knew about Iron. Few respondents knew about protein (23.2%) and Iodine (16.8%)

Table - 13

Percentage distribution of the respondents by knowledge about taking of Tetanus Toxoid (Inj. T.T). (N = 250)

Respondents opinion	Knowledge (N = 250)		Practice (N = 205)	
	Number	Percent	TT taken (N = 190)	TT not taken (N = 15)
Yes	228	91.2%	92.68%	7.32%
No	22	8.8%	NA	NA
Total	**250**	**100.00%**		

Table - 13 Shows that about 91.2% respondents knew about Tetanus Toxoid doses. Among this percentage, 92.68% had taken this doses during their pregnancy.

Table - 14

Percentage distribution of the respondents by knowledge about Oral Polio Vaccine of their children. (N = 250)

Respondents opinion	Knowledge (N = 250)		Practice (N = 220)	
	Number	Percent	Vaccinized (N = 192)	Not Vaccinized (N = 28)
Yes	220	88.0%	87.27%	12.73%
No	30	12.0%	NA	NA
Total	**250**	**100.00%**		

Table - 14 Shows that 88.0% respondents knew about Oral Polio Vaccine for their children. Among this percentage, 87.27% had taken Oral Polio Vaccine for their children.

Table - 15

Percentage distribution of the respondents by knowledge of their children when suffer from diseases . (N = 250)

Response	Knowledge						
	No.	Percent	Hospital	Private doctor	Homeopath	Kobiraj	Religious leader
Yes	247	98.8%	161(65.18)	50(20.24)	29(11.74)	04(1.62)	03(1.21%)
No	03	1.2%	NA	NA	NA	NA	NA
	250	**100.00%**					

Foot Note: Number in the parenthesis indicate percentage of the respondents.

Table - 15 show that 98.8% respondents attended various places when their preschool children suffer from diseases. From which highest number (65.18%) attended at hospitals, 20.24% attended private doctors, 11.74% homeopath, 1.62% Kobiraj and only 1.21% attended a religious leader. Only 1.2% attendants did not go any places for their preschool children as they could give medicine at the time of illness.

3.3 Attitude on nutritional aspects

Table - 16

Percentage distribution of the respondents attitude on breast feeding to the child up to 2 years regularly. (N = 250)

Attitude	Number	Percent	Up to 2 years regularly	
			Yes (%)	No (%)
Yes	239	95.6%	196 (78.4%)	54 (21.6%)
No	11	4.4%	NA	NA
Total	**250**	**100.00%**		

Table - 16 Revealed that 95.6% of the respondents showed positive attitude on breast feeding to the child up to 2 years. In this percentage, 78.4% of the respondents breast fed up to 2 years regularly.

Table - 17

Percentage distribution of the respondents attitude about immunization pattern regarding 6 infectious diseases. (N = 250)

Attitude on immunization	Number	Percent	Immunized their child	
			Complete(%)	Incomplete(%)
Yes	212	84.8%	145(68.4%)	67(31.6%)
No	38	15.2%	NA	NA
Total	**250**	**100.00%**		

Foot Note: Number in the parenthesis indicate percentage of the respondents.

Table-17 Shows that majority of the respondents (84.8%) knew about 6 infectious diseases. More than two third (68.4%) of the respondents completed vaccination or immunization of their children properly. But about one third did not complete it.

Figure : 3

Percentage distribution of the respondents attitudes about accurate weight of their preschool childreen. (N=250)

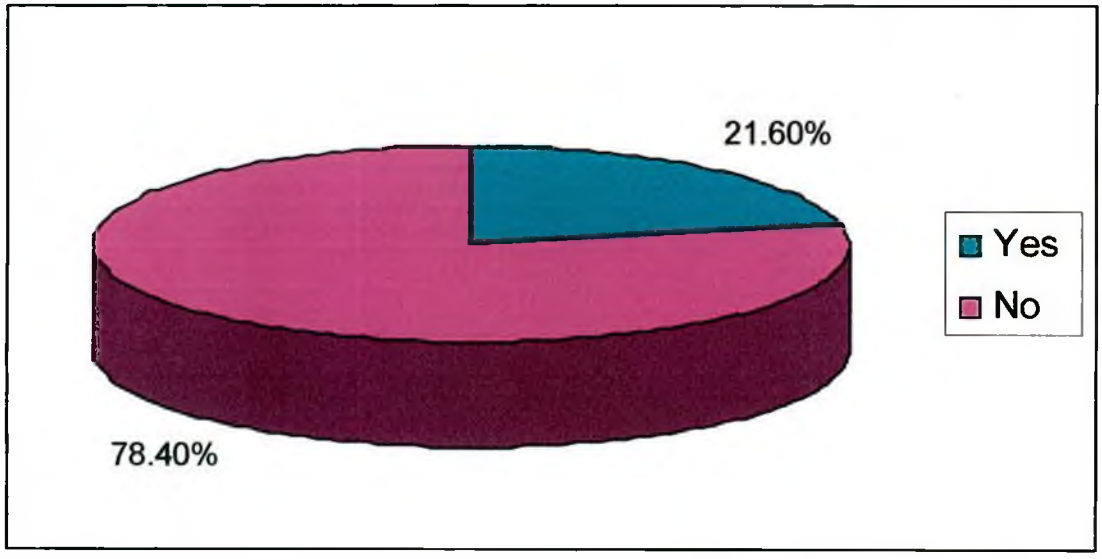


Figure : 3 Shows 78.4% respondents did not know the accurate weight of their preschool children.

Figure : 4

Percentage distribution of the respondents practice of covering vegetables while cooking. (N=250)

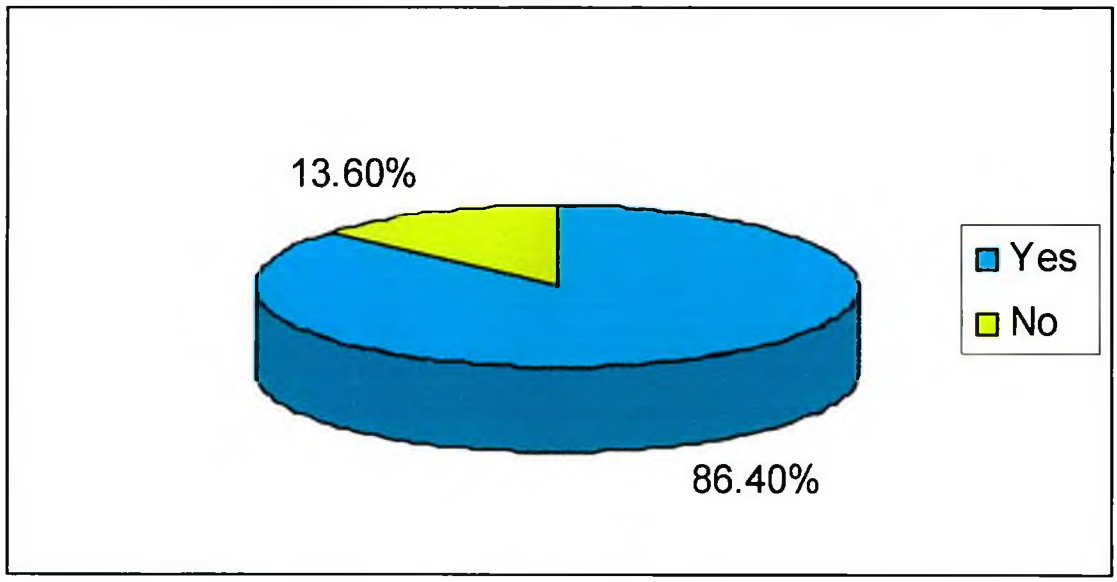


Figure : 4 Shows almost all respondents (86.40%) opined that vegetables should be covered while cooking.

3.4 Practice on nutritional aspects

Table - 18

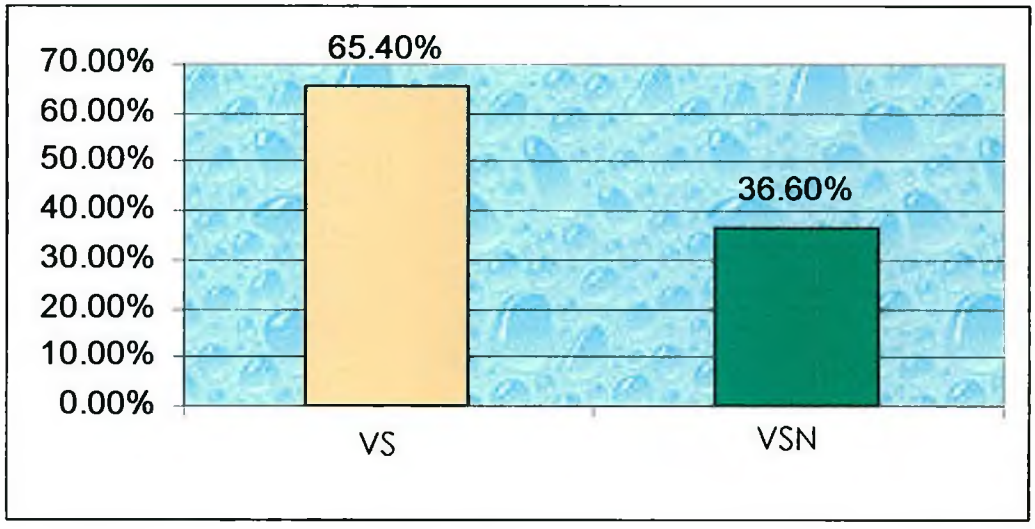
Percentage distribution of the respondents practice on discursion of water after boiling rice and cooking vegetables. (N = 250)

Practice	Discursion of water			
	Boiling rice		Cooking vegetables	
	Number	Percent	Number	Percent
Yes	192	76.8%	22	8.8%
No	58	23.2%	228	91.2%
Total	**250**	**100.00%**	**250**	**100.00%**

Table - 18 shows that more than three fourth respondents opined that water should be discarded after boiling rice. On the other hand, 91.2% respondents opined that water should not be discarded after cooking vegetables.

Figure : 5

Percentage distribution of the respondents practice of cooking vegetables into pieces before washing. (N=250)



VS = Vegetables should wash after cutting into pieces.
VSN = Vegetables should not wash after cutting into pieces.

Figure : 5 Shows 65.40% respondents washed vegetables after cutting into pieces.

Figure : 6

Percentage distribution of the respondents practice about source of drinking water. (N=250)

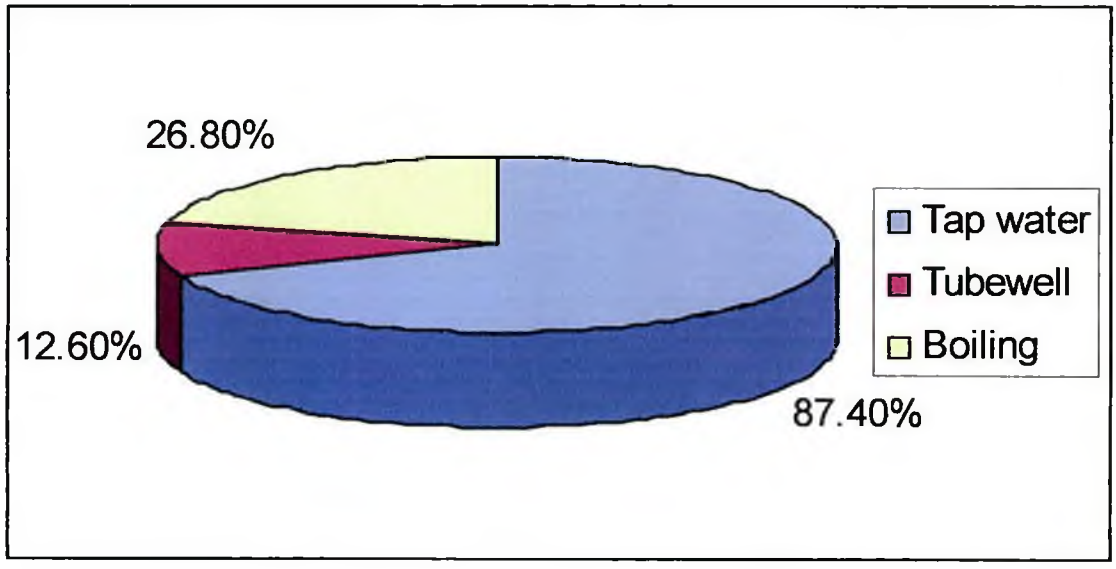
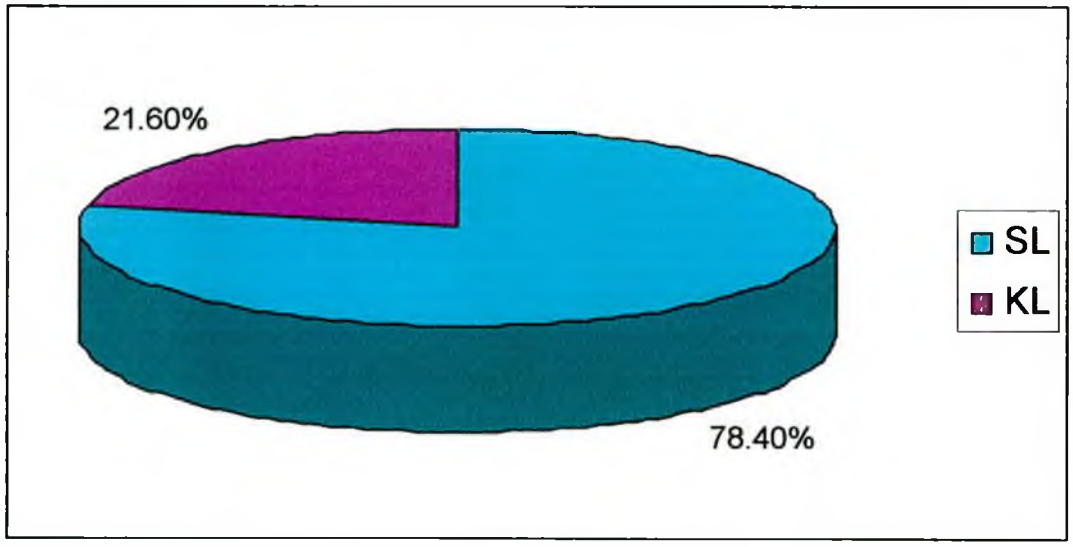


Figure : 6 Shows that 87.40% respondents used tap water for their drinking purpose. Only 12.60% used tubewell water and 26.80% households used drinking water after boiling.

Figure : 7

Percentage distribution of the respondents practice about type of toilet. (N=250)

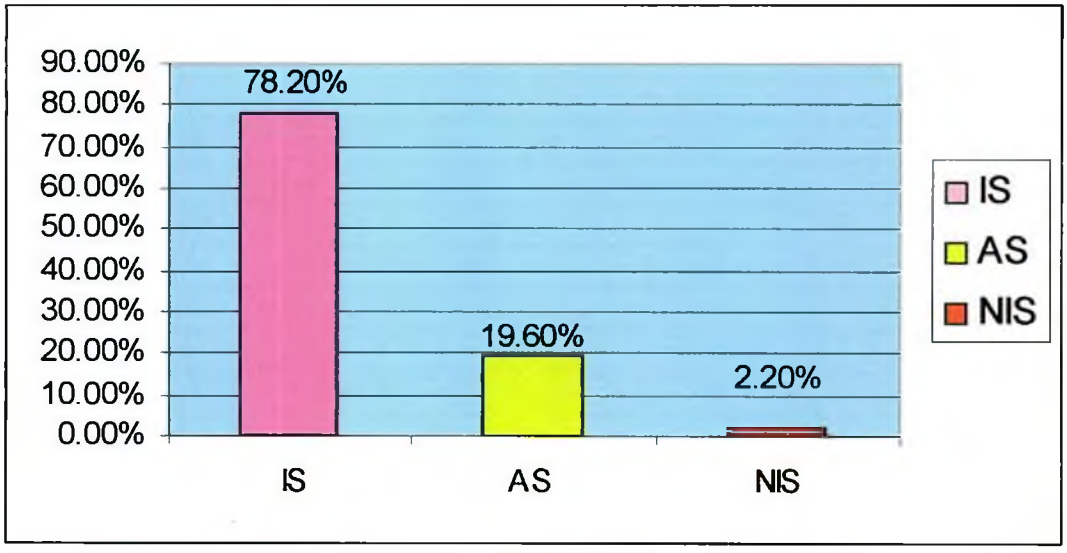


SL = Sanitary Latrine
KL = Kaccha Latrine

Figure : 7 Shows that only 21.60% households used kaccha latrine.

Figure : 8

Percentage distribution of the households practice of using type of salt during cooking. (N=250)



IS = Iodized Salt
AS = Any Salt
NIS = Non Iodized Salt

Figure : 8 Shows that only 2.20% households used non iodized salt and 19.60% households used any salt during cooking.

Figure : 9

Percentage distribution of the households practice of using oil for cooking vegetables. (N=250)

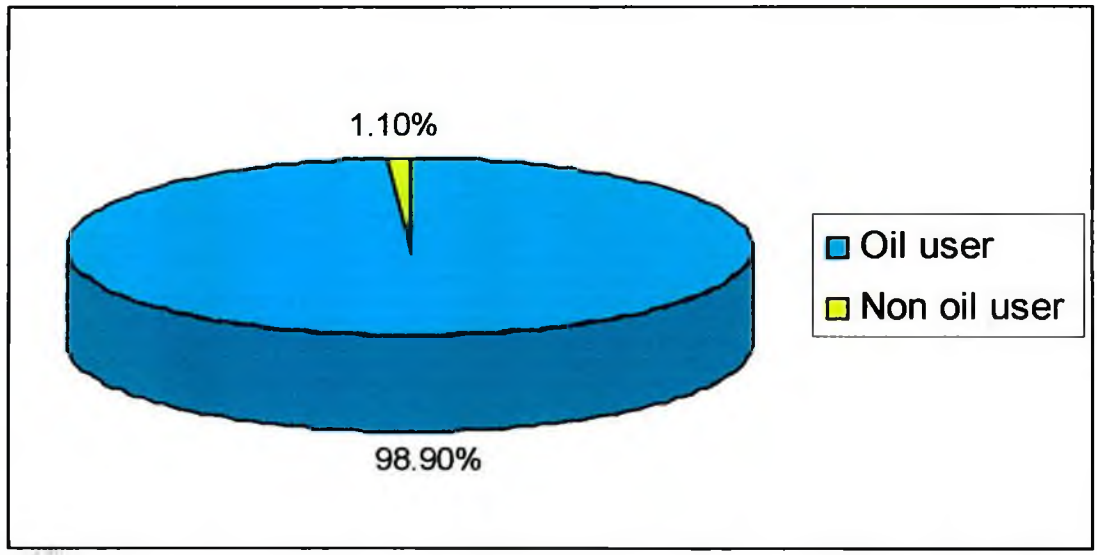


Figure : 9 Shows that 98.90% households cooked vegetables by using oil, which reflects positive behaviour.

Figure : 10

Major diseases of the preschool children.

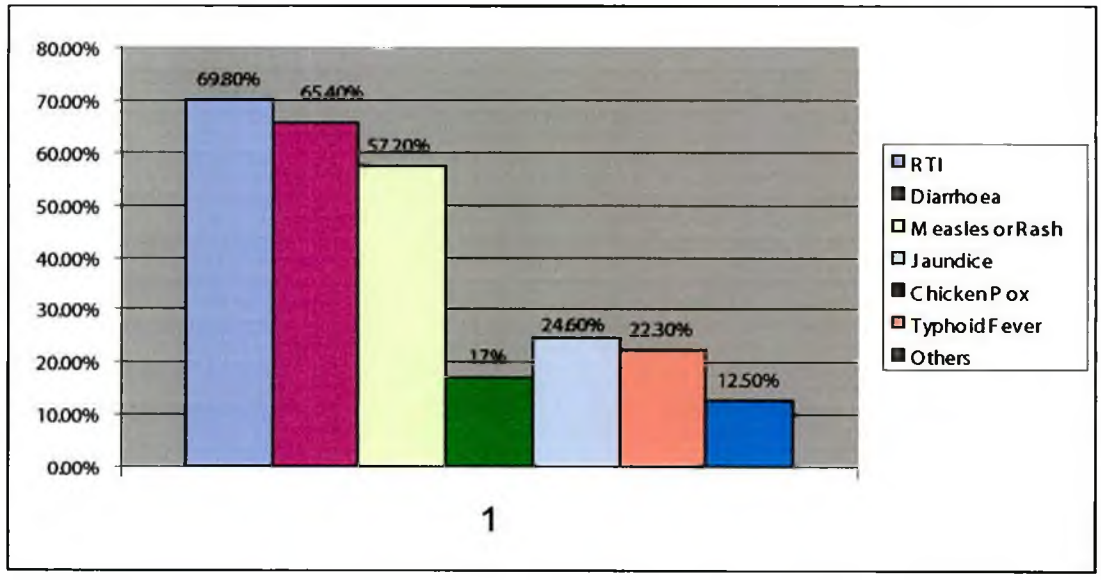


Figure : 10 Shows the different major diseases that occurred in preschool children in their life time. Amongst the total population 69.80% suffered from various types of respiratory tract infections, 65.40% suffered from diarrhoea, 57.20% suffered from measles or rash. Only 12.50% preschool children suffered from other major diseases where life threatening dengue fever involved.

3.5 Antropometric measurements

Table - 19

Anthropometric measurements of the preschool children by age and sex. (n = 305)

Age (month)	Number	Weight (kg)		Length / height (cm)		Mid Upper Arm Circumference (MUAC) (cm)	
		Mean	±SD	Mean	±SD	Mean	±SD
Male (n = 165)							
24 - 29	25	9.9	± 1.3	84.2	± 5.6	14.4	± 1.3
30 - 34	30	10.8	± 1.7	86.8	± 3.8	14.6	± 0.8
35 - 39	23	12.5	± 1.5	95.6	± 4.1	14.6	± 1.0
40 - 44	22	13.7	± 1.2	99.4	± 4.5	14.7	± 0.9
45 - 49	30	14.3	± 1.4	100.7	± 7.2	14.8	± 1.1
50 - 54	20	14.8	± 1.2	101.5	± 4.6	14.9	± 1.3
55 - <60	15	15.4	± 1.0	102.2	± 1.2	15	± 1.2
Female (n = 140)							
24 - 29	27	9.6	± 1.4	84.0	± 5.7	14.5	± 0.7
30 - 34	26	9.9	± 1.5	86.1	± 5.3	14.6	± 0.9
35 - 39	20	10.1	± 1.4	95.3	± 3.6	14.6	± 1.3
40 - 44	22	12.4	± 1.5	99.2	± 6.0	14.7	± 1.0
45 - 49	25	13.3	± 1.3	100.4	± 5.4	14.8	± 1.4
50 - 54	10	14.2	± 1.4	101.2	± 5.2	14.8	± 1.2
55 - <60	10	14.6	± 1.6	101.9	± 5.1	15.0	± 1.4

Table - 19 Shows the mean weight, height and MUAC of the preschool children by different age group. Mean weight, height and MUAC for male children were 13.06 kg (±1.33), 95.77 cm (±4.43) and 14.71 cm (±1.09). For female children, the mean value of weight, height and MUAC were 12.01 kg (± 1.24), 95.44 cm (± 5.19), 14.71 cm (±1.13) respectively. It has been observed from this table that, the mean value of weight and height increases with age. Mean value of weight and height of male children were greater than those of female children.

Table - 20

Percentage distribution of preschool children by nutritional status by height for age (Z-score categories) according to age group. (n = 305)

Age (Month)	Height for age (Z-score)		Total
	-2SD and below	Above -2SD	
24 - 29	28 (53.8%)	24 (46.2%)	52 (100.00)
30 - 34	30 (53.6%)	26 (46.4%)	56 (100.00)
35 - 39	25 (58.1%)	18 (41.9%)	43 (100.00)
40 - 44	30 (68.2%)	14 (31.8%)	44 (100.00)
45 - 49	32 (58.2%)	23 (41.8%)	55 (100.00)
50 - 54	19 (63.3%)	11 (36.7%)	30 (100.00)
55 - <60	16 (64.0%)	9 (36.0%)	25 (100.00)
Total	**180 (59.0%)**	**125 (41.0%)**	**305 (100.00)**

Foot Note: Number in the parenthesis indicate percentage of the children.

Table - 20 Shows the growth achievement (H/A) of the preschool children. It shows that, more than half (59%) were stunted (below - 2SD). The rate of stunting (<-2SD) was highest (68.2%) in the age group of 40 – 44 months.

Table - 21

Percentage distribution of preschool children by nutritional status by weight for age (Z-score categories) according to age group. (n=305)

Age (Month)	Weight for age (Z-score)		Total
	–2SD and below	Above –2SD	
24 - 29	38 (71.7%)	15 (28.3%)	53 (100.00)
30 - 34	28 (75.7%)	9 (24.3%)	37 (100.00)
35 - 39	23 (52.3%)	21 (47.7%)	44 (100.00)
40 - 44	21 (53.8%)	18 (46.2%)	39 (100.00)
45 - 49	20 (64.5%)	11 (35.5%)	31 (100.00)
50 - 54	35 (74.5%)	12 (25.5%)	47 (100.00)
55 - <60	40 (74.1%)	14 (25.9%)	54 (100.00)
Total	**205 (67.2%)**	**100 (32.8%)**	**305 (100.00)**

Foot Note: Number in the parenthesis indicate percentage of the children.

Table - 21 Represents the growth performance (under weight) of the preschool children using the indicator weight for age (W/A). It shows that about 67% of the preschool children were under weight (<-2SD). The highest (75.7%) of under weight preschool children were in the age group of 30-34 months.

Table-22

Percentage distribution of preschool children by nutritional status by weight for height (Z-score categories) according to age group.

Age (Month)	Weight for height (Z-score)		Total
	–2SD and below	Above –2SD	
24 - 29	8 (19.0%)	34 (81.0%)	42 (100.00)
30 - 34	5 (15.2%)	28 (84.8%)	33 (100.00)
35 - 39	7 (15.9%)	37 (84.1%)	44 (100.00)
40 - 44	7 (21.9%)	25 (78.1%)	32 (100.00)
45 - 49	6 (18.7%)	26 (81.3%)	32 (100.00)
50 - 54	11 (23.9%)	35 (76.1%)	46 (100.00)
55 - <60	13 (17.1%)	63 (82.9%)	76 (100.00)
Total	**57 (18.7%)**	**248 (81.3%)**	**305 (100.00)**

Foot Note: Number in the parenthesis indicate percentage of the children.

Table - 22 Shows the distribution of preschool children's weight for height using the indicator W/H (Z-score) according to age group. Almost all children (81.3%) were not wasted. Less than one fifth (18.7%) were wasted. The highest wasted range were in the age group of 50 – 54 months.

Table - 23

Percentage distribution of preschool children by different categories of MUAC. (n = 305)

MUAC (cm)	Number	Percent	Nutritional status
< 12.5 cm (severe)	14	4.6%	Malnourished
12.5 – 13.4 cm (Moderate)	43	14.1%	Border line
≥ 13.5 cm (Normal)	248	81.3%	Normal
Total	**305**	**100.00%**	

Table - 23 Shows the distribution of preschool children by different ranges of MUAC. 81.3% were normal (≥13.5 cm), 4.6% were severely malnourished (<12.5 cm) and 14.1% were border line malnourished (12.5 – 13.4 cm)

3.6 Interrelationship between nutritional status and other variables

Table - 24

Prevalence of malnutrition (growth retardation) according to age group.

(n = 305)

Age (month)	Number of preschool children	Wasting (W/H)	Underweight (W/A)	Stunting (H/A)
24 - 29	52	19.0 (8)	71.7 (38)	53.8 (28)
30 - 34	56	15.2 (5)	75.7 (28)	53.6 (30)
35 - 39	43	15.7 (7)	52.3 (23)	58.1 (25)
40 - 44	44	21.9 (7)	53.8 (21)	68.2 (30)
45 - 49	55	18.7 (6)	64.5 (20)	58.2 (32)
50 - 54	30	23.9 (11)	74.5 (35)	63.3 (19)
55 - <60	25	17.1 (13)	74.1 (40)	64.0 (16)
Total	**305**	**18.7 (57)**	**67.2 (205)**	**59.0 (180)**

Foot Note: Number of the parenthesis indicate the number of preschool children.

Table - 24 Shows the prevalence of malnutrition (growth retardation) by using different anthropometric indicators. Among all the preschool children, highest proportion of children (67.2%) were found to be malnourished (underweight) using W/A indicator. Among all the subjects, prevalence of wasting and stunting were 18.7% and 59.0% respectively. Age group 50–54 months shows highest wasting (23.9%), age group 30 – 34 months shows highest underweight (75.7%) and age group 55– <60 months shows highest stunting (64.0%).

Table - 25

Distribution of preschool children according to weight for age (Gomez classification). (n = 305)

Age (month)	Weight for age (%)			
	Normal (>90%)	Mild (89–75%)	Moderate (74–60%)	Severe (<60%)
24 – 29	4 (12.5%)	9 (28.12%)	17 (53.13%)	2 (6.25%)
30 – 34	5 (9.09%)	21 (38.18%)	24 (43.64%)	5 (9.09%)
35 – 39	4 (9.76%)	18 (43.90%)	15 (36.58%)	4 (9.76%)
40 – 44	6 (10.34%)	28 (48.28%)	22 (37.93%)	2 (3.45%)
45 – 49	3 (5.66%)	23 (43.40%	24 (45.28%)	3 (5.66%)
50 – 54	4 (10.53%)	15 (39.47%)	17 (44.74%)	2 (5.26%)
55 – < 60	3 (10.71%)	4 (28.57%)	16 (57.14%)	1 (3.57%)
Total	**29 (9.51%)**	**122 (40.00%)**	**135 (44.26%)**	**19 (6.23%)**

Foot Note: Number in the parenthesis indicate the percentage of pre-school children.

Table - 25 Shows that according to Gomez classification maximum malnourished preschool children (44.26%) were found at the moderate group. Only 6.23% were severely malnourished and 9.51% were found to be normal group.

Table - 26

Percentage distribution of the respondents occupation and their preschool children's nutritional status. (N = 250)

Respondents occupation	H/A (Z-score)		W/A (Z-score)		W/H (Z-score)	
	-2SD & below (%)	Above -2SD (%)	-2SD & below (%)	Above -2SD (%)	-2SD & below (%)	Above -2SD (%)
Working mother	74 (52.11%)	68 (47.89%)	47 (40.87%)	68 (59.13%)	34 (23.94%)	108 (76.06%)
Non working mother	84 (62.22%)	51 (37.78%)	83 (60.14%)	55 (39.86%)	99 (73.33%)	36 (26.67%)

Foot Note : Number in the parenthesis indicate the percentage of the preschool children.

Table - 26 Shows that preschool children of the working mothers had well nutritional status than those of the non working mothers.

Table - 27

Distribution of the monthly total income of the households and their preschool childrens nutritional status. (n = 305)

Monthly total income (Tk.)	H/A (Z-score)		W/A (Z-score)		W/H (Z-score)	
	-2SD & below (%)	Above -2SD (%)	-2SD & below (%)	Above -2SD (%)	-2SD & below (%)	Above -2SD (%)
< 2000	13 (59.09)	9 (40.91)	17 (58.63)	12 (41.38)	14 (43.75)	18 (56.25)
2000 – 2999	32 (61.54)	20 (38.46)	36 (66.67)	18 (33.33)	13 (18.84)	56 (81.16)
3000 – 3999	26 (40.63)	38 (59.37)	33 (42.31)	45 (57.69)	18 (27.27)	48 (72.73)
4000 – 4999	23 (45.10)	28 (54.90)	19 (33.93)	37 (66.07)	21 (40.38)	31 (59.62)
5000 – 5999	47 (61.84)	29 (38.16)	28 (44.44)	35 (55.56)	22 (31.43)	48 (68.57)
6000 – 6999	22 (32.35)	46 (67.65)	30 (40.00)	45 (60.00)	15 (36.59)	26 (63.41)
7000 – 7999	13 (18.31)	58 (81.69)	16 (27.12)	43 (72.88)	9 (18.00)	41 (82.00)
>8000	8 (28.57)	20 (71.43)	15 (34.88)	28 (65.12)	37 (54.41)	31 (45.59)

Foot Note : Number in the parenthesis indicate the percentage of preschool children.

Table - 27 shows that those households who earned Tk. 7000 – 7999, their children were well nourished according to H/A (81.69%), W/A (72.88%) and W/H (82.00%).

Table - 28

Percentage distribution of the respondents educational background by their preschool childrens nutritional status.

Mothers education	H/A (Z-score)		W/A (Z-score)		W/H (Z-score)	
	–2SD & below (%)	Above –2SD (%)	–2SD & below (%)	Above –2SD (%)	–2SD & below (%)	Above –2SD (%)
Illiterate	87 (60.84%)	56 (39.16%)	108 (62.43%)	65 (37.57%)	46 (24.47%)	142 (75.53%)
Literate	18 (32.14%)	38 (67.86%)	23 (30.26%)	53 (69.74%)	26 (42.62%)	35 (57.38%)

Foot Note : Number in the parenthesis indicate the percentage of preschool children.

Table - 28 Shows that comparatively preschool children of literate mothers were well nourished than the illiterate mothers.

Table - 29

Percentage distribution of the respondents educational background by their childrens nutritional status.

Mothers education	H/A (Z-score)		W/A (Z-score)		W/H (Z-score)	
	-2SD and Below %	Above –2SD %	-2SD and Below %	Above –2SD %	-2SD and Below %	Above –2SD %
Illiterate	47.03(111)	52.97(125)	63.21(177)	36.79(103)	24.14(63)	75.86(198)
Literate	34.25(25)	65.75(48)	44.83(13)	55.17(16)	20.83(10)	79.17(38)

Foot note: (Number in the parenthesis indicates the number of preschool children)

Table - 29 shows that comparatively literate mothers preschool children were well nourished than that of illiterate mothers.

3.7 Laboratory examinations (Biochemical and stool examination)

Table - 30

Prevalence of anaemia and mean haemoglobin level of the preschool children according to age group. (n = 192)

Age group (month)	Number of preschool children	Hb level (g/dl)		Prevalence of anaemia
		Mean	± SD	
24 – 29	52	10.95	1.43	35 (67.31%)
30 – 34	40	10.68	1.83	28 (70.00%)
35 –39	33	10.14	1.97	27 (81.82%)
40 – 44	24	10.04	1.98	18 (75.00%)
45 – 49	25	11.23	1.70	17 (68.00%)
50 – 54	13	11.82	1.63	9 (69.23%)
55 – < 60	5	11.35	1.94	3 (60.00%)
Total	**192**	**10.29**	**1.78**	**137 (71.35%)**

Foot Note: Number in the parenthesis indicate percentage of the preschool children.

Table-30 Represents the prevalence of anaemia and mean haemoglobin level. Among the total (n=192) blood collected preschool children, 71.35% were anaemic (<11 gm/dl). Mean haemoglobin level of all the children were 10.29 gm/dl (± 1.78). The most affected age group was the children of 35 – 39 month with a high prevalence rate (81.82%) of anaemia.

Table - 31

Percentage distribution of the worm infestation among preschool children.

(n = 208)

Worm infestation	Number	Percent
+ve	148	71.15%
–ve	60	28.85%
Total	**208**	**100.00%**

Table - 31 shows that considerable number of preschool children (71.15%) were worm +ve, which indicate that most of the families were not conscious about the hygienic behaviour of their children.

Table - 32

Percentage distribution of the preschool children by urinary iodine level (cut of point < 10 μg/dL). (n = 163)

Iodine	Number	Percent
Deficient	36	22.1%
Normal	127	77.9%
Total	**163**	**100.00%**

Table - 32 shows that only 22.1% of the preschool children were suffering form iodine deficiency.

Table - 33

Percentage distribution of the preschool children in relation to urinary iodine level and stunting. (n = 163)

	Height for age (stunting)	
	–2SD & below (stunting)	**Above –2SD (Not stunting)**
Deficient	29(17.79%)	24(14.72%)
Normal	8(4.91%)	102 (62.58%)

Foot Note : Number in the parenthesis indicate percentage of preschool children.

Table - 33 Reflects the relation between iodine level and stunting of preschool children. This table shows that height is dependent on iodine level. 62.58% of the preschool children could be classified as normal i.e. not stunted. Only 17.79% preschool children were both iodine deficient and stunted.

CHAPTER - FOUR

DISCUSSION

The present study represents the nutritional status of preschool children in two densely populated areas of Dhaka city, along with anaemia, worm infestation and iodine deficiency and even more investigations were made into their dietary pattern, morbidity, general awareness of health and nutrition etc. It has been reported in several nutritional surveys conducted in Bangladesh, malnutrition is one of the major public health problems in Bangladesh, as elsewhere in the developing world. Prevalence of protein energy malnutrition (PEM), anaemia, iodine deficiency, worm infestations are quite alarming amongst the children who belong to the lower socio-economic status and overcrowding environment. Under 5 mortality rate is 89/1000 live birth due to different causes including malnutrition[8]. Thus keeping in view of this alarming situation in my present study it was sought to investigate the anthropometric measurements of preschool children. They were also looked into their worm infestation, haemoglobin and urinary iodine. Since iodine has been reported to have mental growth promoting activity.

The study was a community based cross sectional study conducted on 305 preschool children of whom 165 were male and 140 were female children. Among the 305 preschool children there were 250 mothers who were the respondents. Mothers educational level was lower with 32.0% being class I-V level, 29.2% class VI – X and 18.8% being illiterate (Table-3). Family income was below Tk. 4000 per month for majority (20.8%) and less than Tk. 2000 for 12.0% of the parents (Table-5). Family members were within more than six persons in average (Table-2). Majority (63.2%) of the respondents were housewife (Table 4).

It was found that 59.7% families practiced family planning and they were more educated than others. The low income group of the households did not practice family planning method properly and their family size was high and they face very much difficult to maintain their family. The highest number of households (20.4%) spent Tk. 3000–3999 per month on food and their mean expenditure on food was Tk. 4187.52 (± 1197.07) per month (Table-6). Due to limited expenditure on food it was very difficult to provide nutritious or balanced food to the family members, specially to the children. Most of the households (62.5%) lived in brick building with old model and dam condition (Fig. 2). Majority of the respondents used tap water (87.40%) which was unhygienic and 73.2% households used to drink unboiled drinking water (Fig. 6) and such socio-demographic evidence provide enough reasons to consider that this study subjects belong to low socio-economic and overcrowded status. This study also reveals the knowledge, attitude and practices of dietary pattern, health, sanitation and immunization of the preschool children. Their nutritional knowledge was low.

In this study the mean height, weight and mid upper arm circumference were found to be 95.77 cm (± 4.43), 13.06 kg (± 1.33), and 14.71 cm (±1.09) respectively for male children (Table-19). In Child Nutrition Survey (BBS, 1997) the mean values of height, weight and mid upper arm circumference of the of the under 5 children were found to be 86.67 cm (± 12.25), 11.15 kg (± 2.8) and 13.91 cm (± 1.2) respectively. Again in Nutrition Survey of Bangladesh[9], the mean values of height, weight and MUAC were found to be 86.11 cm (±12.27), 11.15 kg (± 2.9) and 13.97 cm (± 1.3) respectively. Mean anthropometric values of present study are higher than the values reported in Child Nutrition Survey[9] and Nutrition Survey of Bangladesh[2]. In another study conducted by Helen Keller

International (HKI 1985), there were 10.0% severely malnourished children measured by MUAC indicator[34].

Prevalence of wasting (W/H), underweight (W/A) and stunting (H/A) among the preschool children were 18.7%, 67.2% and 59.0% respectively (Table-22,21,20). Highest prevalence of wasting was observed among the preschool children of age group 50–54 months (23.9%). On the other hand prevalence of underweight was highest in the age group of 30 – 34 months (75.7%) and highest stunting was in the age group of 40–44 months (68.2%). So, this figure is also in agreement with the previous studies in Bangladesh which also have shown that malnutrition is highly prevalent among children during first 2 years to onwards of live[35,36,37]. In Ethiopia, it was found that a high prevalence of stunting (24.5%) and wasting (18.4%) amongst preschool children[91].

Thus, in this study, 67.00% were under weight (W/A) as against 57.4% reported in Child Nutrition Survey of Bangladesh[9]. Total prevalence of stunting (H/A) is slightly less (59.00%) as compared to the rate (60.4%) reported in Nutrition Survey of Bangladesh[18]. At the same time prevalence of wasting (18.7%) is also higher than that of reported previous survey[18]. Child Nutrition Surveys by BBS[9,33] also reported that the percentage of severely malnourished children measured by MUAC indicator were 14.1% and 10.7% respectively.

The present study reveals that, 4.6% preschool children were severely malnourished as measured by MUAC indicator (Table-23). In Last Child Nutrition Survey by (BBS, 1997)[9], the percentage of severely malnourished children as measured by MUAC indicator was 9.8% for Bangladesh. Child Nutrition Surveys also reported that the percentage of

severely malnourished children measured by MUAC indicator were 14.1% and 10.7 respectively.

This study also reveals that 68.4% preschool children were immunized regarding 6 infectious diseases completely (Table-17). Another study found 66% children completed immunization properly[38]. In Child Nutrition Survey of Bangladesh, 1995–96 (BBS, December, 1997) shows that 76.7% children were immunized[9]. In this study, the rate of immunization was lower than BBS, 1997. This study shows that only 26.8% households used safe drinking water i.e. after boiling (Figure-6). Drinking water is a risk factor for infectious diseases.

In another study in India, Rahmathullah et al. demonstrated that using Z-score classification, 72% of their study children were malnourished[39]. Approximately 31% of the children were stunted, 18% were both stunted and wasted and 23% were only wasted. Thus, stunting affected a somewhat larger proportion of the children than wasting, indicating that prolonged malnutrition was more common than acute under nutrition among the study children. In Zaire, Donner in 1996 also reported that stunting (66.4%) accounted for more of the under nutrition (58.5%) than wasting (12.1%)[40]. In agreement with those previous findings, prevalence of stunting (59%) in my study is higher than that of wasting (18.7%). It is to be noted that prevalence of underweight in my study is higher than stunting.

This study reveals that, prevalence of malnutrition by taking weight for age (W/A) indicator, 32.8% of the preschool children were considered as normal (Table-21). Whereas this figure has been reported to be 42.6% by BBS, 1997. Total prevalence rate of stunting (H/A) was also slightly lower

(59.0%) in comparison with the rate reported (60.4%) in the last Child Nutrition Survey in Bangladesh in 1997 and higher than BBS, 1997[18] and BDHS, (1997)[4] in which the rate were reported to be 60.4%, 51.4% and 54.6% respectively[3]. But the prevalence rate of wasting (18.7%) was higher than that reported in BBS, 1997 (16.6%)[9] and Nutrition Survey of Bangladesh, (17%)[2].

This study reveals that the prevalence of malnutrition by Gomez classification was almost similar than that reported by BBS, 1997 and Nutrition Survey of Bangladesh 1997. In the present study normal, mild, moderate and severe malnutrition were 9.51%, 40.0%, 44.26% and 6.23% respectively (Table-25). Whereas these figures have been reported to be 10.3%, 47.0%, 38.4% and 4.3% by BBS, 1997 and 9.43%, 37.88%, 47.14% and 5.55% by last Nutrition Survey in 1997 by INFS[9,18].

According to Water low classification in this study shows that only 18.7% preschool children were wasted and the age of these wasted children was 50–54 months (Table - 22). In comparison, Nutrition Survey of Bangladesh revealed that only 49.3% children below 5 years were having normal nutritional status and 50.7% suffered from malnutrition[18].

This study shows that 18.8% mothers were illiterate and 32.0% mothers literacy was up to class five. In cross tabulation of mothers literacy and childrens nutritional status it was found that comparatively literate mothers children were well nourished as H/A, W/A and W/H and these were 67.86%, 69.74% and 57.38% respectively (Table-28). In Child Nutrition Survey (1997) mothers literacy was up to class five, their children's nutritional status 55.1% were stunted and 61.2% were underweight[18].

Anaemia and Nutritional status is one of the main nutritional problem worldwide with a high prevalence estimating currently to affect more than 500 million people globally. In Bangladesh, around 75% of under 5 children suffer from nutritional anaemia and malnutrition[3]. The mean haemoglobin (Hb) level of the preschool children was found to be 10.29 gm/dl. (± 1.78) (Table-30). In Nutrition Surveys of Bangladesh in 1997, 1983 and 1977, the mean haemoglobin level of under 5 children were found to be 9.7 gm/dl, 10.2 gm/dl and 10.3 gm/dl respectively[18,29,30]. Mean haemoglobin level in this study was slight greater than that of previous Nutrition Surveys. In Thailand, the mean haemoglobin level was found to be 11.2 gm/dl[31] which was higher than the present study. There were 71.35% anaemic preschool children in this study (Table-30). In Nutrition Surveys of Bangaldesh the percentage of anaemic children were 82%, 73% and 69.5% respectively[18,29,32]. In this study the prevalence of anaemia was highest (81.82%) in the age group of 35–39 months and lowest (60.0%) in the age of 55–<60 months of age. This is due to unhygienic food intake, unhygienic environment and other socio-economic factors, the anaemia is highest in the 35–39 months of age group and the prevalence of malnutrition (growth retardation) is highest after the age of 24 months to onwards.

Micronutrient deficiencies are major public health problem in Bangladesh. One of the most important micronutrient deficiency disorders is iodine deficiency disorders (IDD). The first National IDD survey conducted in 1993 showed that iodine situations was severe in all over Bangladesh. Total Goitre Rate (TGR) was 47.1% and nearly 69% of the Bangladeshi population had biochemical iodine deficiency (Urinary iodine concentration < 10 μg/dl). The first follow-up national IDD survey

conducted in 1999 showed that TGR has reduced to 17.8% and 43.1% of the population were found bio-chemically iodine deficient[3].

This study reveals that the prevalence of urinary iodine deficiency was 22.1% (Table-32). In Nutrition Survey of Bangladesh shows that prevalence of goitre was 3.87% among the age of 0–4 years. According to salt intake of this study 78.20% take iodized salt, 2.2% take non iodized salt and the remaining 19.60% take any salt (Figure-8). In Nutritional IDD Survey (1993) also found that 47.79% take iodized salt, 39.12% take non-iodized salt and the rest of 16.09% take any salt. These figures show the positive attitude to take iodized salt among the respondents. Taking of iodized salt of this study was higher than IDD survey[7].

CONCLUSION

This study reveals that the extent of malnutrition among preschool children in the densely populated area is exceptionally high which is also supported by all previous reports on nutritional status of under five children in Bangladesh. The findings call for urgent attention of the concerned authorities to the need for appropriate interventions to improve the nutritional status of the population whom live in densely and over crowded area.

RECOMMENDATIONS

Malnutrition is one of the major public health problems of our country mainly in over crowded and densely populated area. From this study, we can see that the lower socio-economic condition is not only the cause of malnutrition, also the other causes are lake of proper knowledge, practice and attitude on proper food behaviour and also the hygiene due to over crowding. The following steps are recommended to reduce malnutrition from densely populated dwellers -

1. Nutritional knowledge should be given to the mothers by personal contact of the field workers.
2. Food beliefs should be modified by the change of attitude.
3. They should be provided safe drinking water and sanitary latrine.
4. They must put on sandless to protect from bacteria and worm, as densely area is unhygienic and spread of disease is very high.
5. Nutritional knowledge should be materialized through practice.
6. Children must be immunized in proper time and adequately.
7. Appropriate campaign through mass media like radio, television and poster should be required to improve nutritional knowledge of them.

PURPOSE OF THE STUDY

Nutritional status of preschool children is very important for their future carrier. A child with good health and sound mind can given better effort for his / her development in life and carrier. Many study was carried out to estimate nutritional status of under five children, but in Bangladesh very few study was done to assess the nutritional status of preschool children. The present study is under taken not only to estimate the nutritional status but also to see how the over crowded environment hamper their health and growth.

LIMITATIONS OF THE STUDY

1. Many respondents and their preschool children were absent from their house, which hamper the time schedule.

2. While collecting the data regarding the age of the preschool children, the interviewer had some difficulties as many of them had no birth records. So, to get their actual age the interviewer had to use some indirect technique.

3. To collect blood, urine and stool samples, the interviewer had to face embarrassing situation.

4. The respondent expected immediate benefits from the study, since the interviewer was not in a position to provide such benefits.

5. Many households did not allow to collect data because of conservative attitude and insecurity and privacy ground.

CHAPTER - FIVE

BIBLIOGRAPHY

1. Editorial Article on Infant Nutrition and International code of Marketing of Breast Milk Substitute.
   Bangladesh Pediatrics Journal, December 1981, 9(2):3.

2. Bangladesh National Nutrition Survey, 1995–96, Institute of Nutrition and Food Science, University of Dhaka, July 1998.

3. Nutrition Society of Bangladesh: 8th Bangladesh Nutrition Conference, 23–25, March, 2002.

4. Bangladesh Demographic and Health Survey, 1996–97.

5. Health and food behaviour pattern of urban migrants. An M.Sc. Dissertation, 1991–92, INFS, Dhaka University.

6. Child Nutrition Survey of Bangladesh (1992), BBS,
   Statistics Division, Ministry of Planning, 1994.

7. Yusuf, H. K. M., Salamatullah Q. Islam, M. N. and Hoque, T. (Eds). Report of the National IDD survey in Bangladesh, 1993. Dhaka University.

8. Institute of Public Health Nutrition (IPHN/UNICEF): Night Blindness Prevention Programme Evaluation Report, 1989, Dhaka.

9. Child Nutrition Survey of Bangladesh 1995 – 96.
   Bangladesh Bureau of Statistics (BBS), June 1998.
   Baldwin, B.T. (1925) Weight, Height, Age standards in metric units for American born children, Am. J. Phys. Anth 8(1).

10. The state of the world's children 2001, UNICEF. New York, 2001.

11. Rahman, A., Marshall, T. and Azad, A. K.; Nutritional Vulnerability in Dhaka Slums, 2000. Institution for development policy analysis and advocacy, Proshika, Bangladesh.

12. Burden of Morbidity in Bangladesh, October, 1997 (BBS).

13. Pufer RR. and Serrano CV. (1973). Patterns of mortality in children PAHO, WHO, 1973.

14. Scrimshaw, N. S, and Gordon, J. E.; (1968) : Am. J. Pubi. HlTh, 58:505. The MIT press. Cambridge Massachusetts and London, England.

15. Taomkins A. (1981) Nutritional status and severity of diarrhoea among Preschool Children in rural Nigeria, Lancet 1: 860–862.

16. Poh Siang Choo. (1990). Nutritional status of Indian preschool children in the rubber plantation sector in Malaysia. The Indian Journal of Nutrition and Dietetics Vol. 27, No. 5 p. 14.

17. Nutrition Survey of Rural Bangladesh, 1981–82, Institute of Nutrition and Food science, Dhaka University, December, 1985.

18. Bangladesh National Nutrition Survey, 1995 – 96, Institute of Nutrition and Food Science, University of Dhaka, July, 1988.

19. WHO (1979), Health aspects of food nutrition (3rd edition), Regional office of the western Pacific of the WHO, Manilla.

20. Nutrition Survey of Rural Bangladesh, 1981–82, Institute of Nutrition and Food Science, University of Dhaka, December, 1983.

21. Hand book of Human Nutritional Requirement, FAO/WHO, 1974.

22. Food and Nutrition Board, National Research council, USA (1980).

23. WHO/UNICEF Report on Infant and young child feeding, 1991.

24. FAO/WHO/WNU Expert consultation (1985). Energy and protein requirement.

25. Pilch, S. M. and Senti, S. M. (1984). Assessment of the non Nutritional status of the US population based on the data collected in the second National Health and Nutrition Examination. 1976–1980. Eds. Federation of American Societies for Experimental Biology, Bethesda, p. 65.

26. Dolman, P. R., Yip, R. and Johnson, C.; Prevalence and Causes of Anaemia in the United States, 1976 to 1980. Am. J. Clin. Nutr., 1984, 39. 437–445.

27. Ahmed Dr. Shamim, (INFS): Overview of Nutritional Situation in Bangladesh. 2002.

28. Nutrition Survey of Rural BD, 1975–76. Dhaka BD; Institute of Nutrition and Food Science, University of Dhaka. December, 1977.

29. Nutrition Survey of East Pakistan (1962–64). US Department of Health, Education and Welfare, Public Health Service. 1966. pp. 95–123.

30. Nutrition Survey, the kingdom of Thailand, Interdepartmental Committee on Nutrition for National Defence, 1962.

31. IPHN. Report on Nutritional Goitre Prevalence. Study of Bangladesh. 1981–82, 83.

32. Hassan, N. and Ahmed, K., Nutritional status of under 12 Urban Children of Bangladesh. Bang. J. Nutr., 1993, (2): 1–15.

33. HKI; Bangladesh Nutritional Blindness Study, 1982–83. Helen Keller International and Institute of Public Health Nutrition, Bangladesh, 1985.

34. Talukder, M. Q. K., Kabir, A. R. M. L., Kawaser, C. A.; Feeding Pattern, Socio-dynamics, Clinical spectrum and recovery of severely malnourished children: a study of 155 cases. Bangl. J. Child. Health, 1988, 12:14–21.

35. Khanom S.; Factors Contributing to protein energy malnutrition in Urban Dhaka. Bangl. J. Child. Health, 1985, 9: 80 – 81.

36. Shakur, S., Banu, N., Ehsan, M. A.; Clinical , Biochemical and Socio-economic factors associated with severe degree of malnutrition in children admitted in Dhaka Shishu (children) Hospital, J. Dhaka, 1991, 7: 5–12.

37. Sultana, W.; Nutritional status and dietary pattern of under 5 children of Dhaka University employees belonging to low socio-economic status. 1995. An M.Sc. Thesis, INFS, DU.

38. Rahmatullah, L., Barbara, A., Underwood, R. D., Thulasira, J., Roy, C., Milton, K. R., Rameen, R. and Ganesh, B.; Reduced mortality among children in southern India receiving a small weekly dose of Vitamin A; N. Engl. J. Med. 1990, 323: 929–35.

39. Donnen, P.D., Brasseur, M., Dramaix, F., Vertongen, B. N., Zihindala, Mand Hennart, P.; Vitamin A deficiency and protein energy

malnutrition in a sample of preschool children in the kivu province in Zaire. Eur. J. Clin. Nutr., 1996 1. 50: 456 – 461.

40. WHO, (1972), Nutritional anaemias, Techa-Rep. Ser. No. 405. WHO. Geneva.

41. Mejia, L. A. et al. (1979). Role of Vitamin A in the absorption, retension and distribution of iron in the rate. J. Nutr. 109. 129–137.

42. Ahmed F., Mohiduzzaman, M., Barua, S., Saheen. N., Margetts. B. M. and Jackson, A. A. (1992); Effect of family size and income on the biochemical indices of Urban School Children of Bangladesh. EUR. J. Clin. Nutr. 46. 464–472.

43. Bangladesh Bureau of Statistics, (1992), Ministry of Planning. Statistical pocket book of Bangladesh.

44. Reshid, K. M., Khabiruddin, M. and Hyder, S.; Food and Nutrition. Textbook of community Medicine and Public Health, First edition, 1992: 116.

45. Bogert, L. J., George, M. B. And Callowahy, D. H.; Nutrition and physical fitness, 10th Edn., Saunders College Publishing, (1973). pp. 3–5.

46. Jellifee, D. B. and Jellifee, E. F. P. In; Community Nutritional Assessment. Oxford University Press, New York. pp 1–3. 1989.

47. UNICEF; Situation of children and priorities for action in Bangladesh: background for 1990s. UNICEF, Dhaka, pp 1–6, 1990.

48. Brown, J. E.; Ethnic growth differences in nutritional status of growing children from low income area of an urban community. Am. J. Clin. Nutr., 1986: 44(6), 938–44.

49. Mbago, M. C., Namfua, P. P.; Some determinants of nutritional status of one to four years old children in low income urban areas in Tanzania. J. Trop. Pediatr., 1991. 38(6): 299 – 306.

50. Monckeberg, F.; The Effect of Malnutrition and Environment on Mental Development, Western Hemisphere Nutrition Congress II. San Jaun, Puerto Rico, Chigaco: A. M. A. P., 1968: 216.

51. Reports of the Child Nutritional Status Module, Bangladesh Household Expenditure Survey, 1985–86, BBS.

52. Reports of the Nutritional Status Survey, 1989–90, BBS.

53. Ali, K.; Prevalence of Morbidity among normal & malnourished children of a slum area of Dhaka city. Bangladesh J. Nutr. Vol. 3, No. 1 and 2, Dec. 1989 and June 1990.

54. Hassan, N. And Barua, S.; Nutrition profile of the orphan: A case study in the Dhammarajika orphanage of Dhaka city. Bangladesh J. Nutr. Vol. 3, No. 12(43–52), Dec., 1989 and June 1990.

55. Begum, J. A. and Hauqe, A. A. S. M.; A study of the health & nutritional status of children in rural Bangladesh, Journal of Preventive and Social Medicine, Dec. 1992, Vol - 2, pp 45–48.

56. Gorstin, J., Sullivan, K., Yip, R., Onis, Dem, Trowbridge, F. L., Fajams, P. and clugston, G.: Issues in the assessment of nutritional status using anthropometry, Bullt. WHO, 1994, 72(2): 273–283.

57. Kamal, M. M., Hossain, A. M. M. M. and Khan, M. N. I.; Nutritional status of 2-5 years children in a slum area of Dhaka city. Nutrition society of Bangladesh; 7th Bangladesh Nutrition Conference, March 15 – 17, 1997.

58. Jahan, K. and Hassan, N.; Nutritional status of children and the relationship with some characteristics of mother and children Bangladesh J. Nutr., 1994, 7(1):1–8.

59. Monteiro, C. A., Benicio, M. H., Iunes, R., Gouveia, N. C., Taddei, J. A., Cardoso, M. A.; Nutritional status of Brazilian children: trends from 1975 to 1989. Bult. WHO., 1992, 70(5): 657 – 66.

60. Coetzee, D. J. and Ferrinho, P., Nutritional status of children in Alexendra township. Clinic based data and a community survey: S. Afr. Med. J., 1994 87(7): 413 – 5.

61. UNICEF (1987), "An analysis of the situation of children in Bangladesh" Dhaka.

62. BBS (1987), "Statistical year book of Bangladesh."

63. Alcram, D. S. (1990), "Nature and nurture", in national health special supplement on the child, Vol. 8, No. 1, OMAJICS Pvt. Karachi. Pakistan.

64. Bhuyan, M. A. H. and Rahman, S. M. M.; Nutrition Education on school performance in a primary school in Dhaka Bangladesh. J. Nutr., 6(1 & 2): 41–46, Dec. 1992 and June 1993.

65. Hadges, R. E., Sauberlish, H. E., Canhn, J. E., Ruoher, R. S., Mejia, L, A., and Mohamram, M.: High Anaemia Prevalence among school children Am. J. clin. Nutr., 1978, 31:876.

66. Chattopadhya, D., Saha, K., Chakrabarty, A. K., Pao, K. N., Patil, S. K., Sharma, A. and Dusaj, I. S.: Nutritional status of urban children Based on Biochemical Parameters; Eur, J. Clin. Nutr., 1992, 46(12): 885 – 95.

67. Rahman, M. and Islam, S.; Iron deficiency Anaemia of children. Nutrition Society of Bangladesh. 7th Bangladesh Nutrition conference, March 15 – 17, 1977.

68. Hetzel, B. S.; Iodine Deficiency Disorders; International Conference of Nutrition, Rome, 1992, pp. 1–2.

69. Pandav, C. S., Karmaker, M. G.; Nath, L. M. and Hetzel, B. S. Iodine Deficiency Disorder- A global Phenomenon. In: National Goitre Control Program, Seminar on IDD control, Madras, 1988, pp 26–39.

70. Micronutrient Deficiency Information System,: WHO, MDIS working Paper No. 1. Global Prevalence of IDD. WHO, UNICEF, ICCIDD, 1993. pp. 5.

71. Tielch, J. M. and Sommer, A.; The epidemiology of vitamin A deficiency and xerophthalmia, Ann. Rev. Nutr., 1984, 4: 183–205.

72. Comeron, M. and Hofvander, Y.; Weaning and weaning foods. In: Manual on feeding infants and young children. Oxford University Press, New York, pp 110–116, 1983.

73. UNICEF; A global, regional and country assessment of child malnutrition. Staff working papers, No. 7, 1990.

74. Simondon K. B. and Simondon, F.; Infant feeding and nutritional status: The dilemma of mother in rural Senegal. Eur. J. Clin. Nutr., 49(3): 179–188, 1995.

75. Formal, M. R., Hundt, G. L., Berendes, H. W., Abused K., Zangwill, L., Chang D., Bellmaken I., Abu-Saad I., Graybeard, B. I.; Under nutrition among Bedouin Arab Children: a follow up of the Bedouin infant feeding study. Am. J. Clin. Nutr., 61(3): 495–500, 1995.

76. UNICEF; Situation of children and Priorities for action in Bangladesh: background for the 1990s. UNICEF, Dhaka, pp 1–6, 1990.

77. Wahed; M. A.; Child survival and development programs in Bangladesh for the 1990s: An update In: International child health. An International Pediatric Association publication in collaboration with UNICEF and WHO, 8(1): pp. 101–105, 1997.

78. Executive Summary; Health, Nutrition and Population Unit, South Asia region, the world Bank, 2000.

79. Hartman, B. and James, K.; Needless Hunger: Voices from a Bangladesh Village, Institute for Food and Development Policy, SanFrancisco, C. A. 1979, 9.

80. Bhandari B. N. Bhandari, M. K., Sazawal, S. Clemens, J. D. Bhatnagar, S. and Khosboo, V.; Association of antecedent malnutrition with persistent diarrhoea: a case control study, Br. Med. J. 1989. 298: 1284–87.

81. Briend, A., Hasan K. H. Z., Aziz, K. M. A., Haque, B. A.; Are diarrhoea control programmes likely to reduce childhood malnutrition. Observations from rural Bangladesh, Lancet 2, 1999: 319 – 322.

82. Tomkins, A., Vella, V., Kdiku, J., Marshal, T. and Cortinovis, I.; Anthropometry as a predictor for mortality among Ugandan children, allowing for socio-economic variables. Eur. J. Clin. Nutr. 1994, 48(3): 189–97.

83. Black, E. R., Brown, K. H., Becker, S.; Determining factor in diarrhoeal duration among young children in a longitudinal study in rural Bangladesh, Am. J. Clin. Nutr., 1984, 9: 87–94.

84. Roy, S. K., Chowdhury, A. K. M. A. and Rahman, M. M.: Excess mortality among children discharged from hospital after treatment for diarrhoea in rural Bangladesh, Br. Med. J., 1983, 287: 1097–99.

85. World Bank Bulletin, 1993.

86. Hassan, N. and Ahmed, K.; Nutritional status of under 12 children of Bangladesh; Bangladesh J. Nutr., 1988, volume. 1, No. 1.

87. Vella, V., Tomkins, A., Viku, J., Marshall, T.; Determinants of Nutritional Status in South west Uganda. J. Trop. Pedeatr., 1995, 41(2): 98–98.

88. BBS (1991): Prceeding of the workshop of dissemination of current statistics; women and development related statistics, p. 110.

89. BBS (1993) Women and men in Bangladesh, Facts and Figures.

90. FAO (1996) "The sixth world food survey, 1996". Rome. P. 155.

91. Coutsoudis, A and Jinabhai, L. D.; Determining appropriate nutritional interventions for South African children living in informal urban settlements. S. Afr. Med. J. 1994. 84(9): 597–600.

92. Health situation in the South East Asia Region, 1991–93.

93. Study on prevalence of anaemia associated with food intakes and living condition of children, age between 1–12 years admitted in Dhaka Medical College Hospital; An M. Sc. Dissertation, 1995–96, INFS.

94. Hetzel, B. S., Pandav, C. S.: SOS for A Billion. The Conquest of Iodine Deficiency Disorders, 1994. pp 91.

Appendix - 1

Nutritional status of preschool children in densely populated urban area of Bangladesh.

Questionnaire for data collection

H. H. Identification No. ☐ ☐ ☐

1. Name of the respondent :
2. Age :
3. Respondent's occupation :
4. Husband's name :
5. Husband's occupation :
6. Family income/month :
7. No. of preschool children :
8. Anthropometric information :

Serial No.	Name	Age	Sex	Wt. (Kg)	Ht. (cm)	MUAC (cm)	Blood Hb level (g/dl)

9. Parents Educational Qualification :

Father	Mother
a. Illiterate	a. Illiterate
b. Class I – V	b. Class I – V
c. Class VI – X	c. Class VI – X
d. S. S. C	d. S. S. C
e. H. S. C	e. H. S. C
f. Graduate	f. Graduate
g. Masters	g. Masters

A. Socio - economic Conditions

1. How many members are there in your family?

[1] 3 [2] 4

[3] 5 [4] more than 5

2. Have you ever accepted any family planning method?

[1] Yes [2] No.

3. What is your monthly family income?

[1] < 2,000/= [2] 2000 - 2999/= [3] 3000 – 3999/=

[4] 4000 – 4999/= [5] 5000 – 5999/= [6] 6000 – 6999/=

[7] 7000 – 7999/= [8] >8000/=

4. What amount do you expend from your monthly family income for buying foods? ---------- Taka.

5. Can you afford three good meals for all members of your family with this expenditure?

[1] Yes [2] No [3] Difficult

6. Have your children been admitted to school?

[1] Yes [2] No

7. **Do your children go to school regularly?**

[1] Yes [2] No

8. **Do your daughters go to school regularly?**

[1] Yes [2] No

9. **What is your educational back ground?**

[1] can read only [2] Can read and write only

[3] Illiterate [4] Read up to ---------- class

10. **What is the state of your accommodation?**

[1] Brick house [2] Kaccha

[3] Semi pacca

11. **Type of latrine.**

[1] Sanitary [2] Open

12. **Source of drinking water**

[1] Tap water [2] Tube well water

13. **Purification of drinking water.**

[1] By boiling [2] By using water purification tablet

[3] As like as it available

14. **Is your child suffering from any disease at present?**

[1] Yes [2] No

15. **If the answer is yes, what type of disease?**

[1] cold [2] Fever [3] Diarrhoea [4] Dysentry [5] others

16. **Is your child suffered/Suffering from any major disease?**

[1] Yes [2] No

17. **If the answer is yes, what type of disease?**

[1] Typhoid [2] Measles [3] Pox [4] Pneumonia [5] Jaundice

[6] Dengue fever [7] Others.

18. **Did you vaccinate your child?**

[1] Yes [2] No

19. **Did you deworm your child?**

[1] Yes [2] No

20. **Did you practice family planning?**

[1] Yes [2] No

B. **Knowledge on Nutritional Aspects.**

1. **Among the following food items which give us energy?**

[1] Rice/Bread [2] Fish/meat [3] Vegetables [4] Don't know

2. **Among the following food items which is required for growth and maintenance of your body?**

[1] Rice/Bread [2] Fish/meat [3] Vegetables [4] Don't know.

3. **Which one of the food is required for prevention of diseases?**

[1] Vegetables [2] Pulse [3] Egg [4] Don't know.

4. **What nutrients in abundance are found in vegetables?**

[1] Vitamins [2] Protein [3] Carbohydrate [4] Don't know

5. **What happens to a protein deficient child?**

[1] Suffers from kwashiorkor [2] Pus/Blood comes out from gums.

[3] Does not want to eat [4] Don't know.

6. **What happens to a vitamin A deficient child?**

[1] The child suffers from night blindness [2] Suffers from goitre

[3] Don't know.

7. **What happens to an iodine deficient child?**

[1] Becomes cretin [2] Can't see at night

[3] Loses weight [4] Swelling in front of neck.

[5] Don't know.

8. **What nutrient deficiency is responsible for anaemia?**

[1] Vitamin D [2] Iron [3] Fat [4] Don't know

C. Attitude on Nutritional Aspects

1. **Whom, among your family members do you give more body building food?**

   [1] Adult male [2] Son [3] Daughter [4] Don't know

2. **Did you breast feed your last child regularly up to 2 years of age?**

   [1] Yes [2] No

3. **Should the child be immunized regularly against six infectious diseases?**

   [1] Yes [2] No [3] Don't know

4. **What food should be given to a child when he/she suffers from diarrhoea?**

   [1] Liquid food [2] Rice and fish [3] Vegetables [4] Don't know

5. **Do you think that your preschool children has accurate weight?**

   [1] Yes [2] No [3] Don't know

6. **If the child suffers from diarrhoea, measles or fever, should food be stopped?**

   [1] Yes [2] No

7. **Where do you go when your children suffer from any diseases?**

   [1] Health centre [2] Homeopath [3] A religious leader

   [4] Private doctor [5] Don't know

8. **What should be done before cooking vegetables?**

   [1] Vegetables should be washed before cutting into pieces.

   [2] Vegetables should be washed after cutting into pieces.

   [3] Don't know

9. **Should water be discarded after cooking vegetables?**

   [1] Should be discarded [2] Should not be discarded [3] Don't know

10. **Should vegetables be covered while cooking?**

    [1] Yes [2] No [3] Don't know.