



Nutritional Status And Its Association With Diabetes Mellitus In School Children, India

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ABSTRACT

Background: Poor health and nutrition may impair both the growth and intellectual development of school children. Incidence of malnutrition related childhood diabetes mellitus has increased and continues to be on the rise. **Objectives:** To assess the nutritional status by anthropometry and to screen for diabetes by capillary blood examination of school children. **Design:** Longitudinal study **Setting:** The study was carried out at Sri R.L.Jalappa Central School, Kolar from August 2008 to December 2009. **Methods:** All the school children were interviewed with pre-designed and pre-tested proforma. Height, Weight was measured by standard procedures. The nutritional status was analysed by Body Mass Index (BMI) for age. The school children were also screened for diabetes mellitus by Finger stick capillary random plasma glucose testing. The children were followed up for any major medical problems during the study period. **Participants:** All the students studying in the school during study period. **Results:** Mean height and weight of children were found comparable to the ICMR pooled data. However, compared to NCHS standards and affluent Indian children the mean height and weight were found to be much inferior at all ages. According to BMI for age as per NCHS most of the children were undernourished (79.2%) and 3 children (0.6%) were overweight. Out of 495 children screened for diabetes 14 children had hyperglycaemia (>160mg/dl). These 14 children were further tested by oral glucose tolerance test and found to have normal blood sugars levels. During the follow up two undernourished children developed diabetes mellitus. **Conclusion:** The magnitude of malnutrition among school going children was found to be 79%. During the follow up two undernourished children developed diabetes mellitus, hence under nutrition was associated with diabetes mellitus.

Key words: Height, Weight, BMI, Malnutrition, Diabetes Mellitus

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Introduction

Inadequate nutrition in adolescence can potentially retard growth and sexual development, although these are likely consequences of chronic malnutrition in infancy and childhood.^[1] Poor health and nutrition may impair both the growth and intellectual development of school children.^[2] Epidemiologic studies show that diabetes mellitus is almost as prevalent in undernourished population as it is in the well nourished ones.^[3]

Childhood obesity and overweight was considered a problem of affluent countries. Today this problem is

appearing even in developing countries. Globally the prevalence of childhood obesity varies from over 30% in USA to less than 2% in sub-Saharan Africa. Studies from metropolitan cities in India reported a high incidence of obesity among affluent school children.^[4] Incidence and prevalence of childhood diabetes has increased and continues to be on the rise in Western studies.^[5] A few cases of type-2 diabetes have been detected during mass urine examination for glucose in some countries.^[6, 7]

As there are limited studies available on screening for diabetes mellitus by blood sugar estimation, the present study is undertaken to find out the prevalence

of diabetes mellitus in school children. The objective of the study was to assess the nutritional status by anthropometry and to screen for diabetes mellitus by capillary blood examination in school children.

Material and Methods

A Longitudinal study was conducted from August 2008 to December 2009 at Sri R.L. Jalappa Central School catering the urban and rural children of Kolar. Consent of school authorities and parents of the children were obtained after explaining the objectives and methods of study.

Anthropometric measurements

Anthropometry is the single most universally applicable, inexpensive method available to assess the size, proportion and composition of human body.^[8] The height was measured to the nearest 0.5cm with a portable stadiometer by adopting standard procedure. Body weight was measured to the nearest 0.5 kg with a subject standing motionless on a weighing scale with feet 15cm apart and weight equally distributed on each leg. Body Mass Index (BMI) for age was used in assessing the nutritional status of the school children. It is calculated the same way as for adults but then compared to typical values for other children of the same age. BMI less than 5th percentile is considered underweight, children with BMI between 85th and 95th percentile as overweight and above 95th percentile as obese (National Centre for Health Statistics-NCHS standards).

All the school children who were present at the time of examination were screened for diabetes mellitus by Finger stick capillary random plasma glucose testing. After ensuring hand washing with soap & water the children blood sample was collected using single use (disposable insulin needle No.26) lancing device. Blood sugar was tested by using glucometer (B/BRAUN Accucheck) as it is rapid, inexpensive and safe. The children were also followed up for any major medical problems.

Results

A total of 495 children from 1st to 9th class participated in the study, out of these 291 (58.78%) were boys and 204 (41.21%) were girls. 172(34.7%) children were from rural areas and 323 (65.3%) were from urban are as [Table-1].

The mean height and weight of boys are higher than girls [Figure-1 & Figure-2], except for the age 14 and 15 years where mean weight of girls were higher. There was no significant difference in the mean BMI of boys (13.12) when compared to girls (13.09) [Table-2].

According to BMI for age as per NCHS most of the children were undernourished (79.2%) and 3 children (0.6%) were overweight [Table-3]. 34.2% of the children from the rural areas were undernourished; where as 65.8% of the urban children were under-weight [Table-4].

Table-1: Demographic profile of the study population

Age (years)	Sex				Total	
	Girls		Boys			
	No.	%	No.	%	No.	%
05-09	65	31.9	100	34.4	165	33.3
10-14	123	60.3	158	54.3	281	56.8
15-19	16	7.8	33	11.3	49	9.9
Residence						
Rural	62	30.4	110	37.8	172	34.7
Urban	142	69.6	181	62.2	323	65.3
Religion						
Christi an	3	1.5	6	2.1	9	1.8
Hindu	177	86.8	244	83.8	421	85.1
Musli m	24	11.8	41	14.1	65	13.1
Total	204	100	291	100	495	100

Out of 495 children screened for diabetes by Glucometer Random Blood Sugar (GRBS), 14 children had hyperglycaemia (>160mg/dl). These 14 children were further tested by oral glucose tolerance test and were found to have normal blood sugar levels.

During the follow-up, two children were admitted to RL Jalappa Hospital and Research Centre with high blood sugar levels and were diagnosed as having diabetes mellitus. At the time of screening, these two children were undernourished and had hypoglycaemia.

Discussion

Mean height and weight of children were found comparable to the ICMR pooled data. However, compared to NCHS standard and affluent Indian children the mean height and weight were found to be much inferior at all ages.^[9, 10] Mean weight of the girls in 14 and 15 years were better than boys of the same age groups. This may be due to onset of pubertal growth spurt which is similar to study by Elizabeth.^[11] On comparing BMI with NCHS standards, it was observed that BMI was much lower at all ages.

Table-2: Age and sex variation in anthropometric characteristics of school children

Age (yrs)	Sex	No.	Height (cms) Mean±SD	Weight (kgs) Mean±SD	BMI Mean±SD	NCHS BMI Mean
6	M	5	126.33±2.33	18.66±1.5	11.7±1.19	15.37
7	F	23	125.7±5.67	17.76±2.75	11.2±1.21	15.51
	M	45	128.71±4.6	18.01±2.76	10.86±1.5	15.59
8	F	22	131.77±4.28	20.45±4.03	11.75±2.03	15.85
	M	23	135±5.43	22.13±4.45	12.11±2.19	15.87
9	F	19	134±5.9	19.63±2.19	10.93±0.92	16.32
	M	26	134.58±7.06	19.77±3.95	10.82±1.29	16.68
10	F	40	137.3±6.19	21.25±3.28	11.27±1.55	16.9
	M	38	139.13±7.62	22.08±4.11	11.38±1.73	16.66
11	F	31	129.74±6.03	22.03±4.27	13.01±1.83	17.57
	M	39	132.08±6.7	23.54±4.8	13.4±1.89	17.2
12	F	17	135.53±6.9	26.65±5.13	14.42±1.93	18.36
	M	38	136.89±6.46	27.11±3.91	14.42±1.47	17.84
13	F	16	145.56±9.1	31.38±8.21	14.65±2.69	19.15
	M	26	147.88±6.76	32.5±8.73	14.7±2.78	18.58
14	F	19	147.11±8.7	37.26±7.76	17.23±3.27	19.88
	M	17	148.12±9.18	36.24±11.36	16.26±3.76	19.35
15	F	11	154.73±4.5	41.55±7.43	17.3±2.66	20.86
	M	20	155.25±2.59	37.5±7.07	15.54±2.78	20.1
16	F	4	158.25±6.75	45.25±5.25	18.13±2.49	20.86
	M	10	161.9±8.35	45.7±9.26	17.37±2.64	20.18
17	M	3	169.33±3.79	52.33±11.02	18.19±3.28	21.14

Height $t=2.053$ $P=0.041$ Significant, Weight $t=1.053$ $P=0.293$ Not Significant, BMI $t=0.110$ $P=0.912$ Not Significant

A study of nutritional status of adolescent children by Dasgupta et al shows 47.93% were under nourished (BMI<18.5), similarly 68.52% in Varanasi adolescent girls were undernourished, while in the present study 79.2% of the children were under weight.^[1, 12]

In various Indian studies Overweight/Obesity among children is progressing towards epidemic level.^[13, 14, 15] Where as in our study the prevalence of overweight was only 0.6%, which is similar to the study in Delhi.^[16]

Table-3: Distribution of children according to Body mass index for age

Nutritional status	Sex				Total	
	Girls		Boys			
	No.	%	No.	%	No.	%
Normal	45	22.1	55	18.9	100	20.2
Overweight	1	0.5	2	0.7	3	0.6
Underweight	158	77.5	234	80.4	392	79.2
Total	204	100	291	100	495	100

$\chi^2=0.802$ $P=0.670$ Not Significant

Table-4: Nutritional status according to place of residence

Nutritional status	Residence				Total
	Rural		Urban		
	No.	%	No.	%	
Normal	36	36	64	64	100
Overweight	2	66.7	1	33.3	3
Underweight	134	34.2	258	65.8	392
Total	172	34.7	323	65.3	495

$\chi^2=1.472$ $P=0.479$ Not Significant

Table-5: Blood glucose levels of school children

GRBS	No.	%
<60mg/dl	15	3
60-159mg/dl	466	94.1
>160mg/dl	14	2.8
Total	495	100

Figure-1: Mean Weight of Children according to age

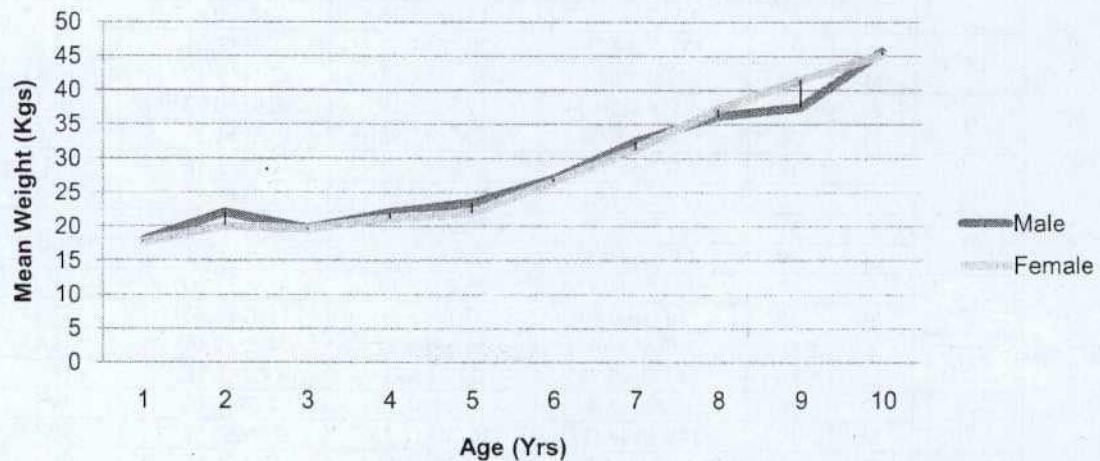
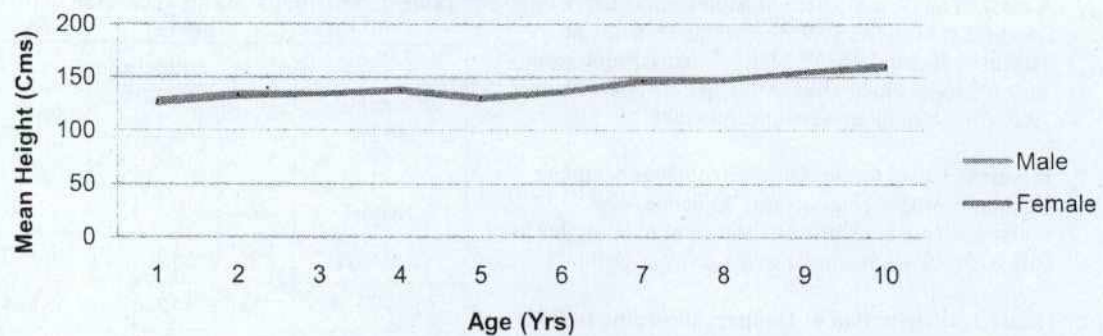


Figure-2: Mean Height of Children according to Age



Several studies in Kuwait and Japan have indicated increased incidence of childhood type-2 diabetes.^[6, 7] Malnutrition related diabetes mellitus is yet another risk in young Indians, epidemiologic studies show that diabetes mellitus is almost as prevalent in undernourished population as it is in the well nourished ones.^[3] In our study two undernourished children developed diabetes mellitus during the follow up suggesting an association between under nutrition and diabetes mellitus. Whereas, in other studies no such cases were reported in undernourished children.^[17, 18] While a study in rural areas of Tamaka Kolar reported that diabetes was common in young adults.^[19]

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