Anthropometric Measurments of School Children of India.

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Abstract: *A cross sectional type of study was carried out to compare nutritional status among, 6-10 years old 750 school children of three different socioeconomic statuses during January 2012- January 2013.* ***METHOD:*** *weight and height was recorded. Analysis was done using statistical software graph pad prism 5 (for ANOVA test and paired T test). ANOVA test was used to compare socioeconomic status while T test was used for comparing gender.*
RESULT*: The study revealed significantly (p < 0.05) lower heights of both male and female children of low SES compared with of high SES . Similarly, mean weight of children of low SES was significantly (p < 0.05) lower than children of middle and high SES. As expected, height and weight of both boys and girls increased with age irrespective of socioeconomic status. However increase in height and weight between 6 and 10 years ages was larger in the high SES group than in the low SES group.*
CONCLUSION:*we can conclude thatsocio-economic status is an important determinant of nutritional status of school children.*
Keywords:*SES - socioeconomic status, school children*

I.   Introduction:

Anthropometrics can be sensitive indicators of health, growth and development in infants and children. Anthropometry is the single most universally applicable, inexpensive and non-invasive method available to assess the size, proportion and composition of human body (WHO, 1995). According to WHO, the ultimate intention of nutritional assessment is to improve human health (1).The physical growth of children is reflected by different anthropometric measurements especially weight and height. The physical dimensions of the body are much influenced by nutrition in growing period of school age. Poor health and nutritional status will affect work capacity as well as cognitive functions. And it is this age group that is a dynamic period of growth and development as children undergo physical, mental, emotional and social changes. Hence, it is necessary to assess the nutritional status of this demographic group (2).Malnutrition which refers to an impairment of health either from a deficiency or excess or imbalance of nutrients is public health significance among children all over the world. Adequate food and nutrition are essential for proper growth and physical development to ensure optimal work capacity, normal reproductive performance, adequate immune reactions and resistance to infections. Inadequate diet may produce severe forms of malnutrition in children(1),.Malnutrition is still a devastating problem in certain parts of the world although proportion and absolute number of chronically under-nourished people have declined. Under-nutrition remains as a serious problem among poor families and of under-developed nations,resulting from consumption of poor diet over a long period of time (3). The basic objective of anthropometric assessment at the community level is to provide an estimate of prevalence and severity of malnutrition. Growth monitoring by anthropometric measurement during childhood and adolescent period, is not only an important health indicator but also a predictor of various morbidities in the community. Most of the attempts of generating anthropometric profile have so far focused on pre-school children and a very few have dealt with the school-going and adolescent age groups. With this background this study was conducted with the objective to assess the nutritional status of school going children by anthropometric measurements(4).

II.   Material And Methods:

The cross sectional type of study was conducted among 750 normal healthy school going children of age group 6-10 yrs belonging to different Socio economic status, over a period of one year from June 2011 to June 2012.The 6- 10 year old children from three different schools one public primary school and two private schools having tuition fees was selected randomly. They were categorized depending on per capita income of

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family using modified Prasad's socioeconomic status classification taking the AICPI for JAN 2012 i.e. 4519.52 in 3 different socioeconomic status High, Middle and Low as follows. (5)

SES GROUP	MODIFIED PRASAD'S SCALE	NO. OF SUBJECTS
HIGH SES	22281and above	250
MIDDLE SES	11140 -22280	250
LOW SES	11139 and BELOW	250
TOTAL		750

Inclusion criteria:
The normal healthy school going children of 6-10 yrs age group was included in the study. Children of low socioeconomic status were taken from public school and Children of high and middle socioeconomic status was taken from two private schools having tuition fees.

Exclusion criteria:
Children who were found physically handicapped with both lower limbs affected and their anthropometric measurement could not be recorded were excluded from study. Students whom parents did not consent were excluded from study. Children having musculoskeletal disorders like muscular dystrophies were excluded. Children above 10yrs and below 06yrs were excluded.

Withdrawal and drop out criteria:
Since the study is a cross sectional type of study, no withdrawal or drop out was needed to be defined .The parents and teachers were informed about the voluntary participation in the study and hence they had the liberty to withdraw their subjects from the study any time without any reason.

The study was approved by Ethical committee. The study was conducted after taking permission of school board. All subjects and their parents were explained about the details of study procedures to be undertaken, about risks, discomforts and benefits. patient information sheet in local language was given to parents and explained thoroughly before taking consent .Informed consent in local language as per proforma was obtained from parents / guardians of each subject and only the students whom parents will give the written consent was included in the study. Age and dates of birth were verified by school records which were based on birth certificate and the age at the time of examination was calculated. The collection of data, and measurements was done in school. Detail history, detail general and systemic examination was done to exclude the diseases. Anthropometric measurements including weight, height, was taken by standard methods. Body mass index was calculated.

All the measurements was carried out during morning hours (10:00 am to 12:00 pm) in the measuring rooms, there was not more than 5 subjects of same sex.

ANTHROPOMETRIC MEASUREMENTS:
WEIGHT:
All students were weighed in their school uniform or clothes they had worn .The weighing machine was regularly standardized with known weight. The student were instructed about the procedure. It was assured that the student removed their belts and sweaters, emptied their pockets, and stood barefooted on weighing scale which was placed on a flat, hard surface. Students were made to stand erect with both feet together without any support with the body weight equally distributed on both feet and fix their vision on a point on the opposite wall such that the plane of vision was perpendicular to their body and parallel to the ground. After zeroing the scale Weight was measured. The weight was read to the nearest 100 g (0.1 kg). Two measurements were taken in immediate succession and average value was taken. Diurnal variations (cyclical changes occurring throughout the day) in weight of about 1 kg in children and 2 kg in adults may occur. For this reason, all the measurements were carried out during morning hours (10:00 am to 12:00 pm).

Height:
For measurement of height, marking was made on the wall using measuring tape. The child was asked to stand upright , barefoot on ground with heels buttocks upper back of head making firm contact with the wall (this help the subject to stretch to his full height). The position of head should be in the Frankfort horizontal plane.

The card board was pressed firmly onto subject's head to form a right angle to the wall and the subject was asked to bend his knees slightly when he steps away so that the cardboard should not disturbed before the height was recorded. The measurement was read to the nearest 0.1 cm.

Statistical analysis: The data was entered in Microsoft excel 2007. Mean and standard deviation was calculated. Analysis was done using statistical software graph pad prism 5 (for ANOVA test and paired T test). ANOVA test was used to compare socioeconomic status while T test was used for comparing gender.
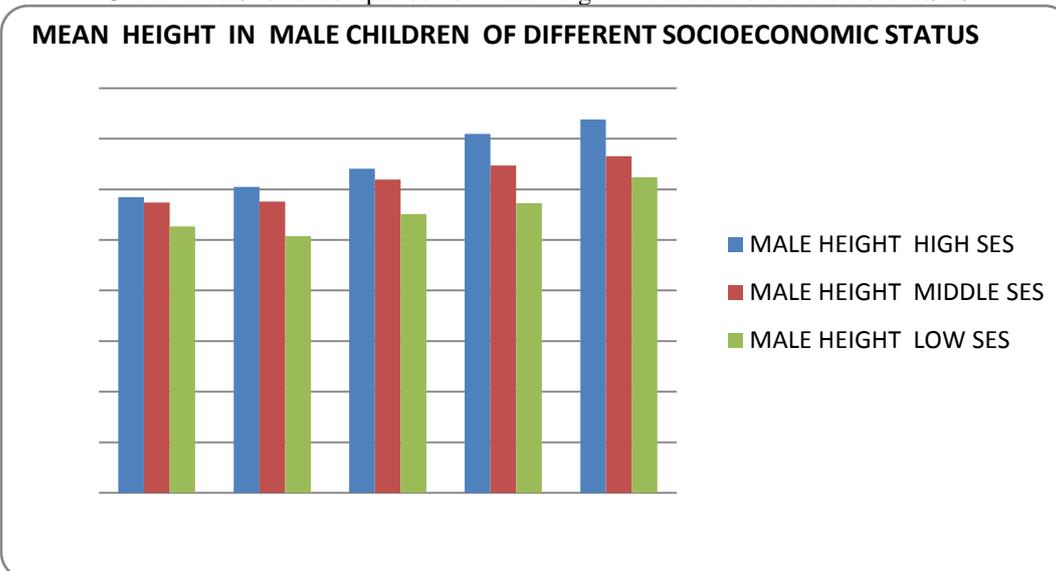
III. Resultsanddiscussion :

According to modifiedprasad's socioeconomic statuses., Total 750 students were selected. Out of which 250 students were of High SES, 250 students were of middle SES & 250 students were of low socioeconomic status.

The Age group 6 years include students of age 6 years to 6years 11 months & 29 days .The students of completed 7 years were included in 7 year group& the same pattern was followed for all class intervals for age group.

Table 1: Showing comparison of height in male children of different SES

Age	SES	MALE HT		F value	p value	Significance
		Mean	SD			
6 year	High SES	1.175	0.05628	36.73	<0.0001	HS
	Middle SES	1.148	0.05364			
	Low SES	1.053	0.04869			
7 year	High SES	1.212	0.05625	71.12	<0.0001	HS
	Middle SES	1.152	0.04048			
	Low SES	1.015	0.07698			
8 year	High SES	1.282	0.02340	112.1	<0.0001	HS
	Middle SES	1.239	0.06454			
	Low SES	1.102	0.03440			
9 year	High SES	1.419	0.01706	185.3	<0.0001	HS
	Middle SES	1.294	0.04454			
	Low SES	1.145	0.07309			
10 year	High SES	1.476	0.05106	169.6	<0.0001	HS
	Middle SES	1.331	0.04295			
	Low SES	1.248	0.03793			

GRAPH 1: Shows comparison of mean height in male children in different SES

MEAN HEIGHT IN MALE CHILDREN OF DIFFERENT SOCIOECONOMIC STATUS

- MALE HEIGHT HIGH SES
- MALE HEIGHT MIDDLE SES
- MALE HEIGHT LOW SES

TABLE 2: Showing comparison of height in female children of different SES

Age	SES	FEMALE HT		F value	p value	Significance
		Mean	SD			
6 year	High SES	1.192	0.05577	13.11	<0.0001	HS
	Middle SES	1.168	0.05190			
	Low SES	1.116	0.05370			
7year	High SES	1.242	0.08232	19.42	<0.0001	HS
	Middle SES	1.170	0.04523			
	Low SES	1.120	0.07667			
8year	High SES	1.287	0.03010	49.94	<0.0001	HS
	Middle SES	1.243	0.07598			
	Low SES	1.139	0.04425			
9year	High SES	1.422	0.02803	95.01	<0.0001	HS
	Middle SES	1.344	0.05715			

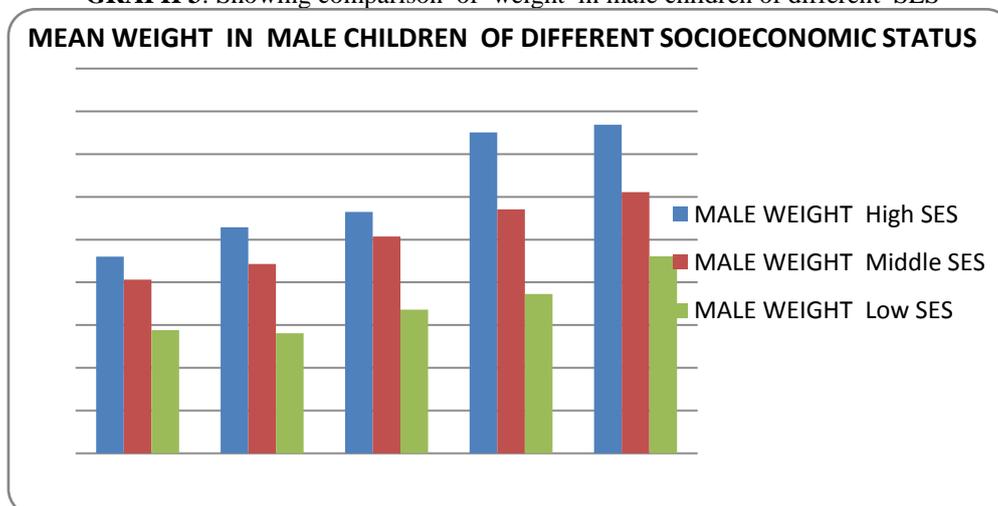| Age	SES					
	Low SES	1.198	0.07840			
10year	High SES	1.489	0.03551	135.1	<0.0001	HS
	Middle SES	1.374	0.04583			
	Low SES	1.280	0.05184			

GRAPH 2: Showing comparison of height in female children of different SES
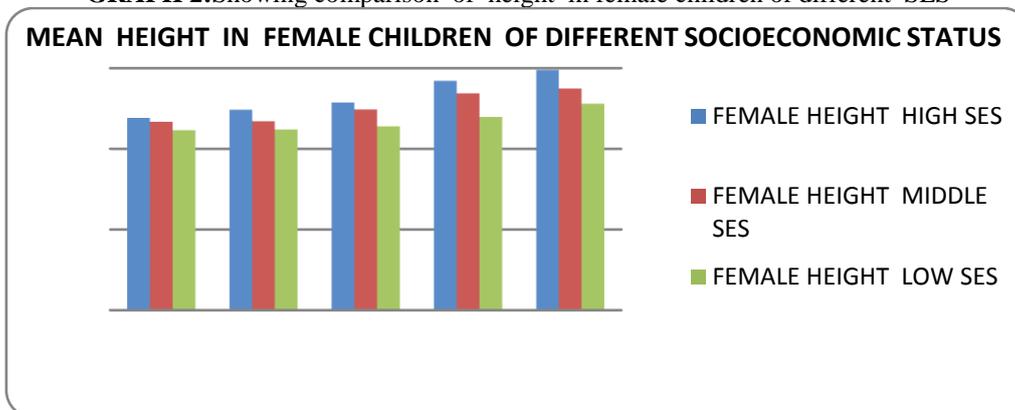
TABLE 3: Showing comparison of weight in male children of different SES.

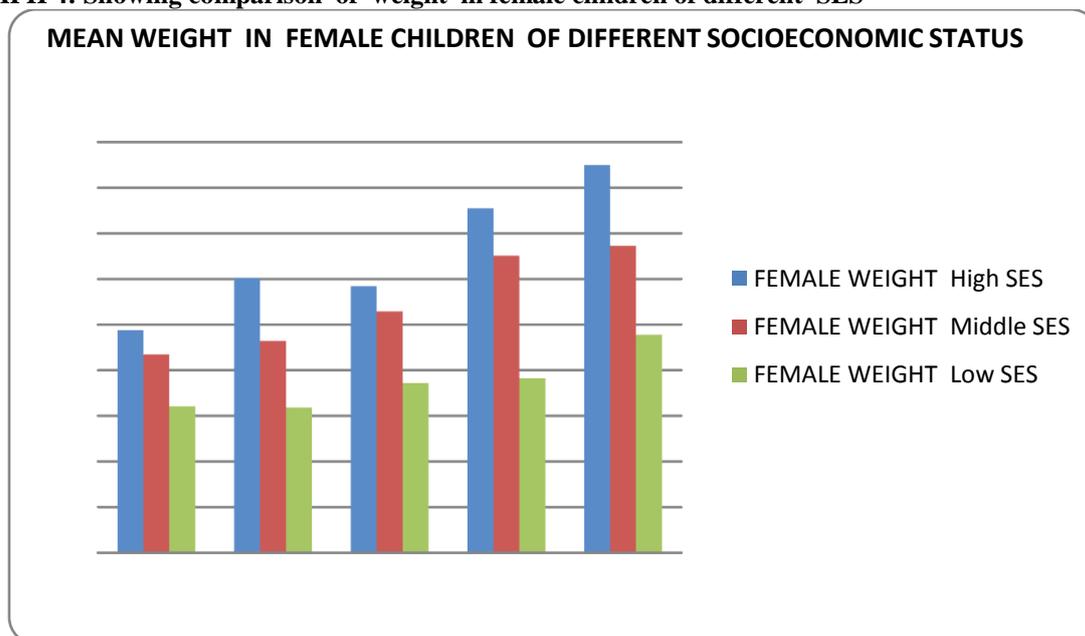| Age	SES	MALE WT			P value	Significance
		MEAN	SD			
6 year	High SES	23	5.058	29.76	<0.0001	HS
	Middle SES	20.32	3.997			
	Low SES	14.40	2.693			
7 year	High SES	26.44	5.229	53.27	<0.0001	HS
	Middle SES	22.16	4.488			
	Low SES	14.04	2.894			
8 year	High SES	28.24	2.905	60.56	<0.0001	HS
	Middle SES	25.36	4.563			
	Low SES	16.80	3.819			
9 year	High SES	37.52	3.721	74.31	<0.0001	HS
	Middle SES	28.52	5.628			
	Low SES	18.64	6.670			
10 year	High SES	38.44	5.501	51.34	<0.0001	HS
	Middle SES	30.56	4.682			
	Low SES	23.04	5.870			

GRAPH 3: Showing comparison of weight in male children of different SES

TABLE 4: Showing comparison of weight in female children of different SES

Age	SES	FEMALE WT			p value	Significance
		Mean	SD			
6 year	High SES	24.40	4.031	28.42	<0.0001	HS
	Middle SES	21.72	3.553			
	Low SES	16.04	4.383			
7 year	High SES	30.12	5.761	56.71	<0.0001	HS
	Middle SES	23.20	4.690			
	Low SES	15.92	3.390			
8 year	High SES	29.20	2.693	52.94	<0.0001	HS
	Middle SES	26.44	4.510			
	Low SES	18.60	3.905			
9 year	High SES	37.76	3.833	83.55	<0.0001	HS
	Middle SES	32.56	6.507			
	Low SES	19.12	5.102			
10 year	High SES	42.48	4.417	76.28	<0.0001	HS
	Middle SES	33.64	7.228			
	Low SES	23.88	3.655			

GRAPH 4: Showing comparison of weight in female children of different SES

MEAN WEIGHT IN FEMALE CHILDREN OF DIFFERENT SOCIOECONOMIC STATUS

FEMALE WEIGHT High SES
FEMALE WEIGHT Middle SES
FEMALE WEIGHT Low SES

Table 8: Shows age &genderwise distribution of mean height in different SES.

Age	SES		MALE HT	FEMALE HT	T value	P value	Significance
6 year	High	MEAN	1.175	1.192	1.110	0.2781	NS
		SD	0.05628	0.05577			
	Middle	MEAN	1.148	1.168	1.282	0.2120	NS
		SD	0.05364	0.05190			
	Low	MEAN	1.053	1.116	3.592	0.0015	S
		SD	0.0868	0.05370			
7 year	High	MEAN	1.212	1.242	1.495	0.1479	NS
		SD	0.05625	0.08232			
	Middle	MEAN	1.152	1.170	1.469	0.1548	NS
		SD	0.04048	0.04523			
	Low	MEAN	1.015	1.120	5.731	<0.0001	HS
		SD	0.07698	0.07667			
8 year	High	MEAN	1.282	1.287	0.8394	0.4095	NS
		SD	0.02340	0.03010			
	Middle	MEAN	1.239	1.243	2.423	0.0233	S
		SD	0.06454	0.07598			
	Low	MEAN	1.102	1.139	3.645	0.0013	S
		SD	0.03440	0.04425			
9 year	High	MEAN	1.419	1.422	0.4811	0.6348	NS

		SD	0.01706	0.02803			
	Middle	MEAN	1.294	1.344	37.76	0.8290	NS
		SD	0.04454	0.05715			
	Low	MEAN	1.145	1.198	3.067	0.0053	S
		SD	0.07309	0.07840			
10 year	High	MEAN	1.476	1.489	0.7878	0.4385	NS
		SD	0.05106	0.03551			
	Middle	MEAN	1.331	1.374	4.084	0.004	S
		SD	0.04295	0.04583			
	Low	MEAN	1.248	1.280	3.222	0.0036	S
		SD	0.03793	0.05184			

Table 9: Shows age &genderwise distribution of mean weight in different SES

Age	SES		MALE WT	FEMALE WT	T value	P value	Significance
6 year	HIGH	MEAN	23	24.40	1.106	0.2798	NS
		SD	5.058	4.031			
	MIDDLE	MEAN	20.32	21.72	1.249	0.2238	NS
		SD	3.997	3.553			
	LOW	MEAN	14.40	16.04	2.095	0.0469	S
		SD	2.693	4.383			
7 year	High	MEAN	26.44	30.12	2.126	0.0440	S
		SD	5.229	5.761			
	Middle	MEAN	22.16	23.200	0.8331	0.4130	NS
		SD	4.488	4.690			
	Low	MEAN	14.04	15.92	2.235	0.0350	S
		SD	2.894	3.390			
8 year	High	MEAN	28.24	29.20	1.490	0.1492	NS
		SD	2.905	2.693			
	Middle	MEAN	25.36	26.44	0.8742	0.3907	NS
		SD	4.563	4.510			
	Low	MEAN	16.80	18.60	1.75	0.0927	NS
		SD	3.819	3.905			
9 year	High	MEAN	37.52	37.76	0.2184	0.8209	NS
		SD	3.721	3.833			
	Middle	MEAN	28.52	32.56	3.035	0.0057	S
		SD	5.628	6.507			
	Low	MEAN	18.64	19.12	0.2960	0.7698	NS
		SD	6.670	5.102			
10 year	High	MEAN	38.44	42.48	2.456	0.0216	S
		SD	5.501	4.417			
	Middle	MEAN	30.56	33.64	2.398	0.0246	S
		SD	4.682	7.228			
	Low	MEAN	23.04	23.88	0.7715	0.4480	NS
		SD	5.870	3.655			

IV. Discussion:

Malnutrition is still a devastating problem in certain parts of the world although proportion and absolute number of chronically under-nourished people have declined. Under-nutrition remains as a serious problem among poor families and of under-developed nations, resulting from consumption of poor diet over a long period of time. Since children at primary school age are in active growth period, deficiency of protein and energy would lead to failure of growth in terms of weight and height. According to WHO criteria, 52% of young children in under-developed countries are considered normal, while 48% of them are malnourished and 10% of them are severely malnourished. Assessment of nutritional status of a patient is important and approach of nutritional assessment involves anthropometric observations, biochemical tests, clinical observations and diet evaluation. However, individual nutritional status has been reported to vary on the basis of person's living conditions, available food supply, health and socio-economic status.(3)

Considering the height, and weight, as indicators of growth, Present study was carried out to determine the growth and nutritional status of children of low, middle and high socio-economic status among 6-10 years old   750 school children of three different socioeconomic status, 250 students in each high middle and low SES .Out of total 750 (100%) students 50% (375) were males and 50% (375) were females, and 20%(150) students in each 6, 7, 8, 9,and 10 years age groups, considering the height, and weight, as indicators of growth.

Similar age group was selected and studied by Muhammad Akhteret al in 2001(3),Raheela M.A. Mian in 2002 et al(6),Pushpa Bharati1 etal in 2005 (2), Iris.Groeneveld in 2007(7), ,Mukherjee and chaturvedi et al in 2008 (8)Amuta, Elizabeth Une et al in 2009(1), S.C. Jai Prabhakar and M.R. Gangadhar in 2009(9)et al(9) Joshi HS , Gupta R et al in 2011(10),

In present study mean weight varied from 23-38.44; 20.32-30.56 ; and 14.40-23.04 in boys of High middle and low socioeconomic statuses respectively. and 24.40-42.48; 21.72-33.64 , and 16.04 - 23.88 ; in girls of high ; middle and low socioeconomic statuses respectively. As expected, weight of both boys and girls increased with age irrespective of socioeconomic status. However increase in weight between 6 and 10 years ages was larger in the high SES group than in the low SES group.

The mean weights of all age group children both boys and girls of low SES was significantly lower (p = <0.0001) than that of middle and high SES of children .while it was lower in children of middle than of high SES.

In all age groups, and in all socioeconomic classes girls had higher weight than boys however it was statistically significant in 6 year (low SES), 7year (high and low SES), 9years (middle SES) and 10 years (high and middle SES) age groups only.

The possible reason may be because of lower level of activity in girls than boys, as girls remain most of the time at homes and invariably found more opportunities to eat various foods compared to boys.(11)

This result was in line with results from studies done in India and other parts of globe that showed that female gender are at risk of overweight and obese. (11)

Our study agree with study done by M**uhammad S. Akhtar and NighatBhatty in 2001** (3)Theyreported that**t**he weight of children (both male and female) was significantly lower in children of low SES than children of middle and high SES, while it was lower in children of middle than of high SES .They also reported that an increase appears in weight with increase in SES, however, the increase in weight of females is relatively higher than males with respect to increase on per year basis.

Similarly Iris.Groeneveld2007 (7) also observed that the mean weights Of all age group children both boys and girls of low SES was significantly lower (p = <0.0001) than that of high SES of children. And weight of both boys and girls increased with age irrespective of socioeconomic status..

Similarly present study agree with **FataiAdesinaMaruf PT et al In 2011** (11) They observed that both male and female children in private school (High SES) had significantly higher weights (p<0.05) than public school children.(low SES)

In present study mean height varied from **1.175-1.476**; **1.148-1.331**; and **1.053-1.248 in** boys of High middle and low socioeconomic statuses respectively. and **1.192-1.489**; **1.168-1.374**, and **1.116- 1.280**; in girls of high ; middle and low socioeconomic statuses respectively. As expected, height of both boys and girls increased with age irrespective of socioeconomic status. However increase in height between 6 and 10 years ages was larger in the high SES group than in the low SES group.

The mean heights Of all age group children both boys and girls of low SES was significantly lower (p = <0.0001) than that of middle and high SES of children of same age and sex .while it was lower in children of middle than of high SES.

In all age groups and in all socioeconomic classes girls had a higher height than boys .however it was statistically significant in low socioeconomic status children of all age groups and In 8 years (middle SES) and 9 years (middle SES) children.

Among poor families, females are more likely than are males to drop out of school. As a consequence, there will be a higher percentage of males than of females from poor families attending school, which could explain the higher mean weight and mean height in female children than male children of low SES as present study was among school children.

This finding was in agreement with most of studies Mohammad S Akhter in 2001(3),Raheela M.A. Mian in 2002 et al (6) AntónioPrista, José AntónioRibeiro Maia et al in 2003 (13)Pushpa Bharati1 etal in 2005 (2) Iris.Groeneveld in 2007(7), Mukherjee and chaturvedi (2008) et al(8) Joshi HS , Gupta R et al in 2011(10),Amuta, Elizabeth Unein 2009(1), Akor Francis, OkoloSeline et al in 2010 (14) observed that, height of both boys and girls increased with age irrespective of socioeconomic status. The mean heights Of all age group children both boys and girls of low SES was significantly lower (p = <0.0001) than that of middle and high SES of children of same age and sex .

Similarly present study agree with **FataiAdesinaMaruf PT et al in 2011 (12)** observed that both male and female children in private school (High SES) had significantly higher heights (p<0.05) than public school children. (low SES) .

V. Conclusion:

From results of present study we can conclude that there was presence of the double burden of malnutrition at the population level. Those who were belonging to low SES are at risk for under-nutrition, while those who belonged to high socio-economic status are relatively more likely to be over-nourished .

In low SES chronic malnutrition and deprivation at the household level is major nutritional problems; it was reflected in the low values of height and weight in children,.

Sustainable intervention based on recuperation of ancient techniques of local food production and preservation, nutritional programstargeting school children and nutritional education for the school children their parents and teachers should be aimed at preventing and solving major nutritional problems .

Acknowledgements

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