

Co-existence of undernutrition and obesity: A cross sectional study among girls and boys below 20 years of age

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ABSTRACT

In developing countries, nutritional transition is going on, and because of it, dual burden of malnutrition is common phenomenon; which can be defined as co-existence of under and over nutrition. The aim of the present study was to assess the level and extent of undernutrition and obesity among the boys and girls of Hathin block, district Palwal, Haryana. A cross sectional study was conducted on a total of 2558 individuals; consisting of 1284 boys and 1274 girls aged 0 to 20 years. The nutritional status was assessed using anthropometric indicators viz. body weight, height and body mass index (BMI), Z score for weight, Z score for height and Z score for BMI. It was found that 4.8% boys and 4.6% girls were underweight, 6.8% boys and 6.3% girls were stunting, 3.5% girls and boys were undernourished whereas 1.5% boys and 1.9% girls were overweight, 2.2 % girls and boys were obese. During early childhood underweight (5.6% boys and 7% girls) and stunting (6.9% boys 7% girls) was higher than >5 years of age. Among children below 5 years of age, a total of 4.4% boys and 3.3% girls were underweight and 6% boys and 6.8% girls were stunting. The study concludes that there is dual burden of malnutrition and it is a serious problem.

Key word: obesity, underweight, stunting, undernourished and Body Mass Index (BMI).

INTRODUCTION

The dual burden of malnutrition is undernutrition, including micronutrient deficiencies, coexisting with overnutrition (overweight and obesity). Malnutrition refers to nutritional deficiencies of macronutrients and micronutrients as well as excesses (WHO 1995). Undernutrition is the result of insufficient intake, poor absorption, and poor biological use of the nutrients. This can result in impaired body functions, impaired growth, and underweight. Overnutrition is the result of excess or imbalanced nutrient intakes, which can result in impaired body functions, as well as overweight and obesity.

Malnutrition represents a set of adverse health outcomes that are caused by imbalances in diet and their interactions with infection. The situation is getting more serious in developing countries because of coexistence of undernutrition and obesity as well as rapid increase in proportion of overweight during the past 30 years. Overnutrition as an overweight and obesity is responsible for non-communicable chronic diseases such as diabetes, high blood pressure and coronary heart disease.

Malnutrition, in every form, presents significant threats to human health. Today the world faces a dual burden of malnutrition that includes both undernutrition and overweight, especially in developing countries. Hunger and inadequate nutrition contribute to early deaths for mothers, infants and young children, and impaired physical and brain development in the young one. At the same time, growing rates of overweight and obesity worldwide are linked to a rise in chronic diseases such as cancer, cardiovascular disease and diabetes which are life-threatening and very difficult to treat in places with limited resources and already overburdened health systems.

According to world health organization “Undernutrition contributes to about one third of all child deaths, 104 million children worldwide were underweight, 171 million children were stunting under age 5 years, and 13 million children are born with low birth weight or prematurely due to maternal undernutrition and other factors. Maternal undernutrition is common in many developing countries, leads to poor fetal development and higher risk of pregnancy complications together, maternal and child undernutrition account for more than 10 percent of the global burden of disease. According to 2008 figures 1.5 billion people are overweight worldwide, of whom 500 million are obese, and 43 million children under age 5 were overweight in 2010. Worldwide, at least 2.6 million people die each year as a result of

being overweight or obese". Growing rates of maternal overweight are leading to higher risks of pregnancy complications, and heavier birth weight and obesity in children.

Undernutrition continues to be the principal cause of ill-health and premature mortality and morbidity among children living in developing countries (Nandy et al. 2005). It has been estimated that approximately 70% of the world's malnourished children live in Asia, giving that region the highest concentration of worldwide childhood malnutrition (Khor 2005). Poverty is considered to be a major underlying cause of such wide spread undernutrition (Ramachandran 2007).

In India, given its large population size and widespread poverty, a majority of individuals are undernourished and underprivileged (Ramachandran 2007). Moreover, India shows the highest occurrence of childhood undernutrition in the world (Bamji 2003) and it has been estimated that more than half of Indian children are undernourished (Measham and Chatterjee 1999). A sizeable number of these studies are on the assessment of nutritional status pertaining to children. Many studies have also pointed out to many socio-economic and socio-demographic variables that can play significant roles in the prevalence of undernutrition (Hien and Kam 2008). Such variables include family size, number of siblings, residence, family income and education.

India is undergoing a rapid socio-economic, demographic and nutritional and health transition. Although it has not yet overcome the problems of poverty, undernutrition and communicable diseases, it is increasingly facing additional challenges related to the affluence that results from industrialization and urbanization. In country like India there are problems of undernutrition as well as overweight and obesity, the problem has been growing especially since last two decades. At one end there are poor people they do not have access to sufficient food. On the other side elite people have excess intake of food resulting in to obesity.

The aim of the study was to assess the extent and level of undernutrition as well as overweight and obesity by a cross sectional survey among girls and boys of 0-20 years of age residing in the rural areas of a administrative block known as Hathin in district Palwal of Haryana (India).

MATERIAL AND METHODOLOGY

Present study is based on a cross sectional survey conducted on a total of 2558 individuals (1284 boys and 1274 girls) of 0 to 20 years of age. Random sampling method was used for

the selection of the sample. The anthropometric measurements were taken during summer and winter of the years 2014. The sample for the present study was collected from 15 villages 16 Educational Institutions, 2 hospitals and 30 Aganwadi centers (AWC) of a block Hathin, district Palwal of Haryana. As the samples were drawn from the schools, AWC and hospital prior written consent was obtained from District Education Officer (DEO), Chief Medical Officer (CMO), and District project Officer (DPO), Block Education Officer (BEO), Supervisor of AWC and the Principle/Head Master/Mistress of schools. Due consideration were given for compliance of ethical guideline as per Helsinki declaration 2000.

The nutritional status was assessed using anthropometric indicators viz. body weight, height/length, Body mass index (BMI) and Z score for weight, height, BMI. Anthropometric measurements (body weight and height/Stature/length) were taken on each child following the standard procedure as described by Lee and Nieman (2007). The measurements were taken with all possible caution maintaining uniformity and accuracy in the techniques, after undergoing extensive training. Portable digital weighing scale and anthropometer rod were used to measure the various anthropometric measurements. A semi-structured schedule was used to collect the information about socio-economic status and family background. The severity of malnutrition was assessed by utilizing the z-score. Subjects with z-score -2 were classified as suffering from low height-for-age (stunting), low weight-for-age (underweight) and low BMI-for-age (undernourished or thinness), -1 to 2 SD were classified as Normal weight, height and BMI, >2 SD were classified as overweight and obese. All the analyses were done using MS-Excel and SPSS (trial version) software.

RESULTS

It is evident from Table 1 that majority (92-94%) of subject have normal body weight and height but 4.8% boys and 4.6% girls were underweight, 6.8% boys and 6.3% girls were stunted, 3.5% girls and boys were undernourished, simultaneously 1.5% boys and 1.9% girls were overweight, 2.2 % girls and boys were obese. During early childhood underweight (5.6% boys and 7% girls) and stunting (6.9% boys 7% girls) was higher than >5 years of age are 4.4% boys and 3.3% girls were underweight and 6% boys and 6.8% girls were stunting. Whereas overweight (1.1% boys 0.5% girls) was lower than >5 years of age (1.7% boys 2.6% girls).

Table.1 Nutritional status among boys and girls of 0 to 20 years of age.

Level of Nutrition	below 4 years of age				Above 5 years of age				Over all			
	Boys		Girls		Boys		Girls		Boys		Girls	
	N	%	N	%	N	%	N	%	N	%	N	%
Weight for age												
Underweight	25	5.6	30	7.0	37	4.4	28	3.3	62	4.8	58	4.6
Normal weight	413	93.2	395	92.5	789	93.9	796	94.1	1202	93.7	1191	93.6
Overweight	5	1.1	2	0.5	14	1.7	22	2.6	19	1.5	24	1.9
Total	443	100	427	100	840	100	846	100	1283	100	1273	100
Height for age												
Stunted	19	6.9	19	7.0	57	6.8	51	6.0	76	6.8	70	6.3
Normal height	251	91.6	251	92.3	778	92.6	785	92.8	1029	92.4	1036	92.7
Tall	4	1.5	2	0.7	5	0.6	10	1.2	9	0.8	12	1.1
Total	274	100.0	272	100	840	100	846	100	1114	100	1118	100
BMI for age												
Undernourished	14	5.1	17	6.3	25	3.0	33	3.9	39	3.5	39	3.5
Normal	253	92.3	250	91.9	797	94.9	797	94.2	1050	94.3	1050	94.3
Obese	7	2.6	5	1.8	18	2.1	16	1.9	25	2.2	25	2.2
Total	274	100	272	100	840	100	846	100	1114	100	1114	100

Impact of Parents' education on nutritional status of their children: In the present study, it was found that education of mothers have positive impact on nutritional status of boys and girls. It is evident from Table 2 and Figure 1 that 81.5% underweight, 83.7% stunted, 84.7% undernourished, 69.2% overweight and 65.1% obese were offspring of poorly educated or illiterate mothers; whereas only 1 to 2 % was underweight, stunted, undernourished and 15.1% overweight and 9.3% obese were offspring of higher secondary and above educated mothers. It is apparent that as education level of mothers has increased, the percentage of undernourished, overweight and obese had declined.

Table 2. Impact of mothers education

Nutritional status	Educational status of Mothers'	Boys		Girls		Total	
		N	%	N	%	N	%
Under weight	Illiterate	53	81.5	48	81.4	101	81.5
	Primary	6	9.2	4	6.8	10	8.1
	Middle and high school	5	7.7	6	10.2	11	8.9
	Higher secondary and above	1	1.5	1	1.7	2	1.6
	Total	65	100.0	59	100.0	124	100.0
Stunted	Illiterate	69	86.3	59	80.8	128	83.7
	Primary	6	7.5	4	5.5	10	6.5
	Middle and high school	5	6.3	9	12.3	14	9.2
	Higher secondary and above	0	0.0	1	1.4	1	0.7
	Total	80	100.0	73	100.0	153	100.0

Undernourished	Illiterate	31	86.1	41	83.7	72	84.7
	Primary	3	8.3	2	4.1	5	5.9
	Middle and high school	2	5.6	5	10.2	7	8.2
	Higher secondary and above	0	0.0	1	2.0	1	1.2
	Total	36	100.0	49	100.0	85	100.0
Overweight	Illiterate	11	57.9	16	80.0	27	69.2
	Primary	5	26.3	1	5.0	6	15.4
	Middle and high school	3	15.8	3	15.0	6	15.4
	Total	19	100.0	20	100.0	39	100.0
Obese	Illiterate	13	59.1	15	71.4	28	65.1
	Primary	4	18.2	3	14.3	7	16.3
	Middle and high school	4	18.2	0	0.0	4	9.3
	Higher secondary and above	1	4.5	3	14.3	4	9.3
	Total	22	100.0	21	100.0	43	100.0

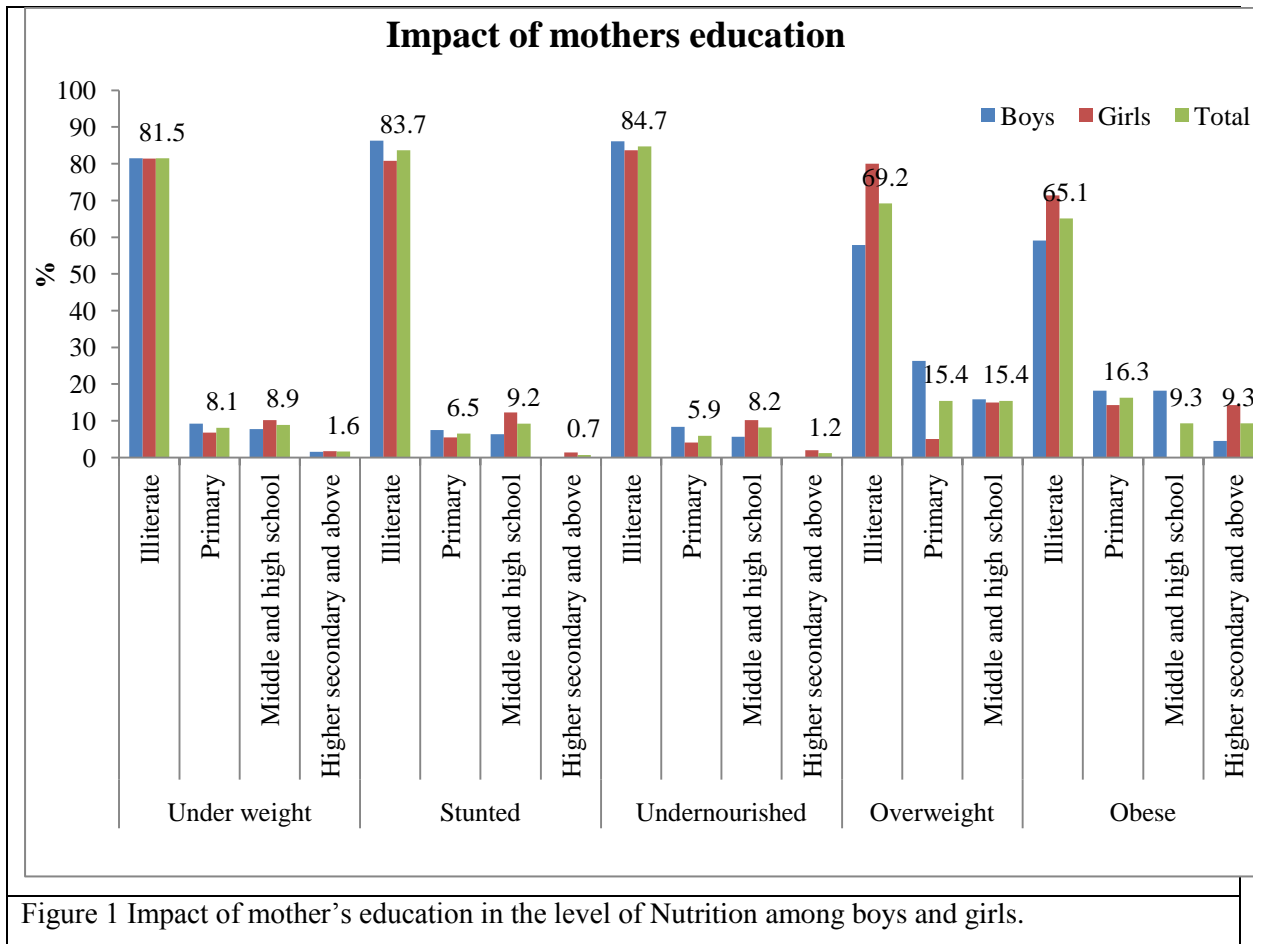
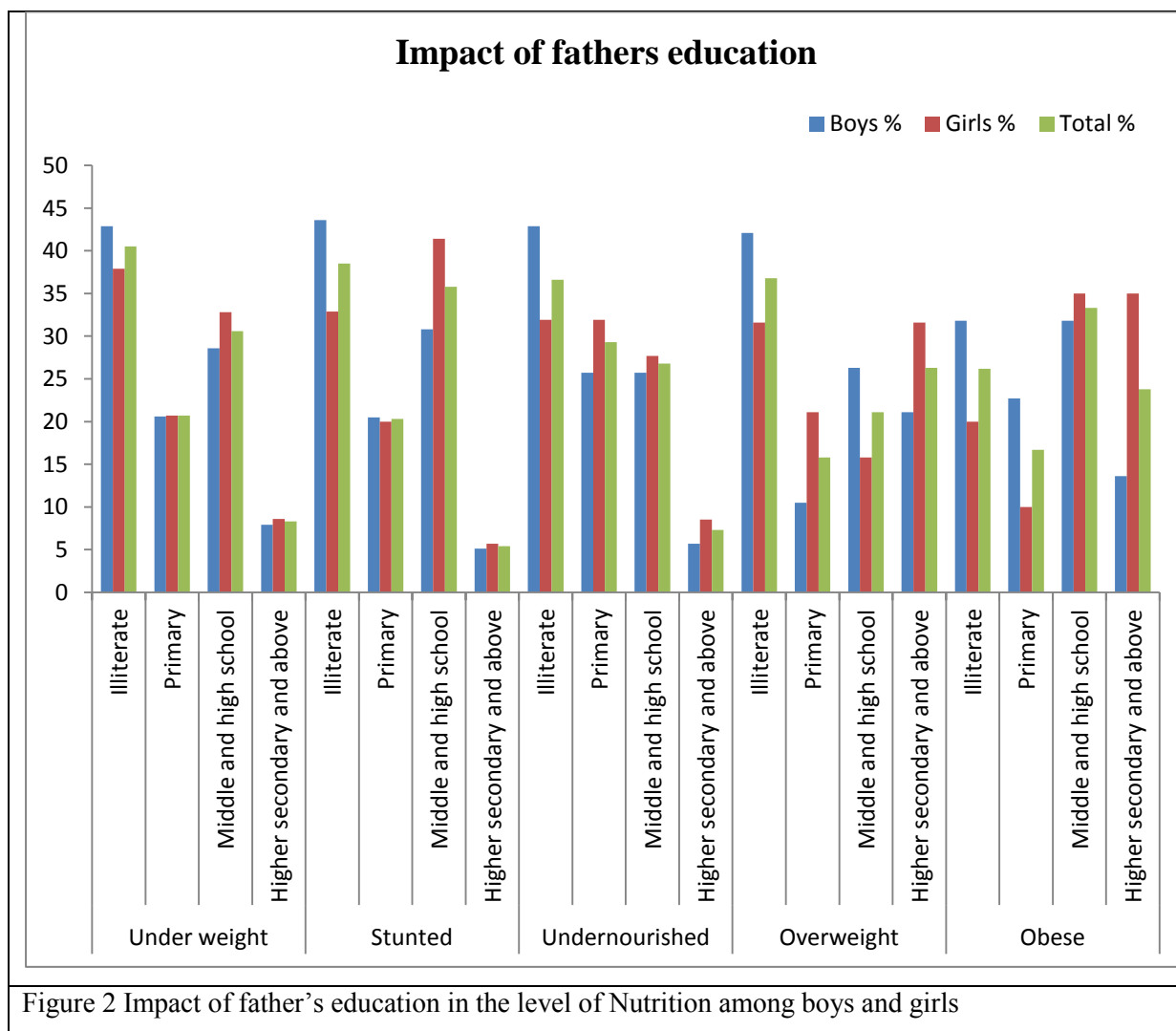


Figure 1 Impact of mother’s education in the level of Nutrition among boys and girls.

Table 3 and figure 2 shows the impact of fathers’ education on nutritional status of their children. It was found that 40.5% underweight, 38.5% stunted, 36.6% undernourished, 36.8% overweight and 26.2% obese were offspring of illiterate fathers’. As education level of

Fathers has increased percentage of undernourished, overweight and obese had declined. Fathers' education level has also found to have positive impact on nutritional status of boys and girls.

Nutritional status	Educational status of father	Boys		Girls		Total	
		N	%	N	%	N	%
Under weight	Illiterate	27	42.9	22	37.9	49	40.5
	Primary	13	20.6	12	20.7	25	20.7
	Middle and high school	18	28.6	19	32.8	37	30.6
	Higher secondary and above	5	7.9	5	8.6	10	8.3
	Total	63	100.0	58	100.0	121	100.0
Stunted	Illiterate	34	43.6	23	32.9	57	38.5
	Primary	16	20.5	14	20.0	30	20.3
	Middle and high school	24	30.8	29	41.4	53	35.8
	Higher secondary and above	4	5.1	4	5.7	8	5.4
	Total	78	100.0	70	100.0	148	100.0
Undernourished	Illiterate	15	42.9	15	31.9	30	36.6
	Primary	9	25.7	15	31.9	24	29.3
	Middle and high school	9	25.7	13	27.7	22	26.8
	Higher secondary and above	2	5.7	4	8.5	6	7.3
	Total	35	100.0	47	100.0	82	100.0
Overweight	Illiterate	8	42.1	6	31.6	14	36.8
	Primary	2	10.5	4	21.1	6	15.8
	Middle and high school	5	26.3	3	15.8	8	21.1
	Higher secondary and above	4	21.1	6	31.6	10	26.3
	Total	19	100.0	19	100.0	38	100.0
Obese	Illiterate	7	31.8	4	20.0	11	26.2
	Primary	5	22.7	2	10.0	7	16.7
	Middle and high school	7	31.8	7	35.0	14	33.3
	Higher secondary and above	3	13.6	7	35.0	10	23.8
	Total	22	100.0	20	100.0	42	100.0



Family income and nutritional status: To understand the role of income of family on the nutritional status of children, the analysis was performed. The findings are presented in the Table 4 and Figure 3. It is apparent that approximately 50 % underweight, stunted, undernourished and 41% overweight, 32.6% obese were from poor families having family income below rupee five thousand per month.

Table 4. Family income and nutritional status

Nutritional status	Monthly Income (in thousands)	Boys		Girls		Total	
		N	%	N	%	N	%
Under weight	< 3	11	19.6	6	12.8	17	16.5
	3-5	18	32.1	19	40.4	37	35.9
	6-8	15	26.8	14	29.8	29	28.2
	9-15	11	19.6	8	17.0	19	18.4
	>15	1	1.8	0	0.0	1	1.0
Total		56	100.0	47	100.0	103	100.0

Stunted	< 3	13	16.3	6	8.1	19	12.3
	3-5	29	36.3	38	51.4	67	43.5
	6-8	22	27.5	14	18.9	36	23.4
	9-15	12	15.0	14	18.9	26	16.9
	>15	4	5.0	2	2.7	6	3.9
	Total	80	100.0	74	100.0	154	100.0
Undernourished	< 3	5	13.9	7	14.3	12	14.1
	3-5	14	38.9	18	36.7	32	37.6
	6-8	11	30.6	16	32.7	27	31.8
	9-15	5	13.9	8	16.3	13	15.3
	>15	1	2.8	0	0.0	1	1.2
	Total	36	100.0	49	100.0	85	100.0
Overweight	< 3	2	10.5	1	5.0	3	7.7
	3-5	5	26.3	8	40.0	13	33.3
	6-8	6	31.6	3	15.0	9	23.1
	9-15	5	26.3	8	40.0	13	33.3
	>15	1	5.3	0	0.0	1	2.6
	Total	19	100.0	20	100.0	39	100.0
Obese	< 3	1	4.5	1	4.8	2	4.7
	3-5	4	18.2	8	38.1	12	27.9
	6-8	11	50.0	6	28.6	17	39.5
	9-15	5	22.7	4	19.0	9	20.9
	>15	1	4.5	2	9.5	3	7.0
	Total	22	100.0	21	100.0	43	100.0

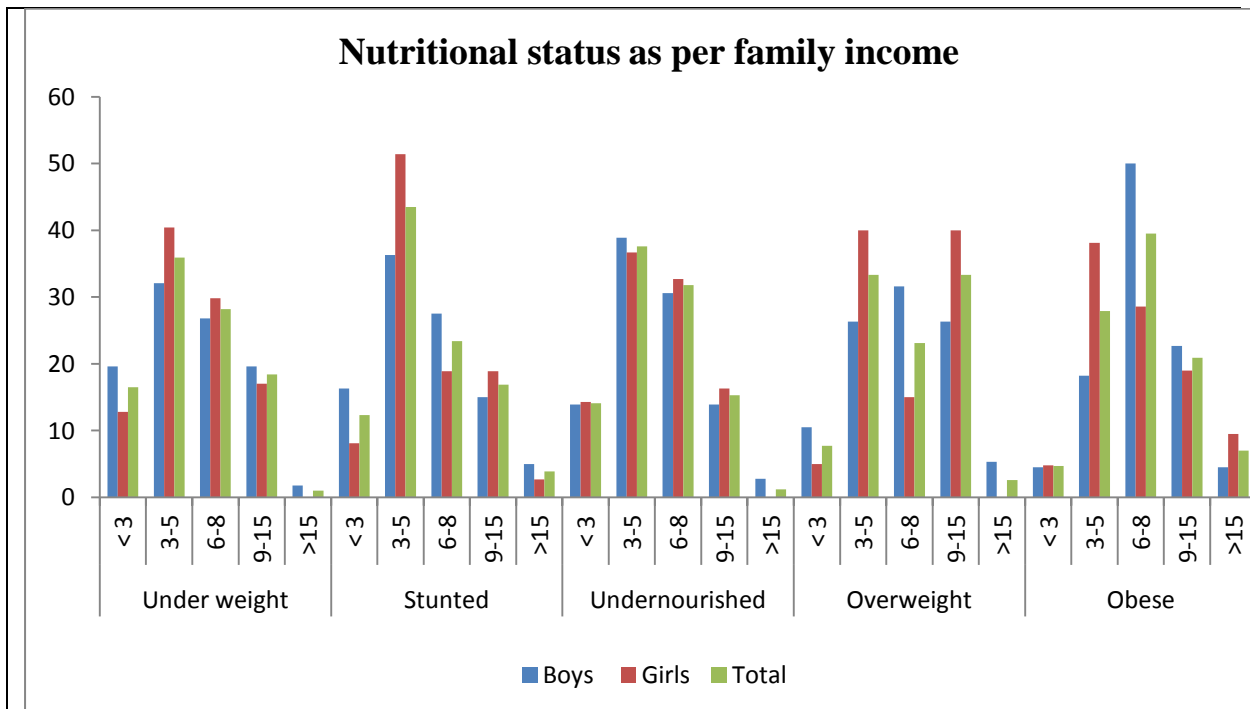
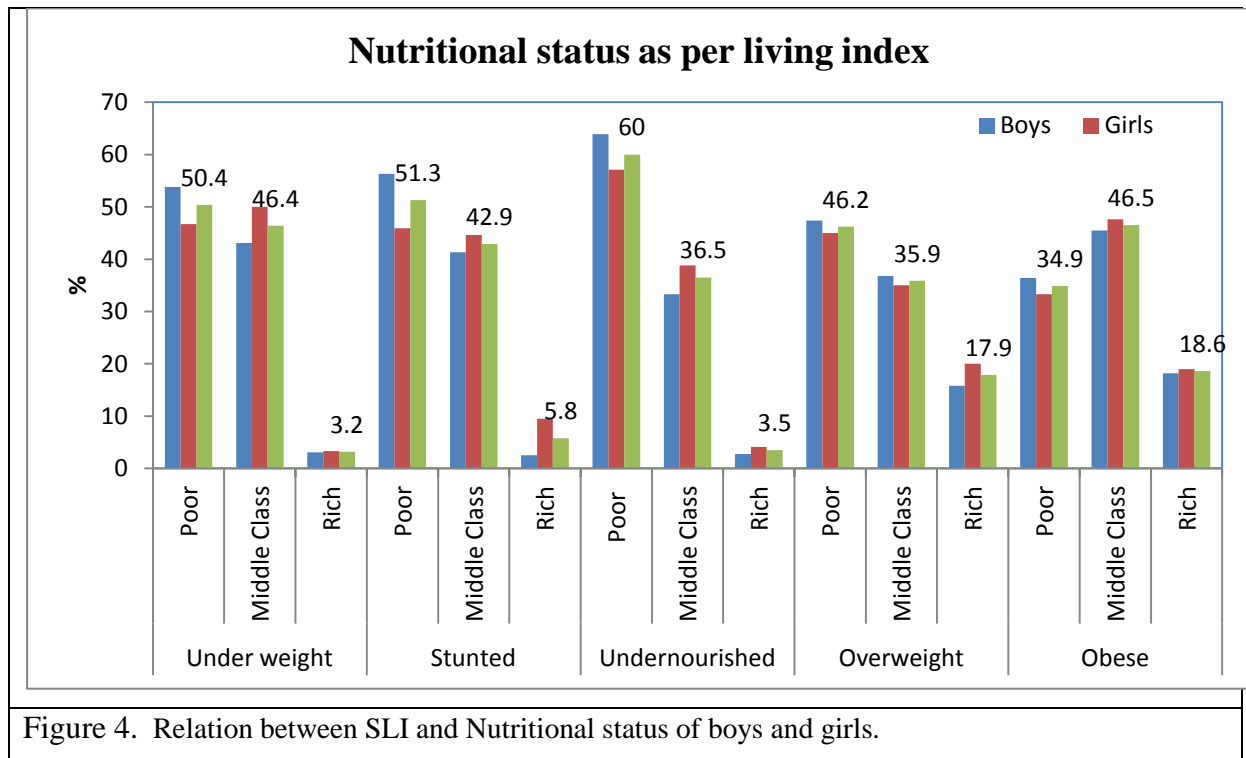


Figure 2 Impact of father's education in the level of Nutrition among boys and girls.

Standard of living index and nutritional status: Table 5 and Figure 4 show the relationship between standard of living and level of nutritional status among boys and girls. It was found that 50.4% underweight, 51.3% stunted, 60% undernourished, 46.2% overweight and 34.9% obese were belonging to poor families. Further, 46.5% obese and 35.9% overweight were belonging to middle class families. It clearly indicate that rich families were proportionately less malnourished (undernourished and over nourished) than medium and poor families. It means standard of living have positive impact on nutritional status.

Table 5. Nutritional status as per living standard

Nutritional status	Living Standard	Boys		Girls		Total	
		N	%	N	%	N	%
Under weight	Poor	35	53.8	28	46.7	63	50.4
	Middle Class	28	43.1	30	50.0	58	46.4
	Rich	2	3.1	2	3.3	4	3.2
	Total	65	100.0	60	100.0	125	100.0
Stunted	Poor	45	56.3	34	45.9	79	51.3
	Middle Class	33	41.3	33	44.6	66	42.9
	Rich	2	2.5	7	9.5	9	5.8
	Total	80	100.0	74	100.0	154	100.0
Undernourished	Poor	23	63.9	28	57.1	51	60.0
	Middle Class	12	33.3	19	38.8	31	36.5
	Rich	1	2.8	2	4.1	3	3.5
	Total	36	100.0	49	100.0	85	100.0
Overweight	Poor	9	47.4	9	45.0	18	46.2
	Middle Class	7	36.8	7	35.0	14	35.9
	Rich	3	15.8	4	20.0	7	17.9
	Total	19	100.0	20	100.0	39	100.0
Obese	Poor	8	36.4	7	33.3	15	34.9
	Middle Class	10	45.5	10	47.6	20	46.5
	Rich	4	18.2	4	19.0	8	18.6
	Total	22	100.0	21	100.0	43	100.0



DISCUSSION

This study set out to examine the nutritional status in context of under and over nutrition among individual of 0-20 years of age residing in rural areas of Hathin block of district Palwal of Haryana, India. Factors like socio economic status, awareness about health are found responsible for nutritional status. In the present study it was found that underweight and overweight/obesity co-exist among the growing children.

Early life undernutrition is an underlying cause associated with about one third of young child deaths. Among the survivors that become stunted in the first two years of life, their capacity to resist disease is poor. Similarly, obesity is an important underlying cause of many non-communicable diseases, including hypertension, diabetes, cancer, stroke, and ischemic heart disease. Non-communicable diseases are responsible for the majority of deaths. Nearly half of deaths in the year 2008 were caused by cardiovascular disease (CVD).

In the present studied boys and girls underweight (4.8% boys and 4.6% girls), stunting (6.8% boys and 6.3% girls), undernourished (3.5% boys), obese (2.2 % girls and boys) were higher than previous studies by Thakur and Gautam (2014, 2015a and 2015b) among boys and girls of Sagar of Madhya Pradesh (4.3% boys and 5.7% girls underweight, 6.3% boys and 5.4% girls stunted , 3% boys undernourished, 1.3% boys and 1% girls obese) but undernourished

(3.5% girls) and overweight (1.5% boys and 1.9% girls) were lower (4.1% girls undernourished, 1.7% boys and 2.2% girls overweight). Further, in the present findings; the proportion of underweight, stunting, undernourished were distinctly lower than tribal children of Madhya Pradesh (51.60% stunting, 61.60% underweight and 32.90% wasted) as documented by Rao et al. (2005) and among children of Rajasthan (53.00% stunting, 60.00% underweight and 28.00% wasted) as reported by Singh et al. (2006). Similarly, the incidences of wasting in present studied boys were found to be lower than the values reported from West Bengal (13.94%) and Assam (14.42%) by Som et al. (2006)

The prevalence of undernutrition observed in the present study was further compared with other reported values from various developing nations. It was found that the incidences of stunting and underweight among population of Haryana is lower than those reported from Malaysian children (29.2% stunting, 26.1% underweight) by Marjan et al. (1998), Pakistani children (29.5% underweight) by Mian et al. (2002), Tibetan children (24.7% underweight) by Dang et al. (2004), Tanzanian children (31.6% stunting; 14.6% underweight) and Kenyan children (14.9% underweight; 30.20% stunted) (Matee et al. 1997; Chesire et al. 2008).

In the present study it was found that the family income, living standard and education of parents' clearly affect the nutritional status of children. The problem like obesity is not limited to elite families but in majority it was found among poor and illiterate.

Conclusion It was found that girls and boys belonging to rich families were less undernourished than medium and poor families. Prevalence of overweight and obese was also found higher in poor and middle class families. Undernourished and over nourished (overweight and obese) were from illiterate mothers. As education level of parents increased percentage of undernourished girls and boys have decreased. The study concludes that there is dual burden of malnutrition and it is a serious problem.

Conflict of Interest: The Author declares that there is no conflict of interest.

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