**Original article:**

# A study on nutritional status and morbidity pattern among primary school children in Sullia town, South India.

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**Abstract:**

**Introduction:** Primary school age is a dynamic period of physical growth and mental development of the child. Research studies indicates that nutritional deficiencies and poor health in primary school age children are among the causes of low school enrolment, high absenteeism, early dropout and poor classroom performance.

**Aims & Objectives:** The present study was carried out to assess the nutritional status and morbidity pattern among primary school children in Sullia town, South India. A descriptive Cross-sectional study was conducted during June 2011 to May 2012 in selected primary schools of Sullia town, Dakshina Kannada district, Karnataka state, South India. Total children included in the study were 424 consisting of 194 from 2 government schools and 230 from 2 private schools.

**Material & Methods:** A structured questionnaire was used to collect basic information about the students. The anthropometric measurements such as weight, height, triceps skin-fold thickness and arm circumference were measured following the standard techniques recommended by Jelliffe. Clinical examination was conducted to detect their morbidity pattern. Statistical analysis was performed using SPSS version 17 and WHO AnthroPlus Software using WHO Reference 2007 values.

**Observations & Results:** In the present study, the prevalence of malnutrition (thinness) among the primary school children is 26.5%. The prevalence of underweight and stunting were 26.5%, 19.2% and 26.5% respectively. The nutritional status of government school children was comparatively poorer than private school children. Boys had a higher prevalence of malnutrition than girls.

**Conclusion:** The current nutritional status of primary school children is unsatisfactory. Prompt integrated efforts should be made to improve the nutritional status of the children belonging to this age group.

**Key-words:** nutritional status, primary school, South India

## Introduction:

Over 1/5th of our population comprises of children aged 5-14 years i.e., the group covering primary and secondary education. Primary school age is a dynamic period of physical growth and mental development of the child. Research indicates that nutritional deficiencies and poor health in primary school age children are among the causes of low school enrolment, high absenteeism, early dropout and poor classroom performance. The present situation with regard to the health and nutritional status of the children in our country is very unsatisfactory. Apart from mid-day meal programme, which is run by the Government of India in government run schools, there are no other efforts for children in age group 5-14 years.

Malnutrition is by far the biggest contributor to child mortality, present in half of all cases globally. On an average, a child dies every 5 seconds as a direct or indirect result of malnutrition - 700 every hour - 16,000 each day - 6 million each year - 60% of all child deaths (2002-2008 estimates).[1]One in

twelve people worldwide is malnourished. In 2006, more than 36 million died of hunger or diseases due to deficiencies in micronutrients".[2] A total of 925 million people are undernourished in 2010, an increase of 80 million since 1990. Nearly all of the undernourished are in developing countries.[3] Malnutrition is more common in India than in Sub-Saharan Africa. One in every 3 malnourished children in the world lives in India.[4]As of 2005, paediatric malnutrition is a risk factor for 16% of the global burden of disease and for 22.4% of India's burden of disease. The prevalence of underweight children is 47% in India is among the highest in the world, and is nearly double that of Sub-Saharan Africa with dire consequences for morbidity, mortality, productivity and economic growth.[5]

In India the National Family Health Survey - 3 reported that both chronic and acute under nutrition was high in many states.[6]The school age group (5-18 years) spans the period between preschool years and adult life. Census 2011 has shown that this age group forms a very large proportion of the population. Population projections indicate that over the next decade this age group will show by far the largest increase in numbers.[7]The United Nations' Sub Committee on Nutrition meeting held in Oslo in 1998 concluded that more data on health and nutrition of school age children are needed to assess their scale of problem.[8]The present study was carried out to assess the nutritional status and morbidity pattern among primary school children (5-11 years) attending schools of government and private sectors in Sullia town.

**Material & Methods:**

**Study Design:** A descriptive Cross-sectional study.

**Study Settings:** study was conducted in Primary schools in Sullia Town, Dakshina Kannada District, Karnataka State, South India.

**Sample Size:** Sample size was calculated using the formula given by Daniel,[9]

$$n = Z^2 p (1-p) / d^2$$

A minimum sample size of 400 children was required for this study.

**Sampling Method:** Probability proportional to size sampling method was used. There were 8 government schools and 5 private primary schools with classes I to VII in Sullia town. All lower primary class children from 1st standard to 4th standard of two government and two private schools were included in the study. A total of 424 students comprised the study population.

**Duration of Study:** June 2011 to May 2012.

**Inclusion Criteria:** All lower primary class children from 1st standard to 4th standard of two government and two private schools were included in the study.

**Exclusion Criteria:** Children and parents who were not willing to participate in the study and those children who were suffering from major illness or undergone recent major surgery were excluded from the study.

**Data Collection:** WHO recommends that acute malnutrition among children and adolescents, 5-19 years be assessed by calculating BMI, and then adjusting for age to generate BMI-for-age. BMI-for-age should be presented in Z-scores based on the 2007 WHO Growth Reference for children 5-19 years.[10] Hence prevalence of thinness represents the prevalence of malnutrition.

Ethical committee clearance was obtained from the institution before starting the study. Initially the purpose of the study was explained to the school principals and permission was taken for conducting the study in their respective schools. Informed consent from the caregivers of the children was taken.A structured questionnaire was used to collect basic information about students from the school admission records.

The anthropometric measurements were taken following the standard techniques recommended by Jelliffe.[11] With the help of trained investigators weight of all the students was taken without foot-ware and heavy clothing with the subject standing motionless on the digital electronic weighing machine with feet 15 cm apart with weight equally distributed on each leg with an error margin of ± 100 grams. The weighing scale was regularly checked with known standard weights. Height was measured with the subject standing without foot-ware in erect posture with the help of a Stadiometer to the nearest 0.1cm.

Triceps skin fold thickness was measured using Harpenden's skin fold callipers. The midpoint of the back of the upper left arm between the tip of oleocranon and acromion process was determined with the arm flexed at 90 degree, then with the arm hanging freely a fold of skin and subcutaneous fat was grasped firmly with the thumb and forefinger and pulled away from the underlying muscular tissue. Measurements were recorded within 2 seconds of applying force.

**Data Analysis:** Data entry and statistical analysis was performed with the help of SPSS, version 17. Continuous variables are presented as mean and standard error of the mean (SEM), while categorical variables are presented as number and percentage. Analysis for anthropometric measurements is performed with **WHO AnthroPlus software version 1.0.3** and Weight-for-age, height-for-age and BMI-for-age values were obtained and were compared with **WHO 2007 reference values**. Triceps skin fold thickness and Mid-upper arm circumference values were compared with **Jelliffe reference values**.[11]

**Observations & Results:**

Total children included in the study were 424. Two government schools consisting of 194 children and two private schools consisting of 230 children were selected. The age group of the children ranges from 5 to 10 years. There were no children in the age group of 10 to 11 years. 13 children were excluded because they had medical illness and a total of 411 children were included in the analysis.

**Table 1. Comparison of socio-demographic characteristics between boys and girls:**

| Variables | All children (n=411) | | Boys (n=214) | | Girls (n=197) | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| **Age group** | | | | | | |
| 5-6 | 77 | 18.7 | 43 | 20.1 | 34 | 17.2 |
| 6-7 | 105 | 25.5 | 52 | 24.3 | 53 | 27.0 |
| 7-8 | 92 | 22.3 | 50 | 23.4 | 42 | 21.3 |
| 8-9 | 107 | 26.0 | 55 | 25.7 | 52 | 26.4 |
| 9-10 | 30 | 7.2 | 14 | 6.5 | 16 | 8.1 |
| **Religion** | | | | | | |
| Hindu | 285 | 69.3 | 142 | 66.4 | 143 | 72.6 |
| Muslim | 119 | 29.0 | 66 | 30.8 | 53 | 26.9 |
| Christian | 7 | 1.7 | 6 | 2.8 | 1 | 0.5 |
| **Caste** | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| SC | 21 | 5.1 | 14 | 6.5 | 7 | 3.5 |
| ST | 30 | 7.3 | 15 | 7.0 | 15 | 7.6 |
| OBC | 285 | 69.3 | 146 | 68.3 | 139 | 70.6 |
| Others | 75 | 18.3 | 39 | 18.2 | 36 | 18.3 |
| **Family size** | | | | | | |
| 3 | 89 | 21.7 | 50 | 23.3 | 39 | 19.8 |
| 4-5 | 231 | 56.2 | 117 | 54.7 | 114 | 57.9 |
| >5 | 91 | 22.1 | 47 | 22.0 | 44 | 22.3 |
| **Birth order** | | | | | | |
| 1st | 223 | 54.3 | 120 | 56.1 | 103 | 52.3 |
| 2nd | 153 | 37.2 | 78 | 36.4 | 75 | 38.1 |
| 3rd and higher | 35 | 8.5 | 16 | 7.5 | 19 | 9.6 |
| **Type of family** | | | | | | |
| Nuclear | 346 | 84.2 | 179 | 83.6 | 167 | 84.8 |
| Joint | 63 | 15.3 | 34 | 15.9 | 29 | 14.7 |
| Extended | 2 | 0.5 | 1 | 0.5 | 1 | 0.5 |
| **Socio-economic status (Modified B. G. Prasad's classification for 2010)** | | | | | | |
| Class I (upper class) | 10 | 2.4 | 3 | 1.4 | 7 | 3.6 |
| Class II (upper middle) | 47 | 11.4 | 26 | 12.1 | 21 | 10.7 |
| Class III(lower middle) | 79 | 19.2 | 41 | 19.1 | 38 | 19.3 |
| Class IV(upper lower) | 153 | 37.2 | 80 | 37.4 | 73 | 37.0 |
| Class V(lower) | 122 | 29.7 | 64 | 30.0 | 58 | 29.4 |
| **Poverty line** | | | | | | |
| Below Poverty Line | 145 | 35.3 | 73 | 34.1 | 72 | 36.5 |
| Above Poverty Line | 266 | 64.7 | 141 | 65.9 | 125 | 63.5 |

**Table 2. Prevalence of underweight, stunting and thinness among school children:**

| Variables | All children (n=411) | | Boys (n=214) | | Girls (n=197) | | Govt. (n=190) | | Pvt. (n=221) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| **Underweight (<-2SD)** | 109 | 26.5 | 67 | 31.3 | 42 | 21.3 | 72 | 37.9 | 37 | 16.7 |
| **Stunting (<-2SD)** | 79 | 19.2 | 48 | 22.4 | 31 | 15.7 | 59 | 31.0 | 20 | 9.0 |
| **Thinness (<-2SD)** | 109 | 26.5 | 66 | 30.8 | 43 | 21.8 | 55 | 28.9 | 54 | 24.4 |

**Table 3. Comparison of nutritional status between boys and girls:**

| Variables | All children (n=411) | | Boys (n=214) | | Girls (n=197) | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| **Weight-for-age** | | | | | | |
| Normal | 160 | 38.9 | 70 | 32.7 | 90 | 45.7 |
| Mild Underweight (>-2SDto<-1SD) | 142 | 34.6 | 77 | 36.0 | 65 | 33.0 |
| Moderate Underweight (>-3SDto<-2SD) | 74 | 18.0 | 41 | 19.1 | 33 | 16.7 |
| Severe Underweight (<-3SD) | 35 | 8.5 | 26 | 12.2 | 9 | 4.6 |
| **Height-for-age** | | | | | | |
| Normal | 199 | 48.4 | 100 | 46.7 | 99 | 50.2 |
| Mild Stunting (>-2SDto<-1SD) | 133 | 32.4 | 66 | 30.9 | 67 | 34.0 |
| Moderate Stunting (>-3SDto<-2SD) | 65 | 15.8 | 36 | 16.8 | 29 | 14.7 |
| Severe Stunting (<-3SD) | 14 | 3.4 | 12 | 5.6 | 2 | 1.1 |
| **BMI-for-age** | | | | | | |
| Normal (-2SDto+2SD) | 278 | 67.6 | 137 | 64.0 | 141 | 71.6 |
| Moderate Thinness (>-3SDto<-2SD) | 76 | 18.5 | 45 | 21.0 | 31 | 15.8 |
| Severe Thinness (<-3SD) | 33 | 8.0 | 21 | 9.8 | 12 | 6.1 |
| Overweight (+1SDto+2SD) | 13 | 3.2 | 6 | 2.8 | 7 | 3.5 |
| Obesity (>+2SD) | 11 | 2.7 | 5 | 2.4 | 6 | 3.0 |

**Table 4. Comparison of nutritional status between government and private schools:**

| Variables | All children (n=411) | | Govt. (n=190) | | Pvt. (n=221) | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| **Weight-for-age** | | | | | | |
| Normal | 160 | 38.9 | 45 | 23.7 | 115 | 52.0 |
| Mild Underweight (>-2SDto<-1SD) | 142 | 34.5 | 73 | 38.4 | 69 | 31.2 |
| Moderate Underweight (>-3SDto<-2SD) | 74 | 18.0 | 45 | 23.7 | 29 | 13.1 |
| Severe Underweight (<-3SD) | 35 | 8.5 | 27 | 14.2 | 8 | 3.6 |
| **Height-for-age** | | | | | | |
| Normal | 199 | 48.4 | 66 | 34.7 | 133 | 60.2 |
| Mild Stunting (>-2SDto<-1SD) | 133 | 32.4 | 65 | 34.2 | 68 | 30.8 |
| Moderate Stunting (>-3SDto<-2SD) | 65 | 15.8 | 45 | 23.7 | 20 | 9.0 |
| Severe Stunting (<-3SD) | 14 | 3.4 | 14 | 7.4 | 0 | 0 |
| **BMI-for-age** | | | | | | |
| Normal (-2SDto+2SD) | 278 | 67.6 | 125 | 65.8 | 153 | 69.2 |

| | | | | | |
|---|---|---|---|---|---|
| Moderate Thinness (>-3SDto<-2SD) | 76 | 18.5 | 38 | 20.0 | 38 | 17.2 |
| Severe Thinness (<-3SD) | 33 | 8.0 | 17 | 9.0 | 16 | 7.2 |
| Overweight (+1SDto+2SD) | 13 | 3.2 | 6 | 3.1 | 7 | 3.2 |
| Obesity (>+2SD) | 11 | 2.7 | 4 | 2.1 | 7 | 3.2 |

**Table 5. Comparison of Mid Upper Arm Circumference values for boys and girls with Jelliffe standard values:**

| Age group (years) | Boys MUAC -for-age Mean± SD(cm) | Jelliffe MUAC-for-age values for boys | Girls MUAC-for-age Mean± SD(cm) | Jelliffe MUAC-for-age values for girls |
|---|---|---|---|---|
| 5-6 | 16.2±1.3 | 17.3 | 17.3±1.7 | 17.3 |
| 6-7 | 16.8±2.4 | 17.8 | 16.9±1.8 | 17.8 |
| 7-8 | 17.0±1.8 | 18.4 | 17.0±1.3 | 18.4 |
| 8-9 | 17.3±2.1 | 19.0 | 18.4±2.2 | 19.1 |
| 9-10 | 18.7±2.2 | 19.7 | 17.8±1.6 | 19.9 |

**Table 6. Comparison of Mid Upper Arm Circumference values for government and private schools:**

| Age group (years) | Govt. MUAC-for-age Mean±SD(cm) | Pvt. MUAC-for-age Mean±SD(cm) |
|---|---|---|
| 5-6 | 16.4±1.7 | 17.0±1.4 |
| 6-7 | 15.7±1.3 | 17.8±2.2 |
| 7-8 | 16.2±1.1 | 17.7±1.6 |
| 8-9 | 16.9±1.9 | 18.7±2.1 |
| 9-10 | 17.5±2.3 | 18.7±1.6 |

**Table 7. Comparison of Triceps Skin Fold Thickness values for boys and girls with Jelliffe standard values:**

| Age group (years) | Boys TSFT-for-age Mean± SD(cm) | Jelliffe TSFT-for-age values for boys | Girls TSFT-for-age Mean± SD(cm) | Jelliffe TSFT-for-age values for girls |
|---|---|---|---|---|
| 5-6 | 7.2±1.5 | 8.2 | 9.6±2.7 | 9.6 |
| 6-7 | 7.9±2.8 | 7.9 | 8.8±2.4 | 9.4 |
| 7-8 | 7.6±2.7 | 7.6 | 8.5±2.1 | 10.1 |
| 8-9 | 8.2±2.7 | 8.2 | 10.1±3.3 | 10.3 |
| 9-10 | 8.2±3.5 | 8.2 | 8.8±2.4 | 10.4 |

**Table 8. Comparison of Triceps Skin Fold Thickness values for government and private schools:**

| Age group (years) | Govt. TSFT-for-age Mean±SD(cm) | Pvt. TSFT-for-age Mean±SD(cm) |
|---|---|---|
| 5-6 | 8.3±2.5 | 8.3±2.3 |
| 6-7 | 7.5±1.5 | 9.1±3.1 |
| 7-8 | 7.9±2.2 | 8.1±2.7 |
| 8-9 | 8.6±2.7 | 9.6±3.4 |
| 9-10 | 7.7±1.7 | 9.0±3.4 |

**Table 9. Morbidity profile of school children:**

| Morbidity condition | Number | %(out of 411) |
|---|---|---|
| Dyspigmented hair | 9 | 2.2 |
| Thin and sparse hair | 6 | 1.5 |
| Easily pluckable hair | 2 | 0.5 |
| Diffuse depigmentation on face | 38 | 9.2 |
| Pale conjunctiva | 39 | 9.4 |
| Conjunctival xerosis | 2 | 0.5 |
| Bitot's spots | 2 | 0.5 |
| Brown spots on conjunctiva | 3 | 0.7 |
| Blurring of vision in night | 2 | 0.5 |
| Pale and atrophied tongue | 2 | 0.5 |
| Mottled dental enamel | 7 | 1.7 |
| Dental caries | 194 | 47.2 |
| Missing tooth | 29 | 7.0 |
| Swollen gums | 2 | 0.5 |
| Bleeding gums | 2 | 0.5 |
| Cracked skin | 8 | 1.9 |
| Follicular hyperkeratosis | 3 | 0.7 |
| Hyperpigmented skin | 2 | .5 |
| Poor wound healing | 4 | 1.0 |
| Nails pallor | 13 | 3.1 |
| White spots on nails | 27 | 6.5 |
| Transverse ridges on nails | 7 | 1.7 |
| Bow legs | 1 | 0.2 |
| Mental confusion | 3 | 0.7 |
| Motor weakness | 2 | 0.4 |
| Tachycardia | 2 | 0.5 |
| Systolic murmur | 1 | 0.2 |

**Discussion:**

The study population was 424 school children. This is similar to other studies[12,13,14,15,16] done in India among primary school children, where the sample size ranges from 400 to 500. Male subjects (52.07%) were more than female subjects (47.93%). This is similar to few studies,[17,18,19] while in some other studies[14,15,17,20,21] female subjects were more than male subjects.

In the present study, the prevalence of malnutrition among the surveyed primary school children is 26.5%. This finding is similar to a study conducted by Joshi HS et al.[22] in schools of Western Nepal, where 26% of the students were found to be undernourished. This finding is in contrast with the study conducted by Hasan I et al.[13] in 2010 in Bangalore in which prevalence of malnutrition was 52%. This is also in contrast to a study conducted by Saluja Neelu et al.[23] in 2007 in urban primary school children in Meerut found that 49.5 % were found to be malnourished. In another study during July 2002 to July 2003 by Shakya SR et al.[24] in five government schools located in Dhankuta town and Ineruwa town of Nepal the total percentage of undernutrition as per IAP classification was 61%. This is also in contrast with a study done by Adegun JA et al.[25] in 2013 in public and private owned primary schools in Ekiti State, Nigeria, using the WHO 1996 BMI norms, which showed that 49.4% of the children sampled were underweight. When their nutritional status was compared, the results showed that there was a significant difference between them. The children in the private primary schools had a higher mean value of $16.66 + 2.36 \text{ kgm}^2$ than that of the children of public primary schools who had a mean value of $15.46 + 3.10 \text{ kgm}^2$. This difference was statistically significant (p>0.05) when t-test was employed. This finding is supported by the findings of Olanipekun et al.[26] in 2012 in primary schools in Ibadan who found that the prevalence of malnutrition to be significantly higher among the public (NFP) schools than the private (FP) schools.

Contrary to the present study findings, in a recent study conducted by Abdelaziz SB et al.[27] during September-December 2013 among school children aged 5-19 years in Beni-Suef Governorate, Egypt, using the newer WHO AnthroPlus Software (Version 1.0.4, 2010); underweight (WAZ<−2) and stunting (HAZ<−2) occurred in 10% and 53.2%, respectively. WAZ and HAZ mean scores of the children were −0.22 (SD = 1.39) and −2.09 (SD = 2.03), respectively. The malnourished children were classified on the basis of (WHO/NCHS) reference population BMI z-scores as being 2.8% thinness (<−2SD) and 34.4% obese (>+2SD). Boys were more underweight (3%) than girls (2.2%). Conversely, girls tend to be more stunted (65.3%) compared to boys (59.9%) in the age group 10 - 14 years.

In the present study, the prevalence of underweight is 26.5%. It is more among boys (31.3%) than girls (21.3%). It is more among government school children (37.9%) than private school children (16.7%). This finding is similar to a study in Pakistan by Mian RMA et al.[28] the prevalence of underweight was 29.5%. This finding is in contrast to a study in Garhwali Himalayan villages of India by Osei A et al.[12] where underweight was present in 60.9% of school children. In a study conducted in Bangalore, India by Hasan I et al.[13] in which the overall prevalence of underweight in the studied school children was 58.20%. The prevalence of underweight in boys was 65.55% and in girls, it was 47.26%. In a study among tribal children in Mysore district, Karnataka conducted by Prabhakar SC et al.[29] moderate underweight was 45.2% and severe underweight

107

was 14.8%. In a study conducted by Mukherjee R et al.[30] in Army School at Pune, the prevalence of underweight was very less, only 9.87%. In a study carried out in Santal children of Puruliya District, West Bengal by Chowdhury et al.[15] prevalence of underweight was 33.7%. In a study among school children of tea garden workers of Assam conducted by Medhi GK et al.[31] prevalence of underweight was 51.7%. In a study among school children from low income households in Kuala Lumpur, Malaysia conducted by Shariff ZM et al.[32] 52% of the school children were underweight. Underweight reflects both acute and chronic malnutrition. In the present study the prevalence of underweight was less compared to the above studies.

The prevalence of stunting in the present study is 19.2%. It is more among boys (22.4%) than girls (15.7%). It is more among government school children (31.0%) than private school children (9.0%). This finding is similar to a study conducted by Joshi HS et al.[16] in schools of Western Nepal, 13% of the students were stunted. In a study conducted by Mukherjee R et al.[30] the prevalence of stunting was 13.81%. In a study carried out by Chowdhury et al.[15] prevalence of stunting was 17.9%. In a study conducted by Medhi GK et al.[31] prevalence of stunting was 21.2%. This finding is in contrast to a study by Osei A et al.[12] stunting was present in 56.1% of school children. In a study conducted by Mandot S et al.[19] prevalence of stunting was 44% and 46.9% among boys 1255 and 762 girls aged 5-16, respectively using NCHS reference. In a study conducted by Saluja Neelu et al.[23] in urban primary school children in Meerut, India stunting was found in 43.8% children (46.0% girls and 41.8% boys). In a study conducted by Prabhakar SC et al.[21] there was high prevalence of mild (41.5%) and severe (6.7%) stunting. In a study conducted by Mian RMA et al.[28] prevalence of stunting was 35%. In a study

conducted by Shariff ZM et al.[32] 50% were stunted. Stunting reflects long-term malnutrition, and is influenced by parental attitudes and child care practices accumulating over a long period of time.

The prevalence of thinness in the present study is 26.5%. It was more among boys (30.8%) than girls (21.8%) and government school children (28.9%) than private school children (24.4%). This finding is similar to a study conducted by Mandot S et al.[19] thinness was higher among boys (69.7%) than girls (59.3%). This finding is in contrast to a study by Osei A et al.[12] thinness was present in 12.2% of school children. Prevalence of thinness was higher among boys (69.7%) than girls (59.3%). Thinness is a measure of acute malnutrition and it reflects the dietary intake of recent duration and physical activity.

The MUAC-for-age values for boys are lower than the standard Jelliffe values. Similarly the MUAC-for-age values for girls are lower than the standard Jelliffe values except for 5-6years age group, for whom it is equal. In comparison between boys and girls, girls have equal or higher values except for 9-10 years age group, for whom it is lower than boys. In contrast to the present study findings, in a study done by Chakraborty U et al.[33] according to MUAC-for-age, prevalence of undernutrition was found to be similar between Santal boys and girls aged 6 to 10 years of Bolpur in West Bengal.

The TSFT-for-age values for boys are equal to the standard Jelliffe values except for 5-6 years age group for whom it is lower. The values shows increment as the age group increases. However the TSFT-for-age values for girls are lower than the standard Jelliffe values except for 5-6 years age group for whom it is almost equal. The values shows variation as the age group increases. In comparison between boys and girls, girls have higher values than boys. The present study finding

108

is similar to a study conducted by Ayatollahi SMT *et al.*[17] TSFT increases by age and is higher in girls than boys. In a study done by Akthar MS *et al.*[34] the data showed significantly lower values (p<0.05) of TSFT in children of low and middle SES than those of high SES in both male and female of all age groups. The rate of increase in TSFT would be more rapid in girls after nine years of age, which may be due to earlier puberty in girls than boys.

Most of the children had dental caries (47.2%). Missing tooth was found in 7% of children which can lead to difficulty in chewing and reduced food intake. Mottled dental enamel may be due to excessive fluoride in water was seen in 1.7% of children. Signs of protein deficiency such as dyspigmented hair, thin and sparse hair and easily pluckable hair were seen in 2.2%, 1.5% and 0.5% of children respectively. Signs of vitamin A deficiency such as conjunctival xerosis, Bitot's spots, follicular hyperkeratosis, cracked skin were seen in 0.5%, 0.5%, 0.7% and 1.9% of children respectively and blurring of vision during night was reported by 0.5% of children. Slight depigmented lesions (Achromia parasitica) on the *face* were found in 9.2% of the children caused by either protein deficiency or niacin deficiency mostly due to worm infestations. Bowed legs, which is a sign of vitamin D deficiency was found only in one child (0.2%). These findings were in contrast to a study by Gill PS *et al.*[35] where signs of protein-calorie deficiency were found in 60.8%, signs of vitamin A deficiency in 46.3%, signs of vitamin D/calcium lack and of essential fatty acids in 10.3% each. Dental caries was seen in 48.9%, periodontal disease in 83% and mottling in 16.3%. In a study done by Shakya SR *et al.*[24] in the five

government schools located in Nepal the most common diseases in those schools were skin diseases(20%), dental caries(19.8%), and lymphadenopathy(10.5%).

**Limitations of the study:** Even though direct methods such as anthropometry, clinical examination and indirect methods such as demographic and socio-economic factors were used to assess the nutritional status; other direct methods such as biochemical and laboratory methods and indirect methods such as survey of ecological variables and vital health statistics were not included in the present study because of time and economic constraints. Further research studies can be undertaken to overcome the above mentioned limitations.

**Conclusion:**

In the present study, the prevalence of malnutrition (thinness) among the primary school children is 26.5%. The prevalence of underweight and stunting are 26.5% and 19.2% respectively. The nutrition status of children from government school was comparatively poor than private schools. Boys had a higher prevalence of malnutrition than girls. The current nutritional status of primary school children is unsatisfactory. Prompt integrated efforts should be made to improve the nutritional status of the children belonging to this age group.

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