



PHYSICAL GROWTH AND NUTRITION STATUS OF LOW BIRTH WEIGHT AND NORMAL BIRTH WEIGHT SCHOOL CHILDREN: A COMPARATIVE STUDY

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ABSTRACT

A total of five hundred and ninety-one (591) school children of 6+ and 7+ years of age living in Mysore city were recruited as subjects using purposive sampling technique. Both schools and households visit were carried out to recruit the subjects. A self-developed questionnaire was administered to the parents to collect the data on socio-demographic conditions and birth history of children. The anthropometric measurements of children were recorded by using standard methods and techniques. The anthropometric data were further used to calculate indices such as BMI-for-age, Height-for-age and Weight-for-age according to child growth reference of World Health Organization.

The findings of the study indicates that the prevalence of malnutrition was distinctively higher among school children born with Low birthweight (LBW)(Stunting=81.3%, underweight= 82.6% and Undernutrition=54.0 %) than school children born with Normal Birthweight (Stunting= 37.6%, underweight=32.6% and Undernutrition=25.12 %). Within Low birthweight groups significant association of gender, age and education with level of stunting (Ht/Age), Age and education with level of underweight (Wt/age) were noticed. Within normal birthweight group, significant association of gender with level of underweight (wt/age) and undernutrition (BMI/age), age and education with level of stunting (Ht/age), education with level of undernutrition (Wt/age) were noticed. Overall, the present study concluded that birth weight determines the physical growth and nutritional status of children in late childhood years i.e. at school age period. The study suggests the implementation of intervention programs and stimulating programs to reduce the long-term consequences of infants born with low birthweight.

Index terms: Low birth weight, normal birth weight, physical growth and nutrition status

INTRODUCTION

Birth weight is the single most important criterion for determining neonatal and infant mortality and morbidity. Many of the newborns die during their first year of life, because of low birth weight (LBW) as they become the victims of protein-energy malnutrition (PEM) and infections. Low birth weight (LBW) is a sensitive indicator of the socio-economic conditions and indirectly measures the health of the mother and the child. The World Health Organization (WHO) has defined the term low birth weight as a birth weight of less than 2500gms, irrespective of the duration of the gestational period. According to world health ranking, India accounts for 27.7% of LBW and placed on 16th ranking (WHO 2014).According to National Family Health Survey-4(2015-16), the prevalence of low birthweight babies in Karnataka state is 17.2% which is nearest to the country average 18.2% of low birthweight babies in India.

The prevalence of stunting and underweight has decreased since NFHS-3, especially for stunting, which declined from 48 percent in 2005-06 to 38 percent in (NFHS-4) 2015-16. The prevalence of wasting remains the same. (NFHS-4).18 % of mothers were answered they had a low birthweight baby (less than 2.5 kg) in NFHS-4 which is down from 22% in NFHS-3.1 in every 7 newborns was born with low birth weight

in 2015. These babies were more likely to die during their first month of life or face lifelong consequences such as stunted growth and lower IQ (UNICEF, WHO, 2019). The present scenario of health and nutritional status of the school-age children in India is very unsatisfactory. As per NFHS-5 data show that 35% of under 5 children were stunted, 19.5% were wasted and 32% were reported as underweight In Karnataka state. (NFHS-5, 2019-20).

Primary school age is a dynamic period of physical growth as well as of cognitive development of the child. Studies indicate that health problems due to miserable nutritional status in primary school-age children are among the most common causes of low school enrolment, high absenteeism, early dropout and unsatisfactory classroom performance.

A number of studies have reported an association between LBW and pulmonary dysfunction, impaired physical growth, adverse neurological outcome, psycho-social development and social disadvantages. An association between LBW and increased respiratory, cognitive, neurological and psychological deficits or dysfunction have also been reported by (Kelly et al and Gissler et al, 2004). The National Family Health Survey (NFHS-3) data show that among low birthweight children 46% are under weight, 23% of children are wasted and 47% of children are stunted. Undernutrition during childhood can slow down the physical and mental development of the children and consequences are usually lifelong (Srivastava et al 2012). There were 293 births totally, of which 57 were LBW (20.1%) in the Mysore rural (Narayanamurthy et.al, 2013) Other scholars have observed low school performance, delayed psychomotor development, adverse emotional well-being, as well as increased conduct disorders among children and adolescents with prior LBW. The present research was aimed to study the physical growth and nutrition status among low birth weight and normal birth weight (NBW) children.

METHODOLOGY

A cross sectional school-based study was carried out to assess physical growth and nutritional status as school age outcome in LBW and NBW children. Selection of sample and data collection was done in two phases. In the first phase, Investigator visited the selected schools and distributed self-prepared questionnaire to 1000 children studying in 1st to 2nd standard to get the information regarding socio-demographic conditions as well as birth history of the child from their parents. A total of 591 children were selected as samples based on parents' response and Birth card/Thayi card, a total of 392 children born with LBW (<2.5 kg) were identified as target group. To have comparison, a total of 199 children born with NBW (≥ 2.5 kg) were also selected as control group. A total of 591 school children born during the year 2010 to 2012, their age ranges from 6+ years and 7+ years during data collection 2018 & 2019, living in the Mysore city were recruited as subjects using purposive sampling technique. In the second phase, the investigator visited the schools and households to collect the specific information like maternal history, birth history, home environment and recorded the anthropometric measurements of children namely height, weight, mid upper arm circumference, skin fold thickness was measured. The anthropometric data were further used to calculate indices such as BMI-for-age, Height-for-age and Weight-for-age according to child growth reference of WHO. The collected data were tabulated and computed using SPSS window 16.0 package. The frequency and percentage were calculated and chi-square test, mean, SD and t test was applied to see the significant association between the attributes.

FINDINGS AND DISCUSSION

Table 1: Distribution of samples under gender, birth weight and age

Information about children		LBW		NBW		Total	
		No	%	No	%	No	%
Gender	Boys	200	51.0	101	50.8	301	50.9
	Girls	192	49.0	98	49.2	290	49.1
Age	6 + years	210	53.6	74	37.2	284	48.1
	7 + years	182	46.4	125	62.8	307	51.9
Class	1 st standard	167	42.6	60	30.2	227	38.4
	2 nd standard	225	57.4	139	69.8	364	61.6
Total		392	66.3	199	33.6	591	100

Table 1 indicates the distribution of sample under gender, birth weight, age and class. Of the total sample, almost equal percentage of (50.9%) and girls (49.1%) were observed. Nearly equal percentage of boys (51.0% and 50.8%) and girls (49.0% and 49.2%) were observed under LBW and NBW groups respectively. Of the total sample, 48.1% of children were of 6+ years of age and 51.9% were of 7+ year of age. Slightly higher percentage of sample were observed under 6 + years of age than 7+ years of age in both LBW (53.6% and 46.4%) and NBW (37.2% and 62.8%) groups respectively. As per class wise distribution of samples, 38.4% of children were studying in 1st standard against to 61.6% of children studying in 2nd

standard. About 42.6% of LBW children and 30.2% of NBW children were studying in 1st standard whereas 57.4% of LBW and 69.8% of NBW children were studying in 2nd standard. Based on the personal profile, school children of the present study were equally distributed under gender, and almost equal percent of children were noticed under age groups. Slightly higher percentage of children were studying at 2nd standard compared to 1st standard.

Table 2: Details about family Background of the sample

Family Social Background		LBW		NBW		Total		χ^2 Value df=1 Sig.
		F	%	F	%	F	%	
Family type	Nuclear	369	94.1	172	86.4	541	91.5	10.106** 0.001
	Non-nuclear	23	5.86	27	13.5	50	8.4	
Monthly Income of Family	>Rs.15,000	244	62.2	145	72.8	389	65.8	6.616* 0.010
	Rs.16,000 and above	148	37.7	54	27.1	202	34.1	
Source of Income	Business	29	7.3	36	18	65	10.9	15.416** 0.000
	Salary	363	92.6	163	81.9	526	89.1	
Religion	Hindu	359	91.6	142	71.4	501	84.8	41.823** 0.000
	Non Hindu	33	8.4	57	28.6	90	15.2	
Mother Tongue	Kannadiga	308	78.5	125	62.8	392	66.3	16.732** 0.000
	Non Kannadiga	84	21.4	74	37.1	199	33.7	

Table 2 reveals the family background of the samples- type of family, monthly income, source of income of family, religion and mother tongue. All most all the LBW children (94.1%) and majority (86.4%) of NBW children were belongs to nuclear family. The remaining percentage of LBW (5.86%) and NBW (13.5%) children were belonging to non-nuclear family. Highly significant association was observed between type of family and birth weight groups ($\chi^2 = 10.106$ at $P < 0.0001$). Majority of LBW (62.2%) & NBW (72.8%) were belonging to income group of >Rs.15000. A significant association was found between monthly income groups and birth weight groups ($\chi^2 = 6.616$ at $P < 0.010$). In majority (89.1%) of the family, the source of income was salary. Amongst them, 92.6% of LBW and 81.9% of NBW children's family was depend on salary, whereas 18% of NBW and 7.3% of LBW children's family depend on income source was business. Highly significance association was found between source of income and birth weight groups ($\chi^2 = 15.416$ at $P < 0.000$). Higher percentage (91.6%) of LBW children and 71.4% of NBW children belong to Hindu religion whereas 8.4% of LBW and 28.6% of NBW belongs to non-Hindu religion group. Highly significant association was observed between religion groups and birthweight groups ($\chi^2 = 41.823$ at $P < 0.000$). Majority (78.5%) of LBW children and 62.8% of NBW children's family speaks Kannada. Whereas 21.4% of LBW and 37.1% of NBW children's family speaks other than Kannada as their mother tongue. Highly significant association was observed between mother tongue and birth weight ($\chi^2 = 16.732$ at $P < 0.000$).

Table 3: Mean, Standard Deviation and t-value for Anthropometric characteristics of sample under birth weight group

Birth weight Group	LBW (N ₁ =391)		NBW (N ₂ =200)		t value df=589 sig
	Mean	SD	Mean	SD	
Height in mt	111.34	4.74	117.7	4.88	-15.309** 0.0001
Weight in kg	17.38	2.26	20.87	2.67	0.005** 0.0001
BMI in (wt/mt ²)	14.00	1.502	15.04	1.65	0.310** 0.0001

Table 3 indicates the mean, standard deviation and t-value for anthropometric measurements of sample under birthweight groups. The mean score of height (111.34±4.74), weight (17.38 ±2.26), BMI (14.00±1.50) for LBW group was significantly lower (t-value= -15.309p<0.001) than that of NBW group (Height=117.7±4.88, Weight=20.87±2.67, BMI=14.00±1.50) respectively. Significant differences between birthweight groups were observed under all anthropometric measurements. This table clearly indicates that LBW children have shown significantly lower growth than NBW group.

Table 4: Mean, Standard Deviation and t value for sample under gender group

Birth weight* Gender Groups	LBW				t-value sig.	NBW				t-value sig.
	Boys (n _{b1} =200)		Girls (n _{g1} =192)			Boys (n _{b2} = 101)		Girls (n _{g2} =98)		
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Height in mt	110.6	4.21	112.1	5.121	-3.194** 0.002	118.58	4.489	116.8	5.138	2.498* 0.013
Weight in kg	17.20	2.10	17.57	2.399	-1.622 0.106	22.19	2.130	19.55	2.510	8.005** 0.000
BMI in wt/m ²	14.04	1.416	13.96	1.587	0.550 0.582	15.79	1.503	14.29	1.435	7.222** 0.000

Table 4 indicates the mean, standard deviation and t-value for anthropometric measurements of sample based on gender and birthweight groups. Within the LBW groups, the mean score of height (110.6±4.21), weight (17.20±2.10), BMI (14.04±1.41) for Boys was found to be lower than that of Girls (Height=112.1±5.121, weight=17.57±2.399, BMI=13.96±1.587). But a statistically significant difference was found between genders with regard to Height. Within NBW group, the mean score of height (118.58±4.489), weight (22.19±2.130), BMI (15.79±1.41) for Boys was found to be lower than that of Girls (Height=116.8±5.138 weight=19.55±2.510, BMI=14.29 ±1.435). A statistically significant differences was found between genders with regard to Height, weight and BMI under NBW group. This table indicates that gender of LBW has significant influence on somatic status especially on height.

Table 5: Mean, Standard Deviation, t value for Anthropometric characteristics of sample under age groups

Birth weight * Age groups	LBW				t value sig	NBW				t value sig
	6+ years (n ₁ =210)		7+ years(n ₂ =182)			6+ years (n ₃ =74)		7+ years (n ₄ =125)		
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Height in mt	110.97	4.626	111.78	4.83	-1.698 0.090	117.87	3.9881	117.66	5.377	0.298 0.766
Weight in kg	17.17	2.31	17.62	2.17	-1.987* 0.048	20.54	2.604	21.09	2.698	-1.405 0.161
BMI in wt/m ²	13.92	1.52	14.1	1.46	-1.171 0.241	14.77	1.626	15.22	1.646	-1.904 0.058

Table 5 indicates the mean, standard deviation and t value for anthropometric measurements of sample based on age groups and birthweight groups. Within the LBW groups, the mean score of height (110.9±4.62), weight (17.17±2.31), BMI (13.92±1.52) for children of 6+ years age group(n₁) found to be lower than those children of 7+years age group (Height=111.78±4.83, Weight=17.62±2.17, BMI=14.1±1.46). But statistically significant difference between age groups of LBW for weight (t=-1.987, P<0.048) was noticed. Within NBW groups, the similar results were observed between age groups i.e., higher mean score were observed for children of 7+ years age group (Height=117.6±5.37,Weight=,21.09±2.69, BMI=15.22±1.64) than that of children of 6+ years age group (Height=117.87±3.98,Weight=20.54±2.60,BMI=14.77±1.6). But statistically no significant differences were noticed between age groups within NBW groups. This table indicates that age of LBW has significant influence on somatic status especially on weight of children.

Table 6: Mean, Standard Deviation, t value for Anthropometric characteristics of sample under Class wise

Birth weight * Age groups	LBW				t value sig	NBW				t value sig
	1 st standard (n _a =167)		2 nd standard (n _b = 225)			1 st standard (n _c =60)		2 nd standard (n _d =139)		
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Height in mt	110.9	4.51	111.6	4.88	-1.622 0.102	117.2	4.15	117.9	5.16	-0.840 0.402
Weight in kg	17.14	2.23	17.54	2.26	-1.757 0.080	20.11	2.52	21.22	2.66	-2.744* 0.007
BMI in wt/m ²	13.93	1.53	14.06	1.47	0.844 0.399	14.61	1.67	15.24	1.60	-2.524 0.012

Table 6 indicates the mean, standard deviation and t value for anthropometric measurements of sample based on class and birthweight groups. Within the LBW groups, the mean score of height (110.9 ± 4.51), weight (17.14 ± 2.23), BMI (13.93 ± 1.53) for children of 1st standard (n_a) found to be lower than those children of 2nd standard (n_b) (Height= 111.6 ± 4.88 , Weight= 17.54 ± 2.26 , BMI= 14.06 ± 1.47). But statistically no significant differences were noticed between classes within LBW groups. Within NBW groups, the similar results were observed between class i.e., higher mean score were observed for children of 2nd standard (Height= 117.9 ± 5.16 , Weight= 21.22 ± 2.66 , BMI= 15.24 ± 1.60) than that of children of 1st standard (Height= 117.2 ± 4.15 , Weight= 20.11 ± 2.52 , BMI= 14.61 ± 1.67). But statistically significant difference between class of NBW for weight ($t = -2.744$, $P < 0.007$) was noticed.

Table 7a: Distribution of sample based on height for age

Birth weight Group	Height-for-age										χ^2 Value df=3 Sig.
	Normal		Mild Stunted		Moderate Stunted		Severe Stunted		Total		
	N	%	N	%	N	%	N	%	N	%	
LBW	73	18.6	132	33.7	141	36.0	46	11.7	392	66.3	1.93**
NBW	124	62.3	45	22.6	23	11.6	7	3.5	199	33.6	0.000

Table 7a indicates level of stunting among samples. As per the height-for-age classification, majority of LBW children were observed under moderate (36%) level of stunting followed by 33.7% LBW children were observed under mild level of stunting and 11.7% of them were observed under severe level of stunting. Whereas higher percentage of NBW (62.3%) children were observed under normal level. Of the remaining percentage of NBW (37.7%) children, about 22.6% of them observed under mild, 11.6% of them were observed under moderate and 3.5% of them were observed under severe level of stunting. As per chi square, highly significant association was found between birthweight groups and level of stunting ($\chi^2 = 1.93$ at $P < 0.0001$). This table indicates that higher percentage of LBW children than NBW children were observed under mild to severe level of stunting.

Table 7b: Distribution of sample based on height-for-age under gender, age, and class wise

Level of stunting		Normal		Mild		Moderate		Severe		χ^2 Value (df=3), Sig.
		N	%	N	%	N	%	N	%	
LBW	Boys	24	12.0	63	31.5	87	43.5	26	13.0	17.184**
	Girls	49	25.5	69	35.9	54	28.1	20	10.4	0.001
	6+ years	53	25.2	86	41.0	62	29.5	9	4.3	44.358**
	7+ years	20	11.0	46	25.3	79	43.4	37	20.3	0.0001
	1 st standard	40	24.0	71	42.5	51	30.5	5	3.0	32.520**
	2 nd standard	33	14.7	61	27.1	90	40.0	41	18.2	0.0001
NBW	Boys	66	65.3	23	22.8	8	7.9	4	4.0	2.767
	Girls	58	59.2	22	22.4	15	15.3	3	3.1	0.429
	6+ years	60	81.1	13	17.6	1	1.4	0	0.0	22.749**
	7+ years	64	51.2	32	25.6	22	17.6	7	5.6	0.0001
	1 st standard	45	75.0	12	20.0	2	3.3	1	1.7	8.343*
	2 nd standard	79	56.8	33	23.7	21	15.1	6	4.3	0.039

Table 6b reveals the distribution of sample based on height-for-age under gender, age and class wise groups. With regard to gender within LBW group, the higher percentage of LBW boys (88.0%) than girls (74.5%) were observed under mild (31.5% and 35.9%), moderate (43.5% and 28.1%) and severe (13.0% and 10.4%) level of stunting respectively. The higher percentage (43.5%) of LBW boys were found to be moderately stunted against to 28.1% of LBW girls. With regard to age groups within LBW group, the higher percentage of 7+ years aged LBW children (89.0%) than 6+ years aged LBW children (74.8%) were observed under mild (25.3% and 41.0%), moderate (43.4% and 29.5%) and severe (20.3% and 4.3%) level of stunting respectively. The higher percentage (43.4%) of 7+ years aged LBW children were found to be moderately stunted against to 29.5% of 6+ years aged LBW children. With regard to class wise groups within LBW group, the higher percentage of 2nd std LBW children (85.3%) than 1st std LBW children (76.0%) were observed under mild (27.1% and 42.5%), moderate (40.0% and 30.5%) and severe (18.2%

and 3.0%) level of stunting respectively. The higher percentage (40.0%) of 2nd std LBW children were found to be moderately stunted against to 30.5% of 1st std LBW children. The highly significant association between gender groups, age groups and class wise groups with regard to level of stunting among LBW was noticed.

With regard to gender within NBW group, the higher percentage of NBW boys (65.3%) than girls (59.2%) were observed under normal as per height-for-age. Equal percentage of Boys (22.8%) and Girls (22.4%) were mildly stunted within LBW group. The higher percentage girls (15.3%) were observed under moderate level of stunting against 7.9% of boys within LBW groups. But no statistically significant association was found between level of stunting and gender of LBW group. With regard to age groups within NBW group, the higher percentage of 7+ years aged NBW children (48.8%) than 6+ years aged NBW children (18.9%) were observed under mild (25.6% and 17.6%), moderate (17.6% and 1.4%) and severe (5.6% and 0.0%) level of stunting respectively. The highly significant association between age groups and level of stunting among NBW groups. With regard to class wise groups within NBW group, the higher percentage of 2nd std NBW children (43.2%) than 1st std NBW children (25.0%) were observed under mild (23.7% and 20.0%), moderate (15.1% and 3.3%) and severe (4.3% and 1.7%) level of stunting respectively. The higher percentage (23.7%) of 2nd std NBW children were found to be moderately stunted against to 3.3% of 1st std NBW children. The significant association between Class groups with regard to level of stunting among NBW was noticed.

On the whole, age, gender and class have shown the significant association with the level of stunting especially among LBW children.

Table 8a: Distribution of sample based on level of underweight

Birth weight Group	Weight-for-age										χ^2 Value df=3 Sig.
	Normal		Mild Underweight		Moderate Underweight		Severe Underweight		Total		
	N	%	N	%	N	%	N	%	N	%	
LBW	68	17.3	160	40.8	148	37.8	16	4.1	392	66.3	1.61**
NBW	134	67.3	53	26.6	12	6.0	0	0.0	199	33.6	0.000

Table 8a indicates level of underweight among samples, As per the weight for age classification, majority (40.8%) of LBW children were observed under mild level of underweight followed by 37.8% of them under moderate level and 4.1% of them were under severe level of underweight. Whereas 32.7% of NBW children were observed under mild (26.6%) and moderate (6.0%) level of underweight. As per chi-square, highly significant association was found between birth weight groups and level of underweight ($\chi^2 = 1.61$ at $P < 0.0001$). This table indicates that LBW children were found to be vulnerable for underweight.

Table 8b: Distribution of sample based on weight-for-age under gender, age and class wise

Level of Underweight		Normal		Mild		Moderate		Severe		χ^2 Value (df=3) Sig.
		No	%	No	%	No	%	No	%	
LBW	Boys	30	15.0	78	39.0	80	40.0	12	6.0	5.853
	Girls	38	19.8	82	42.7	68	35.4	4	2.1	0.119
	6+ years	55	26.2	88	41.9	59	28.1	8	3.8	31.784**
	7+ years	13	7.1	72	39.6	89	48.9	8	4.4	0.000
	1 st Standard	43	25.7	70	41.9	49	29.3	5	3.0	18.224**
	2 nd standard	25	11.1	90	40.0	99	44.0	11	4.9	0.000
NBW	Boys	89	88.1	1	1.0	11	10.9	0	0.0	40.877**
	Girls	45	45.9	42	42.9	11	11.2	0	0.0	0.000
	6+ years	56	75.7	17	23.0	1	1.4	0	0.0	6.068
	7+ years	78	62.4	36	28.8	11	8.8	0	0.0	0.480
	1 st Standard	42	70.0	15	25.0	3	5.0	0	0.0	0.328
	2 nd standard	92	66.2	38	27.3	9	6.5	0	0.0	0.849

Table 8b reveals that distribution of sample based on weight-for-age under gender, age, and class wise. Within the LBW groups, the higher percentage of LBW boys (85.0%) than LBW girls (80.2%) were under moderate level of underweight (40% and 35.4%) followed by mild (39% and 42.7%) and severe (6.0% and 2.1%) level of underweight. But no significant association was observed between genders and level of underweight in LBW children. As per age groupwise distribution, the higher percentage of 7+ years aged LBW children (92.9%) than 6+ years aged LBW children (73.8%) were under moderate level of

underweight (48.9% and 28.1%) followed by mild (39.6% and 41.9%) and severe (4.4% and 3.8%) level of underweight. A significant association ($\chi^2=31.784$, $P<0.0001$) was observed between age groups and level of underweight in LBW children. As per class wise distribution, the higher percentage of 2nd std LBW children (88.9%) than 1st std LBW children (74.3%) were under mild (40.0% and 41.9%) and moderate (44.0% and 29.3%) level of underweight followed by severe (4.9% and 3.0%) level of underweight respectively. A significant association ($\chi^2=18.224$, $P<0.0001$) was observed between class wise groups and level of underweight in LBW children.

Within NBW groups, the higher percentage of NBW girls (54.1%) than NBW boys (11.9%) were under mild level of underweight (42.9% and 1.0%) followed by moderate (11.2% and 10.9%) level of underweight respectively. A highly significant association was found between gender groups and level of underweight in NBW children. Within age groups of NBW, the higher percentage of 7+ years aged NBW children (34.7%) than 6+ years aged NBW children (24.3%) were under mild level of underweight (28.8% and 23.0%) followed by moderate (8.8% and 1.4%) level of underweight respectively. But no significant association was found between age groups and level of underweight in NBW children. Within class groups of NBW, the higher percentage of 2nd std NBW children (33.8%) than 1st std NBW children (30.0%) were under mild level of underweight (27.3% and 25.0%) followed by moderate (6.5% and 5.0%) level of underweight respectively. But no significant association was found between age groups and level of underweight in NBW children.

On the whole, age and class have shown the significant association with the level of underweight especially among LBW children.

Table 9a: Distribution of sample based on BMI interpretation under birth weight

Birth weight Group	BMI-for-age										χ^2 Value df=3 Sig.
	Normal		Mild Malnourished		Moderate Malnourished		Severe Malnourished		Total		
	N	%	N	%	N	%	N	%	N	%	
LBW	180	45.9	146	37.2	49	12.5	17	4.3	392	66.3	50.674**
NBW	149	74.9	44	22.1	6	3.0	0	0.0	199	33.6	0.0001

Table 9a indicates distribution of sample based on BMI-for-age. As per BMI-for-age-classification, majority of LBW(45.9%) and NBW(74.9%) children were under normal level. Whereas 37.2% of LBW and 22.1% of NBW were observed under mild level of malnutrition and 12.5% of LBW and 3% of NBW children were observed under moderate level of malnutrition. Only 4.3% of LBW children were observed under severe level of malnutrition. As per chi-square, highly significant association was found between birth weight groups and level of malnutrition ($\chi^2 =50.67$ at $P<0.0001$). This table indicates that the prevalence of malnutrition was higher among LBW children.

Table 9b: Distribution of samples based on BMI-for-age under age, gender and class wise

BMI-for-Age Level of Malnutrition		Normal		Mild		Moderate		Severe		χ^2 Value Df=3, Sig.
		No	%	No	%	No	%	No	%	
LBW	Boys	93	46.5	72	36.0	22	11.0	13	6.5	5.341 0.148
	Girls	87	45.3	74	38.5	27	14.0	4	2.1	
	6+ years	94	44.8	79	37.6	24	11.4	13	6.2	4.148 0.246
	7+ years	86	47.3	67	36.8	25	13.7	4	2.2	
	1 st Standard	72	43.1	66	39.5	19	11.4	10	6.0	3.026 0.388
	2 nd standard	108	48.0	80	35.6	30	13.3	7	3.1	
NBW	Boys	91	90.1	9	8.5	1	1.0	0	0.0	25.471** 0.001
	Girls	58	54.2	35	41.1	5	4.6	0	0.0	
	6+ years	57	77.0	13	17.6	4	5.4	0	0.0	3.787 0.285
	7+ years	92	73.6	31	24.8	2	1.6	0	0.0	
	1 st Standard	45	75.0	12	20.0	3	5.0	0	0.0	1.657 0.647
	2 nd standard	104	74.8	32	23.0	3	2.2	0	0.0	

Table 9b reveals distribution of samples based on gender wise, age wise and class wise under BMI-for-age interpretation. Within LBW groups, about 36% of LBW boys and 38.5% of LBW girls were mildly malnourished followed by 11% of LBW boys and 14% of LBW girls were moderately malnourished and 6.5% of LBW boys and 2.1% of LBW girls were severe malnourished. Within age groups of LBW, about 36.8% of 7+ years aged LBW children against to 37.6% of 6+ years aged LBW were mildly malnourished followed by 13.7% of 7+ years aged LBW children and 11.4% of 6+ years aged LBW children were moderately malnourished. About 6.2% of 6+ years aged LBW children against to 2.2% of 7+ years aged LBW children were seen under severe level of malnutrition. With regard to class wise distribution of LBW children, about 39.5% of 1st std LBW children against to 35.6% of 2nd std LBW children were seen under mild level followed by moderate (11.4% and 13.3%) and severe (6.0% and 3.1%) level of malnutrition. But no significant association was found between gender groups, age groups and class wise groups with level of malnutrition among LBW children.

With regard to gender wise distribution of NBW, about 41.1% of girls against to 8.5% of boys were mildly malnourished followed by 4.6% of girls and 1% of boys were moderately malnourished. Highly significant association ($\chi^2 = 25.471$ at $P < 0.0001$) was found between gender groups and level of malnutrition. With regard to age wise distribution, slightly higher percentage of 7+ years aged NBW children (24.8%) than 6+ years aged NBW children (17.6%) were seen under mild level of malnutrition followed by 1.6% of 7+ years aged and 5.4% 6+ years aged NBW children were observed under moderate level of malnutrition. With respect to class wise distribution, nearly equal percentage of 1st std and 2nd std NBW children were seen under mild (20.0% and 23.0%) and moderate (5.0% and 2.2%) level of malnutrition respectively. No significant association was found between age groups, class wise groups with level of malnutrition. This table indicates that the gender might have an influence on BMI of the LBW children.

SUMMARY

The findings of the present study are summarized in the following.

- Physical growth of LBW children were at slower rate than NBW children at school age.
- Significant differences between birth weight group for the anthropometric characteristics (Height, weight, BMI and SFT) was noticed.
- The prevalence of malnutrition was distinctively higher among school children born with LBW (Stunting=81.3%, underweight= 82.6% and Undernutrition=54.0 %) than school children born with NBW (Stunting= 37.6%, underweight=32.6% and Undernutrition=25.12 %) respectively.
- Within Low birth weight groups significant association of gender with level of stunting (Ht/Age) , Age with level of stunting (Ht/Age) and level of underweight (Wt/age), education with level of stunting (Ht/age) and level of underweight (Wt/age) was noticed. Within normal birth weight group significant association of gender with level of underweight (wt/age) and level of Undernutrition (BMI/age), age with level of stunting (Ht/age) was noticed. The significance association of education with level of stunting (Ht/age), level of Undernutrition (Wt/age) was noticed.

CONCLUSION

The study finding confirms the significant influence of birth weight on physical growth of school children. The study calls for in depth research on low birth weight children by considering the environmental factors, socio-demographic factors and interaction of all these factors on physical outcome of children.

RECOMMENDATIONS

The children born with low birth weight need preventative guidance and early intervention that might help to prevent problems associated with birth weight in children. Parents, teachers, social workers have to provide help for the individual child especially of low birth weight children. Educational awareness regarding low birth weight and its associated problems need to be given to parents and teachers so that they can manage the children effectively.

REFERENCE

1. Boardman J D, Powers D A, Padilla Y C , Hummer R A. 2002. Low birth weight, Social factors and Developmental outcomes among children in the United States, Population Research Center and Department of Sociology, University of Texas at Austin, Volume 39, Number 2.
2. Kelly YJ, Nazroo JY, McMunn A, Boreham R, Marmot M. 2001. Birthweight and behavioural problems in children: a modifiable effect? *Int J Epidemiol.* February 1;30(1):88–94.
3. Narayanamurthy MR, Siddalingappa H, Kulkarni P.2013. Prevalence and determinants of low birth weight in rural Mysore. *International Journal on Health Sciences & Res.* 2013;3(8):35-39.
4. National Family Health Survey-5, 2019-20. factsheet, Ministry of health and family welfare, Government of India, International Institute for population Sciences.
5. Ruth E.K Stein, Michele J Siagel.2006. Are children of moderately low birth weight at increased risk for poor health? A new look on old question, *Department of pediatrics Vol.118.*
6. Shah Nawaz K, .2014. Association between maternal socio-demographic factors and low birth weight new born in rural area of Bihar, India, *Department of Community Medicine, South East Asia Journal of Public Health* 4(1)
7. UNICEF and WHO .2004. *Low birth weight: country regional and global estimates*, New York, ISBN:92-806-3832-7.
8. UNICEF, (2011), *The situation of India a Profile*, United Nations children's fund, Lodhi estate, New Delhi.
9. UNICEF-WHO.(2019). *Low birth weight estimates level and trends 2000-2015.*
10. World Health Organization. 2014. *Every New Born: an action plan to end preventable deaths*, Every woman Every child, ISBN 978 92 4 150744 8.
11. World Health Organization. 2014. *WHA Global Nutrition Targets 2025: Low Birth Weight Policy Brief.*
12. World Health Rankings, *Live longer live better*, <http://www.worldlifeexpectancy.com/india-low-birth-weight>.