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# Nutrition and Health Status of Children of Government Schools in Rural Areas of Hassan District

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***Data Availability Statement:*** Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

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## Abstract

Nutrition and health in early stages of human life determine to a great extent, the physical and mental well being of a person. Malnutrition is an impairment of health resulting from deficiency of essential nutrients, and over nutrition, which is an excess of one or more nutrients. The present study was undertaken to assess the health and nutritional status of school children of rural areas by assessing their clinical health status. The field study was based on the observations of 208 children, 104 girls and 104 boys studying in five government primary/ upper primary and high schools in Hassan district. Clinical Nutrition Survey Chart developed by FAO/ WHO Expert Committee on Medical Assessment of Nutritional Status was used assesses the symptoms of nutrient deficiency. Anthropometric measurements viz. height and weight of the children were recorded using weighing balance and height measuring rod respectively to study the growth pattern of the children. It was observed from the results that majority of the children boys (82.69%) and girls (72.12%) from the age group 6-15 years were under weight. Only one girl was overweight among the total sample. The nutritional health analysis showed signs of deficiencies among the children. Nutritional deficiency signs and symptoms like mild angular stomatitis due to vitamin B deficiency, loss of luster of hair and skin indicates protein and energy deficiencies and chalky teeth shows calcium deficiency. To overcome this problem the school intervention programmes should be developed which include different foods in adequate quantity to supply all essential nutrients.

***Keywords:*** Nutritional status, anthropometry, under weight, nutritional needs, health

## 1. Introduction

Nutrition is a core pillar of human development and concrete, large-scale programming not only can reduce the burden of under nutrition and deprivation in countries but also can advance the progress of nations. The nutritional status of an individual is often the result of many inter-related factors. It is influenced by food intake, quantity & quality, & physical health. The spectrum of nutritional status spread from obesity to severe malnutrition. Over the decades the problems of malnutrition, anaemia, vitamin-A and iodine deficiency are very common among children in India. Nearly half of all deaths in children under 5 are attributable to under nutrition. Under nutrition puts children at greater risk of dying from common infections, increases the frequency and severity of such infections, and delays recovery. The 2019 edition of the joint malnutrition

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estimates shows that stunting prevalence has been declining since the year 2000, nearly one in four – 149 million children under 5 were stunted in 2018, and over 49 million suffered from wasting. Meanwhile, the number of overweight children worldwide has remained stagnant for more than a decade (Anonymous, 2019)

As India marches ahead with policy and programmatic interventions for achieving the millennium development goals, there is increasing recognition of achieving a truly "Food Secure India". However, India is a poignant example of how food sufficiency at the aggregate level has not translated into nutrition security at the house hold level. In India, according to the findings of Hunger and Malnutrition survey by Anonymous (2012) in 112 districts across nine states of the country has revealed that 42.3% children under the age of five years are underweight, 58.8% are stunted and 11.4 % are wasted. Radhamani and Rajeev (2017) reported that underweight, stunting, and wasting were most prevalent in 2-3-year-oldchildren and minimum among 3-4-year-old children. Elizabeth (2010) reported that nutritional problems among children cause major morbidity and mortality in India. Despite the increase in food production and many interventions in recent years, the problem of chronic malnutrition continues to exist extensively among children. The children below five years are the most vulnerable to under nutrition and its adverse effects (Geoff, 2016)

The consequences of early malnutrition include mental and physical impairment that severely affect a child's growth and development. In addition to an increased frequency of infectious disease children with malnutrition are at significantly higher risk of more severe disease and suffer significantly more acute and long term morbidity and mortality when infected (Walson et al., 2018). In a developing country like India, poverty undoubtedly constitutes a major factor for malnutrition in children, but lack of awareness of what constitutes a balanced diet is also a factor, which needs to be considered. Therefore, the major objective of the present study is to assess the nutritional and health status of the school children in the rural areas of Hassan district of Karnataka, India.

## 2. Materials and Methods

The investigator used random simple sampling technique for selection of sample from five villages Viz., Ankapur, Nagalapur, Rangapur, Kinnerhalli and Ganjalagudu of Hassan district (13.0068° N,76.0996°E) Karnataka state, India. The study was conducted during the academic year 2015-16. In all 208 children, 104 girls and 104 boys studying in government schools from 1$^{st}$ to 10$^{th}$ standard (in the age group 6 to 15 years) were selected randomly for the present study. Clinical Nutrition Survey Chart developed by FAO/ WHO Expert Committee on Medical Assessment of Nutritional Status was used assesses the symptoms of nutrient deficiency. Anthropometric measurements viz. Height and weight of the children were recorded. Height was measured by using digital weighing balance. The height measuring rod was used to record children's height. These observations were used to calculate Body Mass Index (BMI) by using the formula

BMI = Weight (kg)/Height ($m^2$)
The indicators are

BMI of 19 or below: Underweight

BMI between 19 and 24.9: Healthy range

BMI between 25 and 29.9: Overweight

BMI of 30 or greater: Obese

Based on BMI the children were grouped into different categories and % was calculated.

## 3. Results and Discussion

### *3.1. Anthropometric measurements*

Height and weight of the children were recorded and were used to calculate Body Mass Index. Children were classified in to four groups based on the Body Mass Index as underweight, normal, overweight and obese. The mean height and weight of the children from the age group of 6 to 15 years were compared with ICMR standards. The results on the height of boys (Table 1) indicated that the boys were found shorter than ICMR standard by 0.1 cm to 11.50 cm across all ages. The maximum difference was found in age group of 14 years.

The results also revealed that the weight of boys increased with increase in age from 6 to 15 years. The weight of the boys in the age group 6to15years ranged from 16.60 kg to47.60 kg with a total gain of 31 kg. The weight was found lower than the ICMR (1990) standard across all ages.

Student- t test was calculated for all the deficit values of height and weight at 103 degrees of freedom and obtained the respective probability values. The lowest probability of 0.0804<($p$=0.10) was observed at the age of 14 years old boys. It shows significantly higher difference at 10% level with respect to height. No significant highest difference was observed in the weights of the boys. Lowest deficit between height, probability of 0.0684<($p$=0.10) at the age group of 6 years was obtained and lowest deficit weight probability of 0.030 <($P$=0.10)was recorded in the 13 years age group of boys.

Results on the height of girls indicated that (Table 2) the girls were found shorter than ICMR standard by 0.26 cm to 10.33 cm across all ages. The maximum difference was found in age group of 15 years. The weight of the girls in the age group 6 to15years ranged from 14.57 kg to 42.50 kg with a total gain of 27.93 kg. Data showed that the girls were shorter than the ICMR standards for Indian girls at all ages.

Student- t test was calculated for all the deficit values of height and weight for 103 degrees of freedom and obtained the respective probability values. The lowest probability of 0.068<($p$=0.10) was observed at the age of 15 years. It shows

Table 1: Comparison of height and weight of boys with ICMR standards (n=104)

| Age ( Yr) | Mean Ht (cm) | Height ICMR | Deficit | *p*=0.1 | t | Mean Wt (kg) | Weight ICMR | Deficit | *p*=0.1 | t |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 116.0 | 116.1 | 0.10 | 0.0684 | -1.842 | 16.6 | 20.7 | 4.12 | 0.726 | -0.351 |
| 7 | 119.0 | 121.7 | 2.70 | 0.3106 | -1.019 | 19.2 | 22.9 | 3.71 | 0.559 | -0.586 |
| 8 | 121.2 | 127.0 | 5.78 | 0.9650 | -0.044 | 18.4 | 25.3 | 6.86 | 0.224 | 1.224 |
| 9 | 127.0 | 132.2 | 5.20 | 0.8201 | -0.228 | 22.4 | 28.1 | 5.75 | 0.559 | 0.586 |
| 10 | 130.1 | 137.5 | 7.40 | 0.6408 | 0.468 | 24.8 | 31.4 | 6.63 | 0.277 | 1.092 |
| 11 | 135.6 | 140.0 | 4.40 | 0.6315 | -0.481 | 26.8 | 32.2 | 5.41 | 0.697 | 0.391 |
| 12 | 139.3 | 147.0 | 7.67 | 0.5808 | 0.554 | 31.8 | 37.0 | 5.25 | 0.766 | 0.299 |
| 13 | 146.9 | 153.0 | 6.09 | 0.9570 | 0.054 | 40.0 | 40.9 | 0.90 | 0.030 | -2.201 |
| 14 | 148.5 | 160.0 | 11.50 | 0.0804 | 1.766 | 43.3 | 47.0 | 3.67 | 0.544 | -0.609 |
| 15 | 157.6 | 166.0 | 8.40 | 0.4343 | 0.785 | 47.6 | 52.6 | 5.02 | 0.868 | 0.167 |

Table 2: Comparison of height and weight of Girls with ICMR standards (n=104)

| Age ( Yr) | Mean Ht (cm) | Height ICMR | Deficit | *p*=0.1 | t | Mean Wt (kg) | Weight ICMR | Deficit | *p*=0.1 | t |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 112.6 | 114.6 | 2.0 | 0.368 | -0.904 | 14.57 | 19.5 | 4.93 | 0.789 | -0.269 |
| 7 | 118.6 | 120.6 | 2.03 | 0.373 | -0.894 | 17.64 | 21.8 | 4.06 | 0.438 | -0.778 |
| 8 | 126.2 | 126.4 | 0.26 | 0.142 | -1.479 | 20.07 | 24.8 | 4.73 | 0.700 | -0.386 |
| 9 | 127.0 | 132.2 | 5.20 | 0.880 | 0.152 | 21.72 | 28.5 | 6.78 | 0.418 | 0.813 |
| 10 | 132.3 | 138.3 | 5.99 | 0.681 | 0.413 | 27.31 | 32.5 | 5.19 | 0.907 | -0.117 |
| 11 | 135.8 | 142.0 | 6.16 | 0.640 | 0.469 | 29.42 | 33.7 | 4.28 | 0.518 | -0.649 |
| 12 | 140.2 | 148.0 | 7.77 | 0.320 | 1.000 | 34.15 | 38.7 | 4.55 | 0.625 | -0.491 |
| 13 | 145.3 | 150.0 | 4.75 | 0.998 | 0.003 | 40.66 | 44.0 | 3.34 | 0.233 | -1.199 |
| 14 | 152.1 | 155.0 | 2.90 | 0.545 | -0.607 | 40.92 | 48.0 | 7.08 | 0.326 | 0.988 |
| 15 | 150.7 | 161.0 | 10.33 | 0.068 | 1.845 | 42.50 | 51.5 | 9.0 | 0.037 | 2.111 |

significantly higher difference at 10% level with respect to height. Significantly highest difference was observed in the weights of the girls at the age 15 years with probability 0.037<(*p*=0.10). No lowest deficit weight was observed in girls.

Height and weight of the children are used to calculate Body Mass Index and children are classified in to four groups as underweight, normal, overweight and obese. Figure 1. shows the classification of boys in the age group from 6 to 15 years based on BMI.

It is evident from the table that all the boys from the age group 6-9 years were below normal weight. Majority of the children in the age group of 10, 11 and 13 years were also underweight (92.3%, 91.7% and 91.7 % respectively). Lowest per cent of children at the age of 15 years (41.67 %) were underweight. None of the boys from the age group of 6-9 years were neither over weight nor obese. The normal weight was observed only from the age group 10-15 years. In the normal range, highest per cent (58.33%) was recorded at the age group of 15 years followed by 12 years (46.15%). Lowest of 8.33 percent was observed at the age of 11 and 13 years.

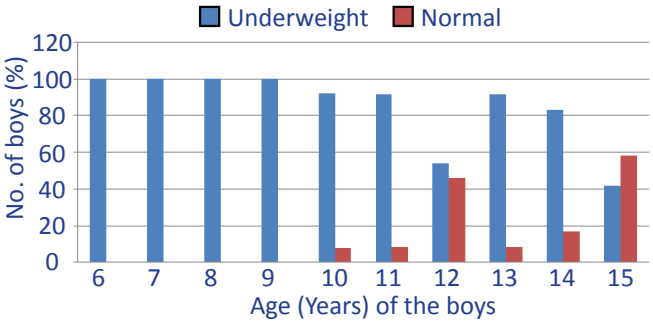


Figure 1: Classification of boys according to BMI

Figure 2 shows the classification of girl students (in the age group 6 to 15 years) based on their Body Mass Index (BMI). It is evident from the table that highest of 100 % of all the girls from the age group 6-9 years were underweight. Followed by 11 year old girls (91.7 %). Similar results were observed by Sharma et al. (2010) who observed malnutrition among children in government schools. Similar trend of severe stunting was observed by Ashwini et al. (2011). Physical development of the child was found to be affected by their nutritional status and environmental conditions. Survey in rural population of

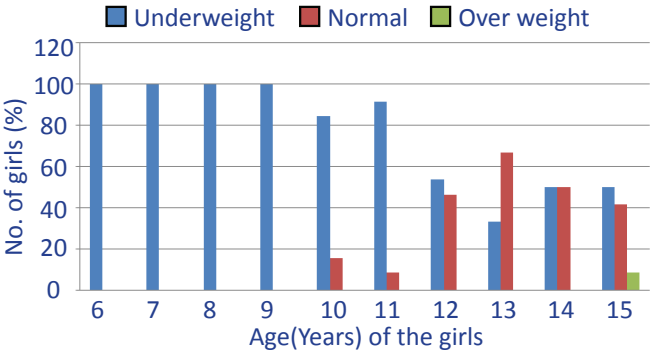


Figure 2: Classification of Girls according to BMI

India, by NNMB (Anonymous, 2002) also reported prevalence of malnutrition. The lowest of 33.33 % was observed at the age of 13 years. None of the girls from the age 6-9 years were in the Normal weight, over weight and obese groups. The normal weight was observed only from the age group 10-15 years. The table also reveals that only one girl in the age of 15 years was overweight. Highest per cent (66.67%) of girls were normal at the age of 13 years followed by 14 years (50.0%). Lowest of 8.33% had normal weight at the age of 11 years.

*3.2. Physical examination and clinical signs of malnutrition*

Malnutrition is widely prevalent among Indian children. As per the report of Express News Service (2009) 42.50% of children under the age of five years are under-weight in India. A single mid day meal in school can not improve the nutrition related needs of children completely but it is a regular source of supplementary nutrition and helping a lot to overcome the problem of classroom hunger. Many children reach the school either with an empty stomach or little breakfast in morning. Even those children, who have taken their meal in the morning, get hungry by afternoon. Table 3 shows the clinical signs of malnutrition among children in the selected schools.

Physical examination of the children showed (Table 3) the percentage distribution of the nutritional deficiency signs amongst children. It was observed that highest % of children (74.04%) had good physical appearance. Among these children percentage of girls was higher (78.85%) compared to boys (69.23%). Lowest of 3.85% children had poor general appearance which includes highest number of boys (5.77%) compared to girls (1.92%).It was found from the results that majority of the boys and girls (47.12% and 49.02%) had normal healthy hair followed by children with lustreless hair. Many children (22.59%) had dull and dry hair. With regard to health of the skin the results revealed that 50% of the children had lustreless skin which includes 55.77% boys and 44.23% girls followed by 22.59% children having dry and rough skin with. Only 27.40% children had normal shiny skin. This shows that these children were suffering from protein calorie malnutrition. The present study also revealed that majority of the children had normal healthy eyes, lips and gums, which indicated that children were, free from vitamin A, C and B complex deficiency diseases. Few children (5.29%) had mild angular stomatitis which is the deficiency disease of vitamin riboflavin. None of the children had marked angular stomatitis.

Physical examination of the children also showed that a large proportion of children had normal teeth. Equal number of boys and girls (15.38%) had discoloured teeth followed by 7.21 % of children with chalky teeth. This showed that the children need proper guidance to maintain cleanliness and normal health of their teeth. Physical examination of the children showed that all the children (100%) had normal bone growth and none of them had rickets. This showed that severe form of vitamin D deficiency was not found in these children. On observing the rural children for any nutritional deficiency signs and symptoms, mild angular stomatitis, loss of luster of hair and skin indicates protein and energy deficiencies, chalky teeth shows calcium deficiency among them. They were also short of carbohydrates requirements. Similar results were recorded by Mehrotra et al (2011).The deficiency signs indicate the poor diet intake, inappropriate amount of food and non- nutritious food. They might tend to eat whatever is locally or cheaply available, a complete meal is lacking in their diet schedule.

The nutritional health analysis shows signs of deficiencies among the children. The frequency of essential food intake like milk and complex carbohydrates is also poor among the rural children studied. Therefore, their energy requirement is not met by their daily diet. Hence it is clear from the results that protein energy malnutrition was found among these children. Similar results were obtained by Shalini et.al (2014) ,the researcher concluded that magnitude of the burden of undernourished students as seen in study would have been much greater in the absence of the midday meal program. Bhoite and Iyer, (2011) reported that in rural population, malnutrition was highly prevalent with 70 % of children being underweight; Stunting was evident in 32.4 % of girls and 30.8 % boys, prevalence of anaemia was 73 % and the severity was more in under-nourished children.

It is not only the rural children but a nutritional gap is also seen among the urban children Shalini et al (2014), hence imparting nutrition knowledge and follow-up of the running nutritional programme should be done. In the urban schools where children bring their own lunch boxes to schools, parents should be counselled about nutrition and a monthly diet plan should be advised to the parents according to the requirement of the child. This can keep a check as well as will help in modifying the diet of the child and the family as well. The government should have a budget to run a comprehensive nutrition education programme in all the schools. The researcher recommends that the food provided to the children under Mid-day Meal programme should be a mixture of all the essential nutrients. Regular weight and height measurements should be taken in the school so that a regular check can be kept on the development of the children.

Table 3: Clinical nutritional survey chart of beneficiary children

| Clinical signs | Boys (n=104) | | Girls (n=104) | | Total | |
|---|---|---|---|---|---|---|
| | No | % | No | % | No | % |
| General-Appearance | | | | | | |
| Good | 72 | 69.23 | 82 | 78.85 | 154 | 74.04 |
| Fair | 26 | 25.0 | 20 | 19.23 | 46 | 22.11 |
| Poor | 06 | 5.77 | 02 | 1.92 | 08 | 3.85 |
| Very Poor | - | - | - | - | - | - |
| Hair | | | | | | |
| Normal | 49 | 47.12 | 51 | 49.02 | 100 | 48.08 |
| Loss of Lustre | 35 | 33.65 | 26 | 25.0 | 61 | 29.33 |
| Discoloured & Dry | 20 | 19.23 | 27 | 25.96 | 47 | 22.59 |
| Sparse & Brittle | - | - | - | - | - | - |
| Eye Discharge | | | | | | |
| Absent | 99 | 95.12 | 101 | 97.12 | 200 | 96.15 |
| Watery | 05 | 4.81 | 03 | 2.88 | 08 | 3.85 |
| Mucopurulent | - | - | - | - | - | |
| Lips | 98 | 94.23 | 99 | 95.20 | 197 | 94.71 |
| Angular Stomatitis, Mild | 06 | 5.77 | 05 | 4.81 | 11 | 5.29 |
| Angular Stomatitis, Marked | - | - | - | - | - | - |
| Gums | | | | | | |
| Normal | 100 | 96.20 | 98 | 94.23 | 198 | 95.19 |
| Bleeding | 04 | 3.85 | 06 | 5.77 | 10 | 4.81 |
| Pyorrhoea | - | - | - | - | | |
| Teeth | | | | | | |
| Normal | 80 | 76.92 | 78 | 75.0 | 158 | 75.96 |
| Chalky Teeth | 07 | 6.73 | 08 | 7.70 | 15 | 7.21 |
| Pitting of Teeth | 01 | 0.96 | 02 | 1.92 | 03 | 1.44 |
| Discoloured | 16 | 15.38 | 16 | 15.38 | 32 | 15.38 |
| Skin | | | | | | |
| Normal | 22 | 21.15 | 35 | 33.65 | 57 | 27.40 |
| Loss of Luster | 58 | 55.77 | 46 | 44.23 | 104 | 50.00 |
| Dry & Rough | 24 | 23.10 | 23 | 22.12 | 47 | 22.59 |
| Hyperkeratosis | - | - | - | - | - | - |
| Bones | | | | | | |
| Normal | 104 | 100 | 104 | 100 | 208 | 100.0 |
| Rickets | - | - | - | - | - | - |

Format Source: FAO/ WHO Expert Committee on Medical Assessment of Nutritional Status

**4. Conclusion**

Malnutrition is widely prevalent among children in rural areas of Hassan. The present study shows that majority of children (82.69% boys and 72.12% girls) from the age group 6-15 years were underweight and suffer from deficiency diseases like mild angular stomatitis, dull hair and chalky teeth. To overcome this problem adequate amount of cereals, pulses as well as good quality of vegetables especially green leafy vegetables,

should be included in the meal to combat deficiencies in micro nutrients.

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