Prevalence of undernutrition among Bengalee preschool children of Sundarban, South 24 Parganas, West Bengal, India

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ABSTRACT

Aim: Undernutrition is one of the most important problems facing developing countries, including rural India. However, there exists scanty information on the prevalence of undernutrition in the form of stunting, wasting and underweight among preschool children of Sundarban area of West Bengal, India.

Methods: This study was carried out among 656 (326 boys; 330 girls) 3-5 years old rural preschool children of Bengalee ethnicity at 28 Integrated Child Development Services centres of Sagar Block, South 24 Parganas District, West Bengal, India. Anthropometric measurements were recorded according to standard procedure and < -2 z-scores of height-for-age, weight-for-height and weight-for-age age were used to evaluate the level of stunting, wasting and underweight, respectively, following the World Health Organization Guidelines.

Results: It revealed that boys were significantly taller and heavier than girls at age combined and also at age 4 & 5 years, except at age 3 years when girls were taller. The overall age and sex combined data showed that rates of stunting, wasting and underweight were 26.22%, 35.37% and 51.07%, respectively. The rates of stunting, wasting and underweight were higher among boys (stunting = 28.22%, wasting = 40.80%, underweight = 53.37%) compared with girls (stunting = 24.24%, wasting = 30.00%, underweight = 48.79). Based on the World Health Organization classification of severity of malnutrition, the overall prevalence of wasting (35.37%) and underweight (51.07%) was very high (≥15%; ≥30%).

Conclusion: The nutritional status of the subjects was unsatisfactory. There is scope for improvement in the form of enhanced supplementary nutrition.

Keywords: Undernutrition, Stunting, Wasting, Underweight, Z-score, Global Scenario.

INTRODUCTION

Undernutrition is a widespread problem in developing countries and about 146 million children under five are underweight in the developing world and more than half of them live in South Asia including India. India has 49% underweight children, which share 39% of the world's underweight children. Numerically, 57 million children are underweight in India (UNICEF, 2006). Moreover, global comparative data indicate that contrary to common perception, prevalence of undernutrition is highest in South Asian children (SCN, 2004). Under nutrition during infancy and childhood substantially raises vulnerability to infection and disease and increases the risk of premature death. Among children in developing countries malnutrition is an important factor contributing to illness and death.

Malnutrition during childhood can also affect growth potential and the risk of morbidity and mortality in later years of life (Alderman et al., 2003). Therefore, growth during childhood is widely used to assess adequate health, nutrition and development of children, and to estimate overall nutritional status as well as the health status of a population. Undernutrition is the most important cause of death in this age group in developing countries including India, where high rates of under five morbidity and mortality are present. Seven out of ten childhood deaths in India are due to respiratory infections diarrhoea and malnutrition (Park, 2005). As in other developing nations, malnourishment is a burden on a considerable proportion of population, the most vulnerable being the youngest of the country (Chatterjee and Saha, 2008). The majority of deaths associated with malnutrition occur in children who are marginally malnourished (Pelletier, 1994). Moreover, several studies have shown that the degree of undernutrition is higher among the underprivileged communities (Bisai et al., 2008) of the rural areas (Biswas et al., 2009).

The three most commonly used internationally recommended anthropometric indicators are stunting (low height-for-age), underweight (low weight-for-age) and wasting (low weight-for-height) (WHO, 1995). Age, gender and body weight largely determine the nutrient requirement of an individual. Body weights and heights of children reflect their state of health, nutrition and growth rate (ICMR, 2009).

According to Jelliffe, malnutrition is a "pathological state resulting from a relative or absolute deficiency or excess of one or more essential nutrients" (Jelliffe, 1966). Thus the term "malnutrition" refers to undernutrition, overnutrition, specific nutrient deficiencies or imbalance

(Chen et al., 2001). Undernutrition can be divided into protein –energy malnutrition and micronutrient deficiencies.

The integrated child development services (ICDS) scheme that is the largest national programme in the world for promotion of mother and child health and child development. It was launched on 2nd October, 1975. The ICDS is the symbol of India's commitment to her children. The beneficiaries of ICDS scheme include preschool children, pregnant and lactating mothers, and other women in the age group 15-44 years. The package of services provided by the ICDS scheme includes immunization, supplementary nutrition, health check-up, referral services, preschool non formal education and nutrition and health information. The scheme's services are provided through workers called "*Anganwadi workers*" at village "*Anganwadi*" centres (Kapil and Pradhan, 1999).

To assess the importance of the said service scheme programme, there is an urgent need to evaluate the nutritional status of children at ICDS centres to conclude whether they have low rates of stunting, wasting and underweight. Low rate of stunting, wasting and underweight would imply that the supplementary nutrition being administered to the children is effective in reducing the rates of undernutrition.

Keeping these in mind, the aim of the present investigation was undertaken to determine age and sex variations in height and weight, as well as to evaluate the levels of stunting, wasting and under-weight, among the 3-5 years old Bengalee ethnicity preschool (ICDS) children of Sagar Block, South 24 Parganas, West Bengal, India.

MATERIALS AND METHODS

The present study was undertaken at 28 ICDS centres in Sagar Block of South 24 Parganas district, West Bengal, India. The study area is situated at Gangasagar (which is famous for Temple of KAPILMUNI), Sundarban area of Kakdwip Subdivision. This is located at approximately 130 km far away from Kolkata, the provincial capital of West Bengal. Total areas of Sagar Island are 194.60 miles^2 (504 km^2) and it has the population of 206890 according to 2011 census. This block has a population density of 1063.155(410.49 per km^2) per square mile. Growth rate is 20.38% during 2001-2011 but decadal growth rate of South 24 Parganas is 20.89% whereas this block decadal growth rate is 17.84%. The area is remote and mostly

inhabited by Hindus. All preschool children (3-5 years old) living in Sagar Block are enrolled at these centres.

The subjects were randomly selected from 28 ICDS centres of DS2 Gram Panchayat of Sagar block, South Parganas district, West Bengal, India. A total number of 656 children (males= 326; females = 330) aged 3-5 years were measured. Ages of the children were ascertained from the *"Anganwadi"* registers, immunization card and also subsequently confirmed by parents of the children. For the analysis age was grouped into 12 months intervals. Formal ethical approval was obtained from Vidyasagar University and ICDS authorities prior to the commencement of the study.

Anthropometric measurements:

The anthropometric measurements (height and weight) were taken by one author (SPG) according to standard procedure (Lohman et al., 1988).

Statistical Analyses:

After collecting information and taking measurements, analyses were done using SPSS (Version 16.00) software. There are several parameters to assess the nutritional status among the preschool children. However, the most commonly used and reliable indicators are stunting (low height-for-age), underweight (low WAZ) and wasting (low WHZ). These were used to evaluate the nutritional status of the subjects of the present study. While stunting reflects a failure to reach linear growth potential due to sub optimal health and/or nutritional conditions, underweight reveals low body mass relative to chronological age, which is influenced by both, a child's height and weight. Stunting is an indicator of chronic undernutrition, the result of prolonged food deprivation and/or disease or illness. Underweight thus cannot distinguish between a child that is small in weight relative to his/her height and a child that is low in height relative to his/her age, but who may be normal in WHZ. On the other hand wasting is an indicator of acute undernutrition, the result of more recent food deprivation or illness (World Health Organization (WHO), 1995).

Internationally accepted the World Health Organization (WHO 2006) age and sex specific – two Z-scores were followed to define stunting, underweight and wasting. Z-scores were calculated following the standard formula:

Z -Score = (X - Median of WHO 2006)/ (Standard deviation of WHO 2006)

Where, X = Particular score of height or weight of a child

Three commonly used undernutrition indicators: stunting, wasting and underweight ware used to evaluate the nutritional status of the subjects. The World Health Organization (WHO-2003) age and sex specific -2 z-scores ware followed to define stunting, wasting and underweight. The following scheme was utilized:

Stunting: <-2 HAZ (z-score for height-for-age);

Wasting: <-2 WHZ (z-score for weight-for-height);

Underweight: <-2 WAZ (z-score for weight-for- age).

We followed the World Health Organization (WHO 1995) classification for assessing severity of malnutrition by percentage prevalence ranges of these three indicators among children. The classification is shown in the *Table 1*.

RESULTS

The age and sex specific anthropometric characteristics are presented in *Table 2; Figures 1 and 2.* Significant sex differences in mean weight were found at the age of 3 (t = 2.30; p < 0.05) and 5 (t = 2.51; p < 0.05) years and significant sex difference in height was found at the age group of 5 (t = 2.47; p < 0.05) year. Significant age variations were found in mean height (Boys: F = 336.58, p < 0.001; Girls: F = 293.44, p < 0.001) and weight (Boys: F = 115.04, p < 0.001; Girls: F = 145.44, p < 0.001). Generally it was found that boys were taller and heavier.

Table 3 presents the mean Z-score of height-for-age, weight-for-height and weight-for-age. Results revealed that the mean HAZ were lower than those of WHO-2006 for both sexes at all age groups. The sex combined z-value ware -1.60, -1.71 and -2.09 for HAZ, WHZ and WAZ, respectively.

Table 4 and *Figures 3 to 5* represent the prevalence of undernutrition among the subjects. The overall rates of stunting, wasting and underweight were 26.22%, 35.37% and 51.07%, respectively. The age combined sex specific rates of stunting, wasting and underweight were

higher among boys (stunting = 28.22%, wasting = 40.80% and underweight = 53.37%) than girls (stunting = 24.24%, wasting = 30.00%, underweight = 48.79%). It was found that stunting frequencies decreased according to age in both sexes. However, wasting and underweight frequencies increased with increasing age in both sexes. According to WHO classification of malnutrition, the overall age and sex combined wasting and underweight was very high but the rate of stunting showed medium level of severity of malnutrition. Noteworthy, the rate of stunting among boys was high at age 3 year. Moreover, highest rates of underweight were observed at age 4 year among boys (64.08%) and girls (56.36%).

DISCUSSION:

In spite of the economic development, a major proportion of children in developing countries are already nutritionally depleted especially among the preschoolers. It was observed that undernutrition among children and adolescents is a serious public health problem internationally, especially in developing countries (Lancet 1984). Therefore, undernutrition remains a significant problem in many Asian countries (Wickramasinghe et al., 2004). Undernutrition is found to be a cause of ill-health and premature mortality among children in developing countries like India (Nandy et al., 2005; UNICEF, 2006). The present study clearly indicated that the overall prevalence of undernutrition were medium (Stunting: 26.22 %) and very high (Wasting: 35.37 %; Underweight: 51.07%) according to WHO classification of severity of malnutrition (WHO 1995). The rate was much higher than those reported (16 %) by (UNICEF 2007) from India. As mentioned earlier that wasting is an indicator of acute undernutrition resulting from more recent food deprivation or illness. The rate of wasting (35.37 %) of the children of the present study was much higher than those reported in an earlier study on ICDS children from Chapra, West Bengal, which had reported rate of 10.6 %. However, both studies found more-or-less similar rates of stunting, i.e. 23.9 % (Bose et al., 2007) and 26.22 % (present study). This indicates a prolonged food deprivation of the children of both the areas. Moreover, recent food deprivation was also revealed in case of the ICDS centers of the present study through higher prevalence of underweight and wasting. The prevalence of wasting is slightly higher (35.57 %) among the girls compared to the boys (30.00 %). Very high prevalence of underweight were found among slum children of Delhi (Saxena et al., 1997), slum children of Midnapore (Bisai et al., 2009) West Bengal and preschool children of Bangladesh (Pryer et al., 2003). Preschool children of Arambag, West Bengal (Mandal and Bose, 2009), slum children of

Gujarat (Shah and Patel, 2009), preschool children of Kenya (Arthur et al., 2003) and preschool children of Salvardore (Strawn, 1996) show closer resemblance of the prevalence of stunting with the present study. The rate of underweight were lower among the preschool children of Punjab (Kaur et al., 2005), preschool children of Kenya (Arthur et al., 2003) and preschool children of Salvardore (Strawn, 1996) compared to the present study. The lowest level of wasting was found among preschool children of Salvador (Strawn, 1996). Underweight, which is used as a composite indicator to reflect both acute and chronic undernutrition, demonstrated in case of the present study that the level was also very high ($\geq$ 30 %). These findings suggest widespread adverse nutritional experience of the subjects. It may be due to the fact that the children of the present study came from remote villages of Sagar block. The parents' educational standard, occupation, health care practices, awareness regarding nutrition may lead to this nutritional stress. .

There is a declining trend in underweight between 1992 and 1998 then between 1998 and 2005 and numerous factors might have influenced this decline in stunting including the rapid economic growth India which has experienced between 1990 and 2007, the provision of primary health care at the national level resulting in improved health of girl children over generations (leading to better long-term nutritional status of their offspring) and implementation of preventive nutrition programs such as the ICDS (UNICEF, 2007). Although the declining trend is a positive finding, it needs to be tempered by the fact that the absolute rates of undernutrition in India continue to be higher than the majority of developing countries (UNICEF, 2007). Although, the prevalence of undernutrition among the children of the area is still serious, but when we compare the nutritional status (underweight and wasting) of the children from the primary school of the present study with that among the ICDS children of the previous study revealed that the rate of underweight and wasting showed improvement. In the ICDS centers, only the Sebika or Anganwari worker and her helper are responsible to run and implement the programs offered by the government. Furthermore, the government's focus is on the increase of the area covered by the ICDS program rather than to maintain the quality. To reduce malnutrition, ICDS activities need to be refocused on the most important determinants of malnutrition. Programmatically, this means emphasizing disease control and prevention activities, education to improve domestic child-care and feeding practices, and micronutrient supplementation. It might also be mentioned here that, a number of social factors have an impact

on undernutrition like number of living rooms and sib ships (Biswas and Bose, 2011a), place of delivery (Biswas and Bose, 2011b), religion (Biswas et al., 2011), parity (Mandal and Bose, 2013), unhygienic personal habits and adverse cultural practices relating to child rearing, breast-feeding (Das and Sahoo, 2011), socio-economic inequalities (Subramanyam et al., 2010), environmental, cultural, social factors as well as poor nutrition policies and gender inequalities (Bundara et al., 2013). Greater convergence with the health sector, and in particular the Reproductive and Child Health Program, would help tremendously in this regard. Involving communities in the implementation and monitoring of ICDS should be used to bring in additional resources into the "*Anganwadi*" centers, improve quality of service delivery and increase accountability in the system (World Bank Report, 2006). Therefore a detailed nutritional monitoring is required to full comprehend the impact, effectiveness and efficacy of ICDS programmers.

Acknowledgements

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Table No. 1. Classification assessment for severity of malnutrition by percentage prevalence ranges (WHO 1995)

Classifications	Low (%)	Medium (%)	High (%)	Very High (%)
Stunting	<20	20-29	30-39	≥40
Underweight	<10	10-15	20-29	≥30
Wasting	<5	5-9	10-14	≥15

Table No. 2. Anthropometric characteristics of the subjects

Age in years	Sex	Number	Height (cm)			Weight (kg)		
			Mean(SD)	t-value	F-value	Mean(SD)	t-value	F-value
3	Boys	119	91.55(4.31)	-0.66		11.94(1.32)	2.30*	
	Girls	120	91.91(4.03)			11.57(1.19)		
4	Boys	103	99.12(3.70)	0.93	Boys =336.58**	12.90(1.47)	0.74	Boys = 115.04**
	Girls	110	98.62(4.16)			12.76(1.39)		
5	Boys	104	105.97(4.36)	2.47*		14.78(1.46)	2.51*	
	Girls	100	104.61(3.38)		Girls=293.44**	14.35(0.98)		Girls = 145.44**
Age combined	Boys	326	98.54(7.26)	1.02		336.58***	2.53*	
	Girls	330	97.99(6.48)			12.81(1.65)		

*=p <0.05, **=p<0.001

Table No. 3. Age and sex specific Mean and SD of WAZ, HAZ and WHZ among the studied subjects

Age in years	Sex	HAZ	WHZ	WAZ
3	Boys	-1.93(0.94)	-1.37(0.91)	-1.99(0.81)
	Girls	-1.64(0.81)	-1.49(0.90)	-1.99(0.77)
4	Boys	-1.60(0.71)	-2.08(0.91)	-2.27(0.83)
	Girls	-1.60(0.84)	-1.81(1.19)	-2.18(0.84)
5	Boys	-1.34(0.82)	-1.91(0.77)	-2.07(0.71)
	Girls	-1.43(0.65)	-1.68(0.53)	-2.06(0.58)
Age combined	Boys	-1.64(0.87)	-1.77(0.92)	-2.11(0.79)
	Girls	-1.56(0.78)	-1.65(0.93)	-2.07(0.75)
Sex combined		-1.60(0.82)	-1.71(0.93)	-2.09(0.77)

HAZ=height-for-age z-score; WHZ=weight-for-height z-score; WAZ=weight-for-age z-score.
Standard deviation (SD) of mean is presented in Parentheses.

Table No. 4. Prevalence (%) of stunting, wasting and underweight among the studied children

Age in years	Sex	Stunting (HAZ<-2.0)	Wasting (WHZ<-2.0)	Underweight (WAZ<-2.0)
3	Boys	44.54	26.05	44.54
	Girls	27.50	23.33	47.50
4	Boys	24.27	53.40	64.08
	Girls	32.73	39.09	56.36
5	Boys	13.46	45.19	52.88
	Girls	11.00	28.00	42.00
Age combined	Boys	28.22	40.80	53.37
	Girls	24.24	30.00	48.79
Sex combined		26.22	35.37	51.07

HAZ=height-for-age z-score; WHZ=weight-for-height z-score; WAZ=weight-for-age z-score

Figure 1. Age trend in mean height (cm) among the subjects

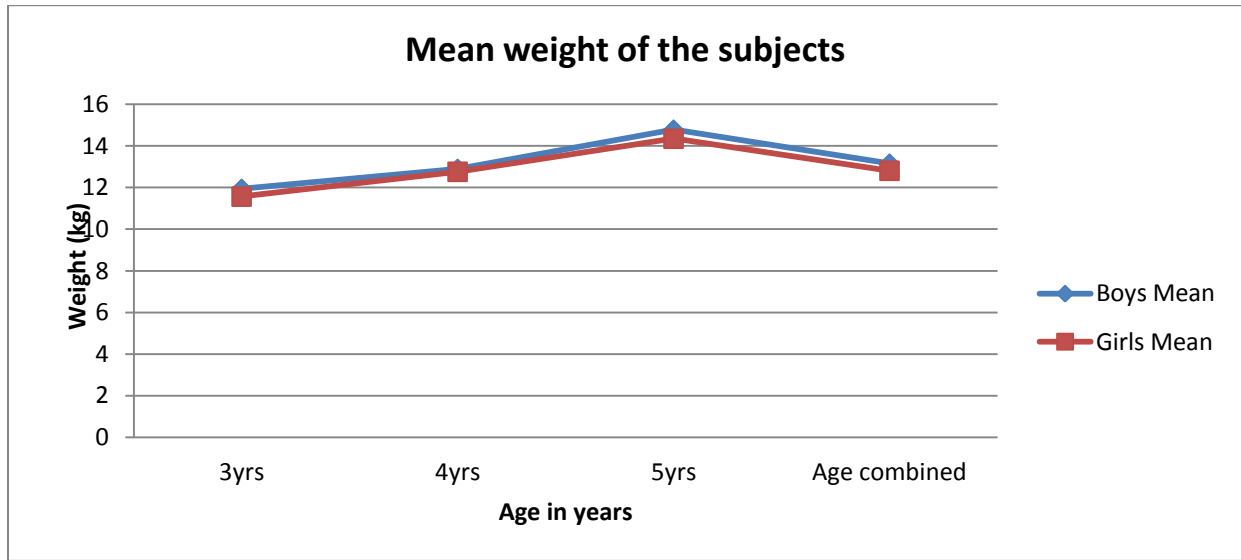Figure 1. Age trend in mean height (cm) among the subjects
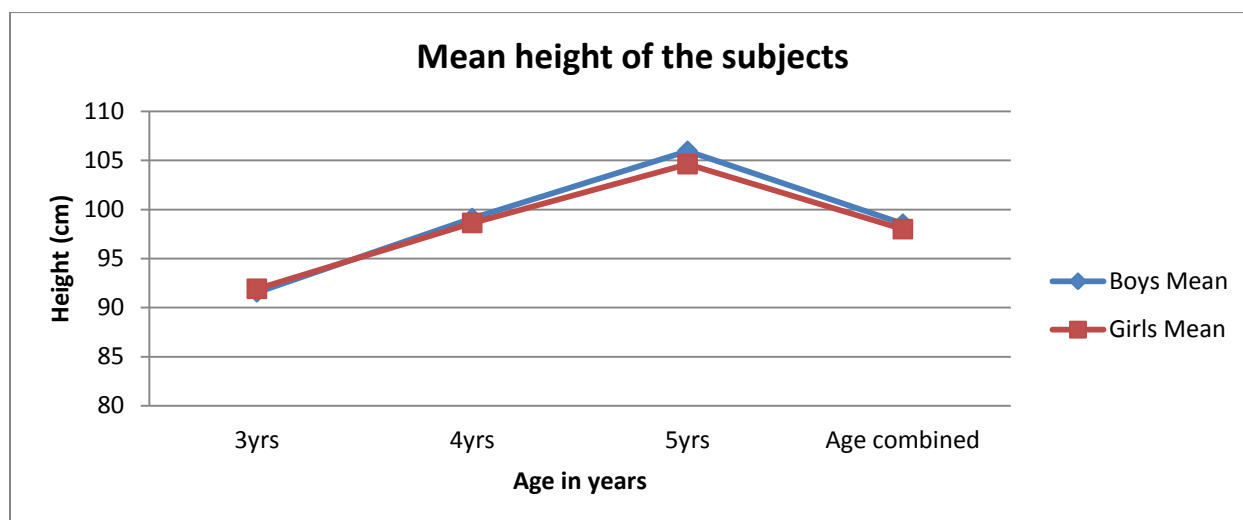
Figure 2. Age trend in mean weight (kg) among the subjects

Mean weight of the subjects

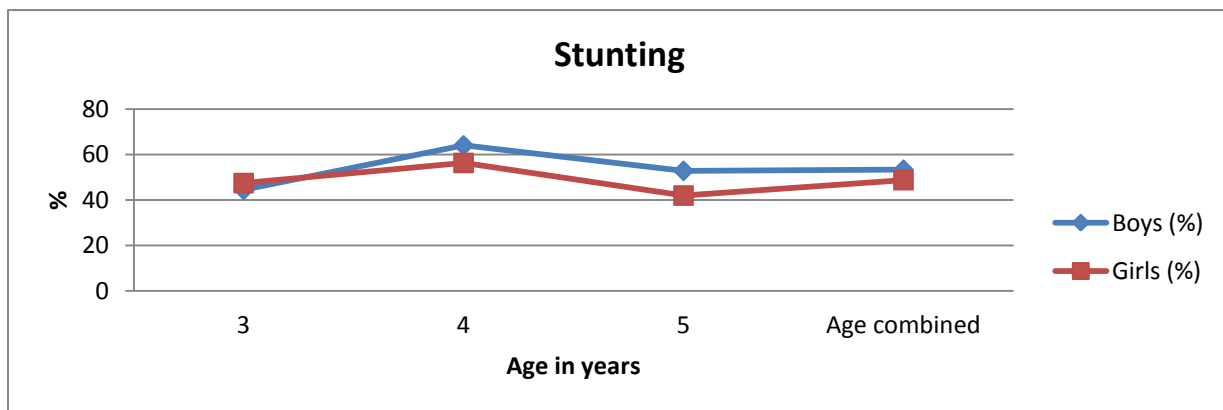**Figure 3. Age trend in prevalence (%) of stunting among the subjects**

Stunting

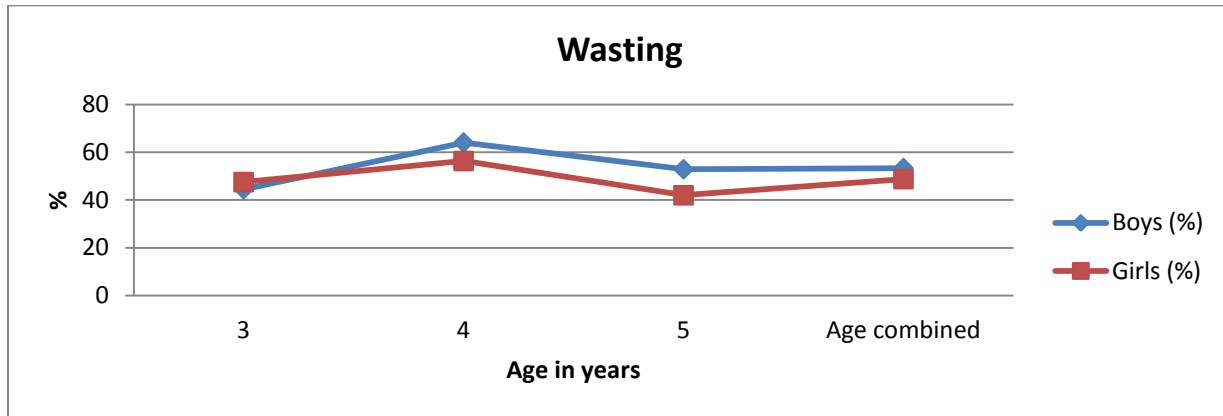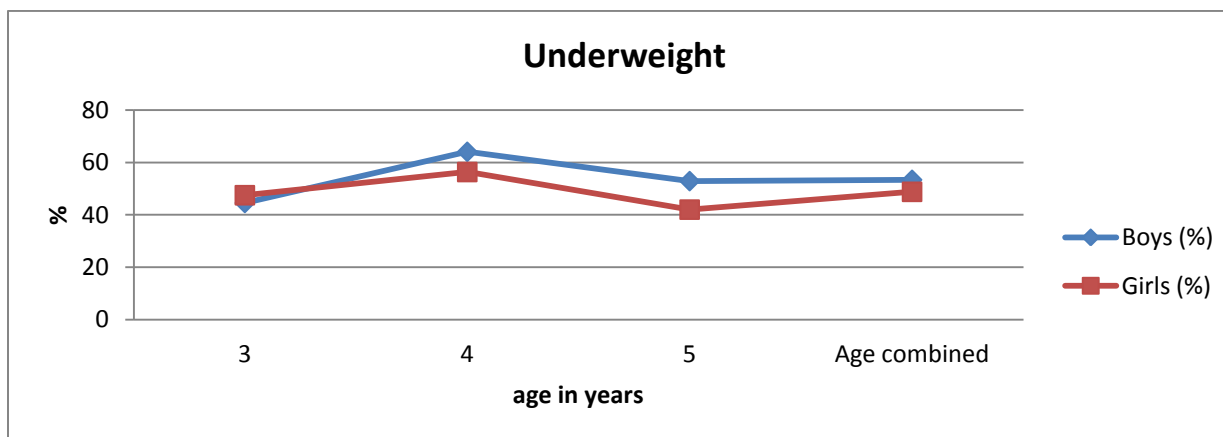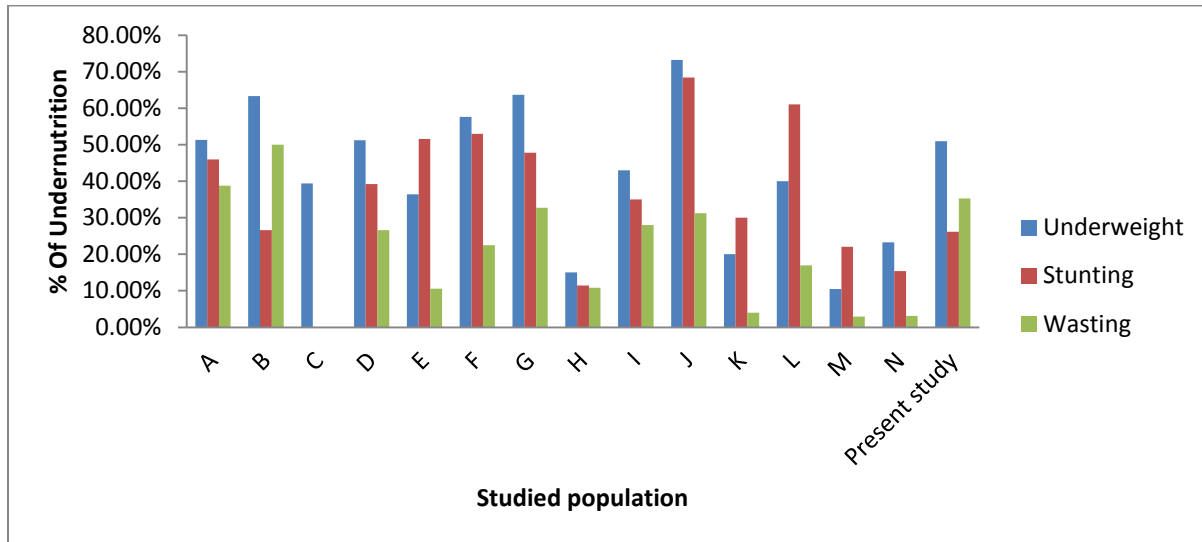**Figure 4. Age trend in prevalence (%) of wasting among the subjects**

Figure 5. Age trend in prevalence (%) of underweight among the subjects

Figure 6. Comparison in prevalence (%) of undernutrition with other studies

A= Rural children of West Bengal (Day and Choudhuri, 2008)

B = Preschool Children of Arambag, Hooghly (Mandal and Bose, 2009)

C = Preschool Children of Chapra, Nadia(Biswas et al, 2009)

D = Bauri Children of Purulia, West Bengal (Das and Bose, 2009)

E = Anganwadi Children of Allahabad, UP (Kumar et al., 2006)

F = Slum Children of Delhi (Saxena et al., 1997)

G = Slum Children of Midnapore, West Bengal (Bisai et al., 2009)

H = Slum Children of Gujarat, (Shah and Patel, 2009)

 I = Preschool Children of Punjab (Kaur et al., 2005)

J = Preschool Children of Bangladesh (Pryer et al., 2003)

K = Preschool Children of Kenya Arthur et al., 2003)

L = Preschool Children of Nigeria (Ifeanyi et al., 2009)

M = Preschool Children of Salvador (Strawn , 1996)

N = Preschool Children of Cape Verde (Wennberg et al., 1998)

Present study= Preschool ICDS children from Sagar Block, W. B. India