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Assessment of nutritional status among girls of 5-18 years of age of a Central Indian City (Sagar)

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ABSTRACT

The present cross-sectional study assesses the prevalence of undernutrition among school-going girls of central Indian town-Sagar of Madhya Pradesh. A total of 312 girls of age cohort of 5–18 years were included. Height-for-age, weight-for-age and body mass index for age were used to evaluate their nutritional status and these were compared with the NCHS (2005) reference data. There were wide variations in stunting, underweight and undernourished among the girls. In the present investigation z- score and composite index of anthropometric failure were also computed. The study reveals that highest mean BMI was found 19.2 Kgm-^{2} for girls of 17 year of age; whereas lowest mean BMI was 13.7 K gm^{-2} for girls of 5 year of age. Present studied girls have low mean body weight, short stature and low mean BMI than the reference population (NCHS). It was found that 5.4% girls were stunted, 5.7% girls were underweight and 4.1% girls were undernourished. As per composite index of anthropometric failure a total of 10.6% girls were undernourished. In the present investigation, it was found that with improved standard of living, the prevalence of stunted girls had decreased; whereas highest proportion of undernourished and underweight girls fall under medium level of living standard. Education level of mother and father had positive impact on the nutritional status of the girls. Dietary habit also found to have impact on the nutritional status of the respondents. But, the impact of standard of living, parents education and dietary habits on the nutrition of the girls were found statistically insignificant ($p>0.90$).

Key words*: Underweight, Stunting, Undernourished, CIAF, Standard of living index, Dietary habit.*

INTRODUCTION

In country like India there is wide discrimination on the basis of caste and sex. There is strong son preference. There is discrimination in nurturing and education of boys and girls. The girl child is often not considered equal to boys. Since very beginning the discrimination started. As they grow, extent of discrimination further widens. Female feticide and infanticide was widely prevalent in different Indian societies, which has resulted in the declining population of women folk around the globe (Gautam et al. 2015). Out of all these adversities, Indian girls are excelling over boys especially in school education; but there is little information about their growth and nutritional status (Thakur and Gautam 2014 and 2015).

Poverty is considered to be a major underlying cause of such widespread undernutrition (Vella et al. 1992; Sachs and McArthur 2005; Ramachandran 2007). In India, given its large population size and widespread poverty, a majority of individuals are undernourished and underprivileged (Ramachandran 2007; Antony and Laxmaiah 2008). Further this problem is more pronouncing in Central India (Adak et al. 2006, Gautam et al. 2006, Gautam 2008, Gautam and Thakur 2009). Gender inequality, casteism, socio-economic differences, dietary habits and inadequate access to health facilities have further accelerated the problem.

We (Thakur and Gautam 2014) have already mentioned that "a significant study carried out in India by the Indian Council of Medical Research (1972) also pointed to the various socio-economic factors that have important roles to play in the prevalence of undernutrition among children. This was further corroborated in subsequent studies (Rajaram et al. 2003; Rao et al. 2004; Som et al. 2006, 2007). A major issue that exists in India is discrimination against the female child, and it has been observed that girls in India were more affected by undernutrition than boys (Bose et al. 2007). Children are considered to be a very susceptible group and a limited number of studies have been carried out among those in the age group 5–18 years, especially in India. It has been opined that chronic undernutrition during this period is linked with slower cognitive development and serious health impairments in later life that subsequently reduce quality of life (Scrimshaw 1995). The prevalence of undernutrition during childhood is considered to have highly detrimental effects on health in those children who survive to adulthood (WHO, 1995). Therefore, studies are needed to document the intensity of undernutrition among such vulnerable children from the developing countries".

Based on the above observation, the present study is an attempt to assess the prevalence of undernutrition (height-for-age, weight-for-age and BMI-for-age) among the

girls in the age group of 5–18 years. In this investigation, there is effort to assess nutritional status of the girls by standardize indices like body mass index, height for age, weight for age, Body mass index for age, z- score and composite index of anthropometric failure (CIAF).

SUBJECTS AND METHODS

The subjects for the present study were recruited from eight government schools of Sagar Town of Madhya Pradesh State of Indian union. The subjects consist of 312 girls, aged 5-18 years of age. The subject were selected at random and due care was taken to include only those subject who were physically and mentally normal and did not suffer from any apparent illness, which may have affected their normal process of growth and development. The anthropometric measurements were taken during the month of December 2013 to February 2014.

For the present investigation, data on Anthropometric measurement (height and weight) were collected on each child following the standard procedure as described by Gibson (1990). Portable digital weighing machine and anthropometer rod were used to measure the girls. Body mass Index (BMI), Z-score and Composite index of anthropometric failure (CIAF) were computed. The whole methodology is already described elsewhere (Thakur and Gautam 2014 and 2015). Beside anthropometric data information on socio-economic status, physical infrastructure, source of drinking water, type of cooking fuel, family size, number of brother and sisters, sib- sib position, educational and occupational profile of the parents of the sample were also collected using a semi-structured schedule.

The analysis was done using SPSS software. In the first step, the age wise mean of body weight, height and BMI were analyzed followed by comparison with the international reference data of NCHS (2005). In the second step, indices of height-for- age, weight-for-age and weight for height were computed to find out the prevalence of three distinct biological processes i.e. stunting, underweight and undernourished and correlate these with living standard, parent's education and dietary intake. And, finally the undernourished girls were assessed by CIAF following (Sevedverg 2000, Nandy et al. 2005, Nandy et al. 2008, Thakur and Gautam 2014 and 2015).

RESULTS

Age wise mean body weight, height and body mass index of present studied girls are compared with NCHS (National center for Health Statistics 2005) data as shown in Table 1. It is apparent that the present studied girls have low mean weight and height than the

reference population (NCHS). During early childhood the difference is less but after 8 year of age it starts increasing and the difference widens. Highest difference is during puberty (14 years of age) for body weight, height and body mass index. It was found that the differences are significant at 1% level ($p < 0.01$).

Table 1. Age wise mean of body weight and Body Mass Index and height among school going girls of central India and their comparison and difference with NCHS (2005) reference data.

Age (yr)	Sample size	Mean Body weight (kg)				Mean Height (cm)				Mean Body Mass Index			
		Present Study		NCHS (2005)	t-test	Present Study		NCHS (2005)	t-test	Present Study		NCHS (2005)	t-test
		Mean	SD			Mean	SD			Mean	SD		
5	20	15.3	1.5	20.6	8.1	105.8	6.3	112.4	4.2	13.7	1.1	16.1	6.4
6	24	17.6	2.5	22.4	6.7	111.7	7.4	117.1	3.2	14.1	0.9	16.2	6.7
7	22	19.2	3.4	25.9	7.8	117.3	6.7	124.4	4.7	13.8	1.3	16.6	8.5
8	21	20.8	3.9	31.9	7.7	120.4	6.9	130.9	6.5	14.2	1.5	18.3	7
9	28	22.6	3.1	35.4	11.6	125.5	6	136.9	8.6	14.3	1.1	18.7	12
10	21	25	3.8	40	9.2	130.7	6.4	143.3	7.7	14.6	1.1	19.3	11.2
11	23	28.6	6.1	47.9	10.3	137.2	7.9	151.4	7.9	15.1	2	20.7	9.3
12	23	33.2	6.4	52	10.8	142.4	7.2	156	8.3	16.3	2.6	21.2	7.4
13	22	35.8	6.5	57.7	11.5	144.6	7.2	159.1	8.7	17	2.3	22.7	8.6
14	21	34.7	6.3	59.9	14.8	145.1	6.4	161.8	11.1	16.4	2	22.9	11.4
15	20	41	6.2	61.1	9.2	151.4	5.2	161.9	7.9	17.8	2.2	23.2	7.4
16	20	40.2	7.8	63	10.8	148.6	5.6	161.9	9.8	18.2	3.3	24	6.7
17	25	45.3	6.6	61.7	9.2	153.2	6.5	163.1	7	19.2	2.1	23.1	6.7
18	22	43.7	5.1	65.2	11.5	153	6.3	163.1	7.2	18.7	2	24.4	8.9

All t-value are significant at 1% level ($p < 0.01$)

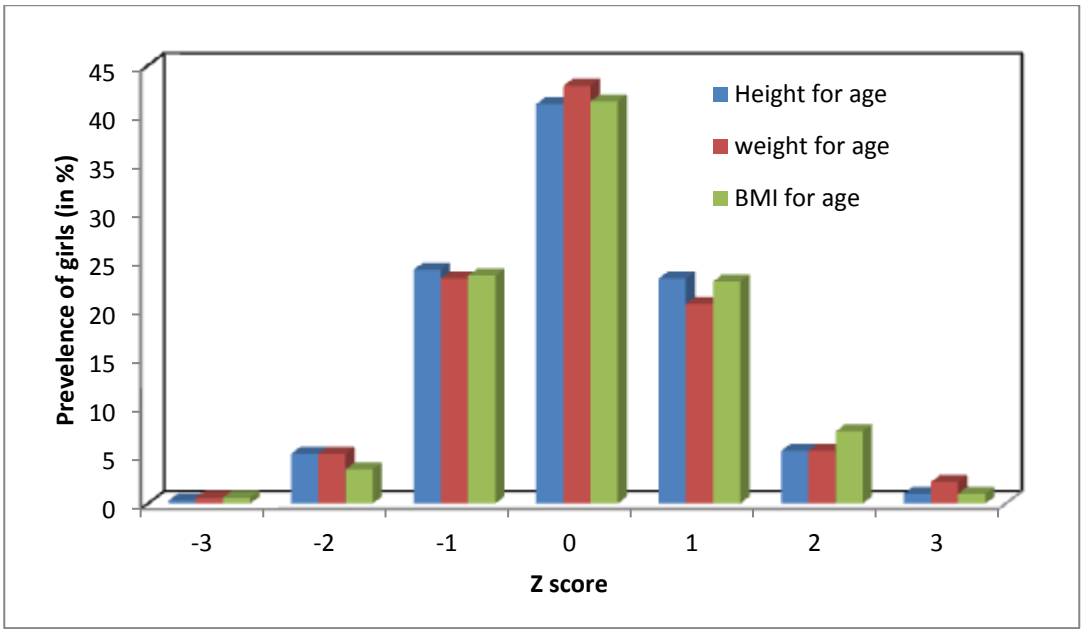

Figure 1. Height for age Z-score among school going girls of 5-18 year of age

Figure 1 reveals the distribution of girls according to Z-score for Height for age, Weight for age and BMI for age. It was found that 5.4% girls were stunted, 5.7% girls were underweight and 4.1% girls were found undernourished they are below – 2 SD, whereas 24% girls fall under -1 SD and approximately 70% girls were found normal in their growth for height. Similarly, 23.1% girls fall under -1 SD and approximately 70% girls were found normal in their growth for weight. Further, 23.4% girls are -1 SD and 71.5 % girls have normal nutritional status.

Composite Index of Anthropometric Failure (CIAF): Table 2 represents Subgroups of anthropometric failure. 89.4% girls in 'group A' (no failure). Group B constitute underweight only, is 1.6% girls. Group C constitute underweight and stunting, it is 2.6% girls. Group D constitute underweight, stunting and undernourished is 0.3% girls, Group E constitute underweight and undernourished is 1.9% girls, Group F constitute stunting and undernourished is 0.3% girls, Group G constitute only stunting is highest 2.9% girls, Group H only undernourished is 2.2% girls, and total CIAF is 10.6% girls.

Table 2 Subgroups of anthropometric failure among school going girls aged 5-18 years**.**

Group Name	Description	N	%
A	No failure	279	89.4
B	Underweight only	5	1.6
C	Underweight and stunting	8	2.6
D	Underweight, stunting, and Undernourished	1	0.3
E	Under weight and undernourished	6	1.9
F	Stunting and undernourished	1	0.3
G	Stunting only	9	2.9
H	Undernourished only	7	2.2
	CIAF	33	10.6

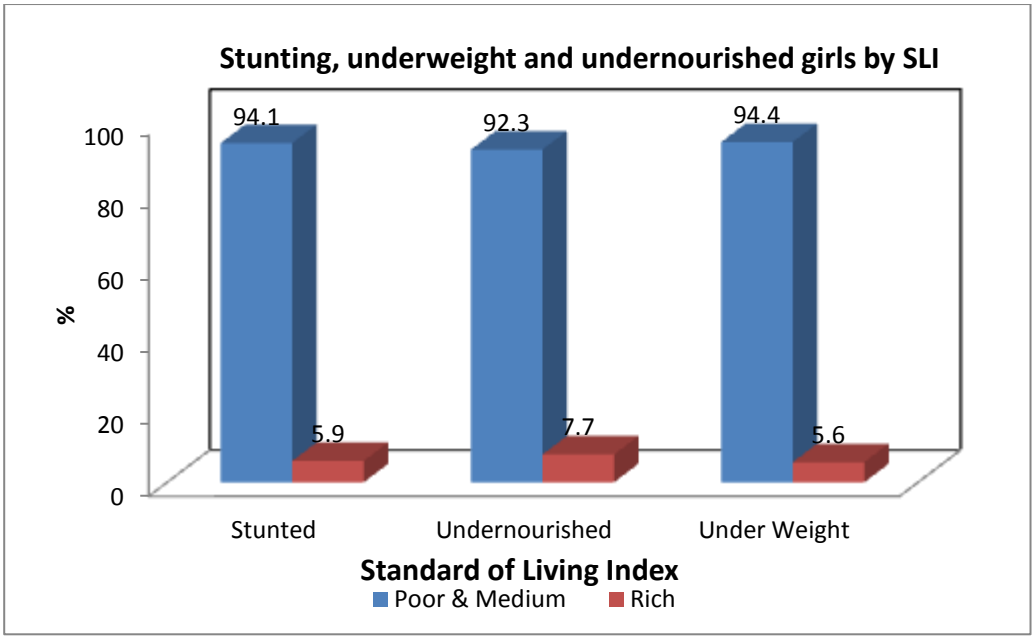

Figure 2 Relation between SLI and Nutritional status of school going girls of Sagar (MP)

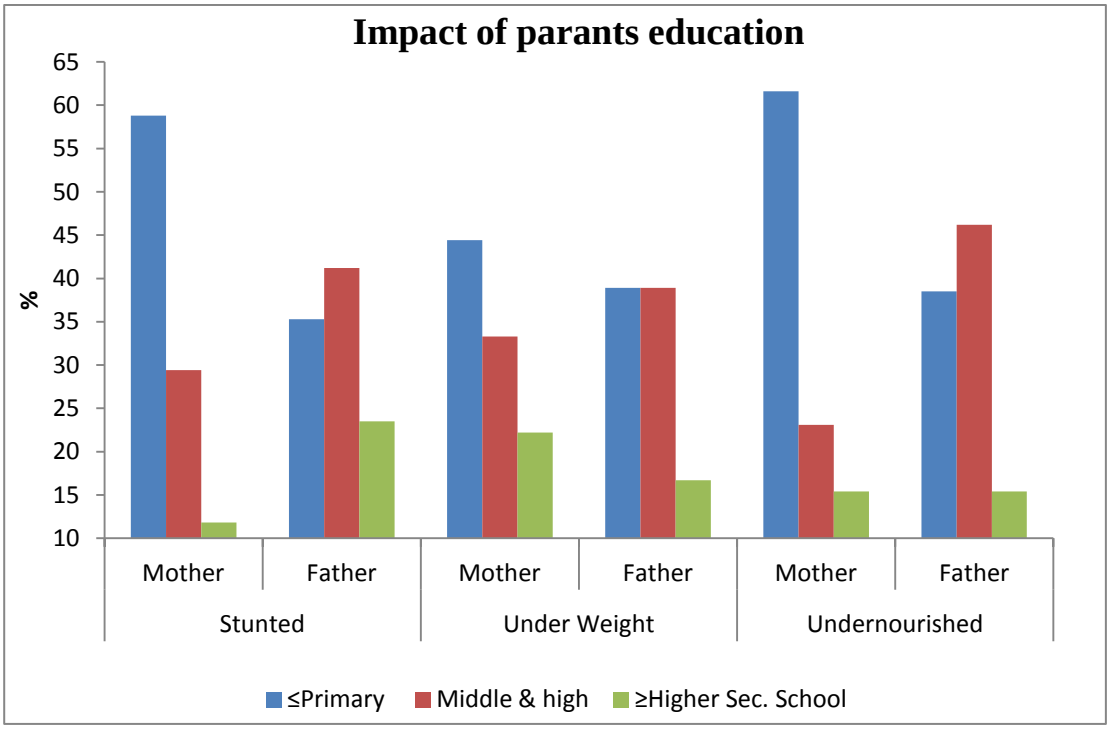

Figure 3 Impact of parent's education in the level of Nutrition of school going girls of Sagar (MP)

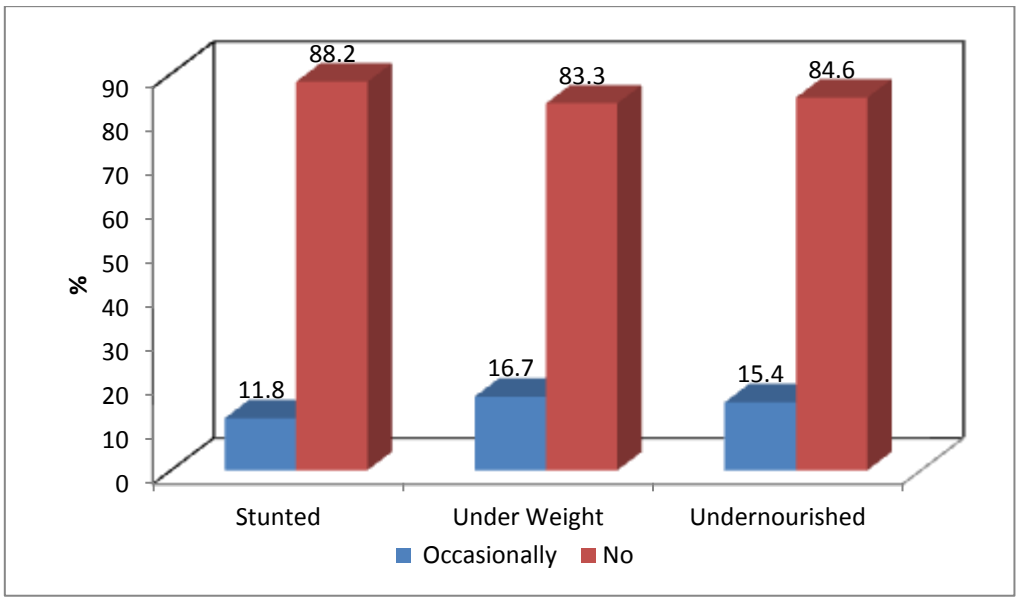

Figure 4 Consumption of meat /fish /chicken and Nutritional status of school going girls of Sagar (MP)

Standard of living index and nutritional status: Figure 2 shows the relationship between standard of living and level of nutritional status among girls. It was found that girls belonging to rich families were proportionately less undernourished than girls of medium and poor

families. It means standard of living have positive impact on nutritional status of the children, but, statistically, the difference is insignificant which points in the opposite direction that the standard of living doesn't influence the nutritional status of children under study (χ^2=0.065; df=2; p>0.98).

Parents' education vs nutritional status: In the present study, it was found that education of fathers and mothers have no impact on nutritional status of girls. It is evident from Figure 3 that 58.8% stunted, 44.4% underweight and 61.6% undernourished girls were from poorly educated or illiterate mothers. As education level increased percentage of undernourished girls have decreased (χ^2=1.38; df=4; p>0.90). Similarly trend can be seen for fathers' education too. Further, to understand the impact of education on the level of nutrition chi-square test was performed which was found insignificant (χ^2=0.48; df=4; p>0.98).

Dietary Habit vs Nutritional status: In the present study it was found that the girls who eat non-veg (meat/ fish/chicken) their nutritional status is better than those who do not eat it (χ^2=0.18; df=2; p>0.95). Further elucidations can we seen through Figure 4.

Discussion

The assessment of undernutrition in the present study was based on indices of height-for-age (stunting), weight-for-age (underweight) and body mass index for age (undernourished). The indices of height-for-age and weight-for-age reflect chronic and acute undernutrition, respectively. The weight-for-age index is used to observe underweight and it is composite measure documenting both chronic and acute undernutrition (Mishra et al. 1999). In the present study, the interpretation of three indexes was done in context of international reference population to determine the prevalence of undernutrition, as recommended by the World health Organization (Dibley et al. 1987). The justification for use of a reference population is the empirical finding that well- nourished children in all communities follow very similar growth patterns (Habicht et al. 1974). Hence the reference values from the National Centre of Health Statistics (NCHS 2005) were used in the present investigation.

To determine the nutritional status of children, the WHO has recommended the use of z-score indicators (Waterlow et al. 1977; Dibley et al. 1987). The severity of undernutrition is assessed by utilizing the Z score. The girls with Z-score -2 were classified as suffering from stunting, underweight and undernourished. It is already discussed elsewhere (Thakur and Gautam 2014), that "the girls suffering from stunting may be underweight and/or wasted. Similarly, the girls suffering from wasting may be stunted and/or underweight. Further, a girl

can be stunted, underweight as well as underweight. In such a condition, there are chances of under reporting. None of three indices is able to provide a comprehensive estimate of the number of undernourished children in a population. To solve this problem Svedberg (2000) have suggested a new index known as composite index of anthropometric failure (CIAF) in which children with wasting, stunting or who are underweight are all considered undernourished, or to be in a state of "anthropometric failure". This index incorporates all undernourished children, be they wasted and/or stunted and/or underweight. For present investigation, CIAF is computed. It was found more appropriate alongwith height-for-age (stunting), weight-for- age (underweight) and body mass index for age (undernourished). Hence, in the present study compound techniques of assessment of undernutrition were used to find out the prevalence of undernutrition among central Indian girls and the technique was found useful."

Several studies have been done in different parts of India on health and nutritional status among tribal children and adolescents (Rao et al. 2005, 2006). A study from West Bengal among Lodha children found the prevalence of underweight, stunting and wasting to be 50.0%, 38.0% and 24.0 %, respectively by Bisai et al 2008. A study from Madhya Pradesh has also documented similar high prevalence among Gond pre- school children by Rao et al (2006). An earlier study among Kodaku tribal pre-school children of Central India also found high prevalence of undernutrition by Dolla et al. (2005). Chowdhury et al. (2008) were reported that the incidences of stunting and underweight among Santhal children of Purulia district of West Bengal were 17.62% and 33.70% respectively. Similarly, Joseph et al. (2002) have reported 9.40% stunting and 31.20% underweight among children of Karnataka. Further the prevalence of stunting was reported 50% among the Kamar tribe of Chhattisgarh (Mitra et al. 2007), 54% among Oraon of North Bengal and tribal children of Bihar (Mittal and Srivastava 2006, Rao and Vijay 2006) and 45.80% among the children of West Bengal (Som et al. 2006).

The incidences of undernutrition obtained in the present study were found to be distinctly lower than those among 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 girls were found to be lower than the values reported from West Bengal (13.94%) and Assam (14.42%) by Som et al. (2006). In this way, the incidences of stunting, underweight and

undernourished among the girls of central India were found (5.4%, 5.7% 4.1%) distinctly lower than all previous studies among the Indian children of different ethnic origin, socio-economic and geo-climatic conditions.

Conclusion

The study reveals that the present studied girls have low mean body weight and they are short in stature than the reference population (NCHS). During early childhood the difference is less but after 8 year of age, it starts increasing and the difference is widened. Similarly Body mass index of the present studied girls indicate low mean BMI than the reference population. During early childhood the difference is less but after 8 year of age it starts increasing and the difference is widen.

As per height for age (Z-Score) 5.4% girls were stunted, As per weight for age (Z-Score) 5.7% girls were underweight and As per body mass index for age (Z-Score) 4.1% girls are undernourished those are below – 2 SD. As per composite index of anthropometric failure a total of 10.6% girls were undernourished (Figure 5).

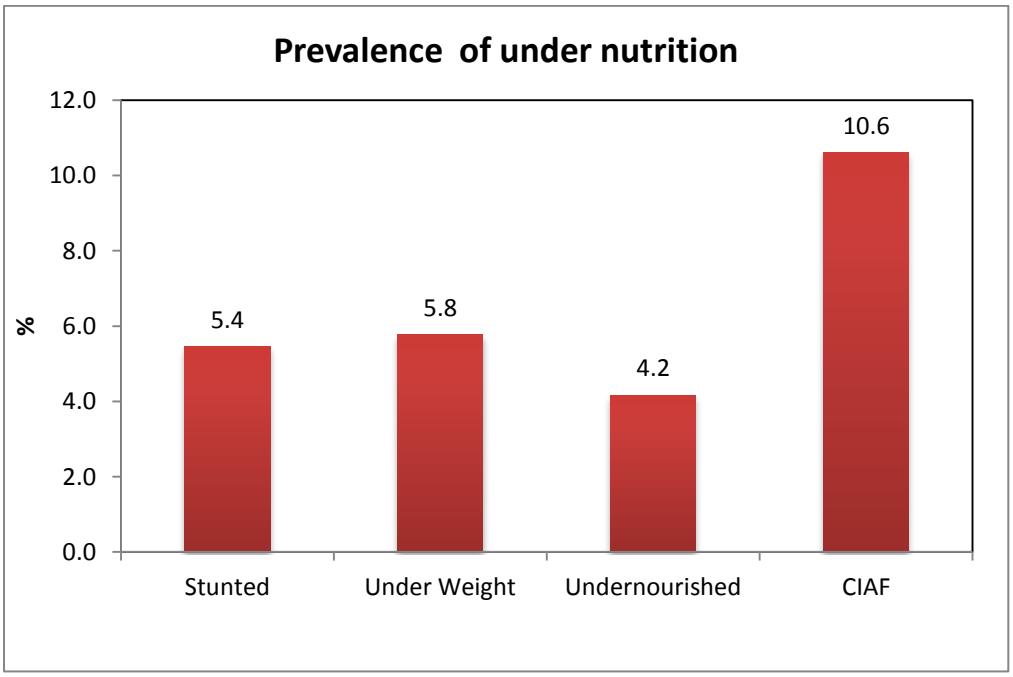

Figure 5 Nutritional status among school going girls aged 5-18 years

In the present investigation it was found that with improved standard of living the proportion of stunted girls had decreased. Parental education was found effective in the improvement of level of nutrition of the children. Lastly, the level of nutrition is also found to

be determined by the dietary habit as the non-veg eater have found proportionately better nutritional level.

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Contribution of Authors:

The idea and vision behind the theme of paper was given by RKG, who has pivotal role in analysis and presentation of data. He trained RT for field work and data collection. He thoroughly edited and revised the paper before and after review. RT has executed the task; she obtained consent and collected data. She did analysis in the supervision of RKG. She prepared first draft of the paper and assisted RKG in revision of the manuscript. In this way, both authors were involved in data collection, analysis and drafting the manuscript and approved the final manuscript.

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

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