

# Determinants of Nutritional Status of School Children

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## Abstract

**Background :** A cross sectional study was carried out to determine the nutritional status of school children in Army School, Pune. **Methods:** Anthropometric survey of 760 school children was carried out and compared against the NCHS/WHO reference standards to determine their nutritional status. Associations of nutritional status with socio-economic status, education status of parents, mothers working status and family size were determined.

**Result:** The prevalence of stunting was 13.81%, wasting 6.71% and under nutrition 9.87%. Mothers' educational level, wasting, socio economic status and family size were significantly associated with the nutritional status of the child.

**Conclusion:** Maternal educational status, socio-economic status and family size are important determinants of nutritional status of school children.

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**Key Words :** Nutritional status; Maternal education

## Introduction

Malnutrition contributes directly or indirectly to more than 60% of 10 million child deaths each year [1]. In the developing world, 43% of the children are stunted and 9% are wasted [2]. In India, the National Family Health Survey I & II reported that both chronic and acute undernutrition was high in many states [3]. This results in decreased scholastic performances, lower IQ levels, poor psychosocial development, decreased cognitive functions and reduced adult size leading to decreased economic productivity [4]. The present study was carried out to determine the nutritional status of children studying in Army School at Pune.

## Material and Methods

A cross sectional study was carried out at the Army School, Pune, which is a coeducational school with classes from nursery to class XII with a total strength of around 2100 children. Each class had five sections and children were randomly allocated to different sections irrespective of sex, socioeconomic status or academic performance. The study was carried out on children in the age group of 5 – 11 years in class I to VI. Sample size was calculated taking alpha error as 5%,  $p = 0.05$ , expected deviation as 4%. As per above assumptions the sample size calculated was 600. Around 1200 children were in the age group of 5-11 years. These were predominantly children in classes I to VI. Three sections were chosen randomly for each class and all children in these three sections were selected into the study. The total number children were 760.

Each child's height and weight was measured in the metric

system, using standardized technique recommended by Jelliffe [5]. Body weight was recorded with the help of a electronic weighing machine to the nearest 0.1 kilogram with their uniforms without any footwear and one kilogram was deducted for weight of uniform. Height was measured with the help of anthropometric rod in the Frankfurt plane to the nearest 0.1 cm. Data was analysed using Epi Info 6 software of CDC, Atlanta, USA. Height for age (Stunted), Weight for height (Wasted), and Weight for age (Under weight) for each child was calculated and compared with the WHO/NCHS standard. Cut off point values between  $\pm 2$  SD were considered normal [6,7].

For assessing socioeconomic status, subjects were divided into three groups, viz. children whose parents were Officers, Junior Commissioned Officers (JCOs) and Other Ranks (ORs) as in the Armed Forces most amenities like housing and income is clearly demarcated between these three groups. If both the parents were employed in the defence services, then child was classified on the basis of the higher ranked parent.

Age of the child was determined using the school records. Mother and father's education level was classified into five groups i.e. Illiterate (no formal education), Primary (completed class V), Middle School (completed class VIII), High School (completed class X), Intermediate (completed class XII) and Graduate and beyond (completed graduation or beyond). Any mother who was gainfully employed, with financial remunerations and was working for at least the past 12 months outside the house, was considered to be a working mother.

## Results

The age and sex distribution of children is given in Table

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1. Of the 760 children studied, 359 (47.23%) were females and 401 (52.77%) males, with a sex ratio of 895 females per 1000 males. Of these 760 children, 426 (56.07%) belonged to the ORs category, 176 (23.15%) were from the JCOs category and 158 (20.78%) from Officer's category. 262 (34.49%) children had mothers who were graduates and beyond, 59 (7.76%) mothers were educated till primary level, 96 (12.63%) till middle school, 180 (23.68%) till high school and 163 (21.44%) had studied till intermediate school. None of the mothers were illiterates. On comparing the homogeneity of distribution of girls and boys according to maternal education status it was found that the boys and girls were homogeneously distributed ( $\chi^2=1.51$ ,  $df=4$ ,  $p>0.05$ ). Majority of the mothers 682 (89.74%) were housewives. The girls and boys were homogeneously distributed as per the working status of the mothers ( $p=0.83$ ). Of the 760 children, 308 (40.55%) had fathers who were graduates or beyond, 223 (29.34%) had studied up to intermediate school, 139 (18.28%) had studied upto high school, 139 (18.28%) up to middle school and 44 (5.78%) up to primary school. None of the fathers were illiterate. The boys and girls were homogeneously distributed with respect to fathers' education status ( $p=0.32$ ). On analyzing the data according to family size 159 (70.26%) children came from families which had three members, and 67 (8.82%) children were from families with more than five members. The girls and boys were homogeneously distributed with respect to the family size ( $p=0.067$ ).

Table 2 shows the mean weights of boys and girls of the study group. The mean weight increased from 18.4 kg and 18.0 kg for boys and girls respectively in the 5+ age group to

34.5 kg and 35.7 kg respectively in the 11+ age group. The mean weight of boys was more than the girls till eight years of age, thereafter the girls weighed more. However there was no statistically significant difference in the mean weights of the boys and girls in any of the age groups. On comparison with the NCHS/WHO standard the mean weight of boys and girls of the present study was found to be lower in all age groups. Table 3 shows the mean height of boys and girls. The mean height of girls was lower than that of the boys till eight years of age, but thereafter the girls were taller than the boys. This difference in the heights of the boys and girls was not significant in any age group. The mean height of boys and girls of the study group was lower than the WHO/NCHS standards in all age groups.

As per the WHO/NCHS standards, 105 (13.81%) children out of the total 760 children were stunted, with 21 (2.76%) children showing severe grade of stunting (Table 4). Among the girls, 45 (12.53 %) were stunted as compared to 60 (14.96%) boys ( $p=0.33$ ). The boys and girls were homogeneously distributed with respect to grades of stunting, ( $p=0.54$ ). Wasting was present in 51 (6.71%) children. Wasting was observed in 22 (6.12%) girls and 29 (7.23%) boys, however this difference between sexes was not statistically significant ( $p=0.54$ ). 75 (9.87%) children were underweight of which eight (1.05%) were of a severe degree. Among the girls, 31 (8.63%) were underweight, while 44 (10.97%) boys were underweight ( $p=0.28$ ).

The highest prevalence of stunting (19 32.20%) was observed among children whose mothers were educated up to primary level, while the lowest prevalence of stunting (23 8.77%) was seen in children whose mothers were graduates or above (Table 5). Of the 59 children whose mothers were educated up to primary level, 18 (30.50%) had wasting while the lowest prevalence of six (2.29%) was observed in children whose mothers were graduates or postgraduates ( $\chi^2$  for linear trends = 53.50,  $p=0.000$ ). The prevalence of underweight was least (nine 3.43%) among children whose mothers were educated till graduation or beyond, while the highest prevalence (20 33.89%) was observed among children whose mothers were educated till primary level ( $\chi^2$  for linear trends = 53.50,  $p=0.000$ ).

The prevalence of stunting and underweight was higher among children whose mothers were housewives, while

**Table 1**  
Distribution of children by age and sex

Age group (years)	Females (%)	Males (%)	Total (%)
5+	25 (48.07)	27 (51.93)	52 (100)
6+	66 (49.62)	67 (50.38)	133 (100)
7+	68 (51.90)	63 (48.10)	131 (100)
8+	46 (36.22)	81 (63.78)	127 (100)
9+	61 (43.57)	79 (56.43)	140 (100)
10+	51 (49.03)	53 (50.97)	104 (100)
11+	42 (57.53)	31 (42.47)	73 (100)
Total	359 (47.23)	401 (52.77)	760 (100)

**Table 2**  
Comparison of mean weight of boys and girls

Age group	Boys				Girls				p value
	Number examined	Mean weight(Kg)	SD	Mean weight (boys) WHO/NCHS standards	Number examined	Mean weight(Kg)	SD	Mean weight (girls) WHO/NCHS standards	
5+ years	27	18.4	2.66	18.6	25	18.0	4.24	18.1	0.42
6+ years	67	19.5	3.50	21.3	66	19.3	3.80	21.0	0.80
7+ years	63	22.4	4.46	24.0	68	22.3	5.45	22.2	0.94
8+ years	81	24.8	4.7	26.4	46	24.6	5.83	26.3	0.98
9+ years	79	27.6	6.25	28.8	61	28.1	6.02	30.8	0.48
10+ years	53	30.7	6.17	33.6	51	31.7	7.16	32.6	0.43
11+ years	31	34.5	5.59	36.9	42	35.7	4.24	37.6	0.35

wasting was higher among children whose mothers were working. However, this difference was not statistically significant for any of the three nutritional indices, viz. stunting, wasting and underweight (Table 6).

Of the 426 children whose fathers were ORs, 73 (17.13%) were stunted. The lowest prevalence of stunting 15 (9.49%) was observed in the children whose fathers were officers. The prevalence of wasting was also lowest among the children of the officers, while the highest prevalence was observed among the children of other ranks. However this difference was not statistically significant. The prevalence of underweight was lowest in the children of officers and highest among children of other ranks. This trend was not statistically significant (Table 7).

Family size showed statistically significant association with the three nutritional indices of stunting, wasting and underweight. (Table 8). The prevalence was highest in families with more than 5 members.

## Discussion

The present study showed a growth lag in the basic parameters of height and weight as compared to the

reference standards laid down by NCH/WHO amongst school children of Army School in Pune. Our findings are in agreement with that reported by other workers from India [8-11].

We analysed the prevalence of stunting, wasting and underweight as markers of undernutrition and found them to be present in 13.81%, 6.71% and 9.87% of children respectively. This was much lower than that reported by other workers who found mothers' education to be significantly related to all the three indices of malnutrition i.e. stunting, wasting and underweight. Data analysis of National Family Health Survey (NFHS) 1 [3], also showed that that mother's education has a strong independent effect on a child's nutritional status even after controlling for the potentially confounding effects of the 12 other demographic and socioeconomic variables [18]. Further improvement in nutritional status with maternal education has been reported by other workers [19-22]. Fathers' education was not significantly associated with any of the three indices of malnutrition.

**Table 3**  
Comparison of mean height of boys and girls

Age group (years)	Boys				Girls				p value
	Number examined	Mean height (cms)	SD	Mean height (boys) WHO/NCHS standards	Number examined	Mean height (cms)	SD	Mean height (girls) WHO/NCHS standards	
5+ yrs	27	107.3	4.07	108.9	25	105.1	9.4	107.9	0.44
6+yrs	67	113.1	6.03	116.1	66	112.8	5.79	115.4	0.77
7+yrs	63	118.1	7.40	122.6	68	117.9	7.08	120.6	0.92
8+yrs	81	123.5	8.2	128.1	46	122.2	8.6	127.4	0.40
9+ yrs	79	129.5	7.30	131.6	61	130.0	8.3	133.2	0.11
10+yrs	53	135.1	6.41	138.1	51	136.9	7.01	138.5	0.18
11+yrs	31	142.1	8.69	143.4	42	143.1	9.63	144.0	0.65

**Table 4**  
Prevalence of stunting, wasting and underweight in study group according to WHO/NCHS standards

	Stunted				Wasted				Underweight		
	Severe (%)	Moderate (%)	Total (%)		Severe (%)	Moderate (%)	Total (%)		Severe (%)	Moderate (%)	Total (%)
Girls (n=359)	9 (2.5)	36 (10.02)	45 (12.53)	0	22 (6.12)	22 (6.12)	44 (12.24)	0	02 (0.56)	29 (8.07)	31 (8.63)
Boys (n=401)	12 (2.99)	48 (11.97)	60 (14.96)	0	29 (7.23)	29 (7.23)	58 (14.46)	0	06 (1.49)	38 (9.47)	44 (10.97)
Total (n=760)	21 (2.76)	84 (11.05)	105 (13.81)	0	51 (6.71)	51 (6.71)	102 (13.42)	0	8 (1.05)	67 (8.82)	75 (9.87)

**Table 5**  
Prevalence of stunting, wasting and underweight in study group according to maternal educational status

Mothers education	n (%)	Stunted (%)	OR	Wasted (%)	OR	Underweight (%)	OR
Graduation and beyond	262 (100)	23 (8.77)	1.00	6 (2.29)	1.00	9 (3.43)	1.00
Intermediate	163 (100)	17 (10.42)	1.21	6 (3.68)	1.63	13 (7.98)	2.55
High School	180 (100)	21 (11.66)	1.37	9 (5.00)	2.25	12 (6.66)	1.65
Middle School	96 (100)	25 (26.04)	3.66	12 (12.5)	6.10	21 (21.85)	8.65
Primary	59 (100)	19 (32.20)	4.94	18 (30.50)	18.73	20 (33.89)	13.77
Total	760 (100)	105 (13.81)		51 (6.71)		75 (9.87)	

$\chi^2$ for linear trends	28.68	48.70	53.50
p value	0.00	0.00	0.00

**Table 6****Prevalence of stunting, wasting and underweight in study group according to mothers' working status**

Mothers working status	n (%)	Stunted		Wasted		Underweight	
		Stunted (%)	Normal (%)	Wasted (%)	Normal (%)	Underweight (%)	Normal (%)
Working	78 (100)	8 (10.25)	70 (89.75)	6 (7.65)	72 (92.35)	7 (8.97)	72 (93.59)
Housewives	682 (100)	97 (14.22)	576 (87.78)	45 (6.59)	637 (93.41)	68 (9.97)	612 (90.03)
Total	760	105	646	51	709	75	685

 $\chi^2=1.00$ , df=1, p=0.31 $\chi^2=0.13$ , df=1, p=0.71 $\chi^2=0.10$ , df=1, p=0.74**Table 7****Prevalence of stunting, wasting, underweight with respect to socioeconomic status**

SE Status	n (%)	Total stunted (%)	OR	Total wasted (%)	OR	Total underweight (%)	OR
Officers	158 (100)	15 (9.49)	1.00	8 (5.06)	1.00	11 (6.96)	1.00
JCOs	176 (100)	17 (9.65)	1.13	12 (6.81)	1.37	17 (9.65)	1.43
OR	426 (100)	73 (17.13)	2.18	31 (7.27)	1.47	47 (11.02)	1.62
Total	760 (100)	105 (13.81)		51 (6.71)		75 (9.87)	

**Table 8****Prevalence of stunting, wasting and underweight with respect to family size**

Family size (members)	n (%)	Total stunted (%)	OR	Total wasted (%)	OR	Total underweight (%)	OR
3	159 (100)	19 (11.95)	1.00	05 (3.14)	1.00	12 (7.55)	1.00
4-5	534 (100)	31 (5.81)	0.45	30 (5.62)	1.83	45 (8.42)	1.13
> 5	67 (100)	55 (82.05)	33.77	16 (23.88)	9.66	18 (26.87)	4.50
Total	760 (100)	105 (13.81)		51 (6.71)		75 (9.87)	

 $\chi^2$  for linear trends

21.898, p=0.000

11.88, p=0.0005

11.88, p=0.0005

The NFHS II observed a higher prevalence of these three indices of malnutrition in children of working mothers [3]. We could not establish any statistically significant relationship between the working status of women and presence of malnutrition in their children. This could be due to the fact that our study population was from a service background where better income, health care facilities and higher educational status of mothers were operative.

On comparing father's rank, taken as a marker for socio economic status, it was seen that children of ORs had higher prevalence of stunting, wasting and underweight as compared to the other two categories, though this difference was statistically significant only in case of stunting. Stunting reflects long-term malnutrition, and is influenced by parental attitudes and child care practices accumulating over a long period of time. Most army personnel stay away from their families for long periods and at such times, the families of officers belonging to relatively higher socioeconomic status generally stay in urban areas while those of ORs go back to their village. This differential in socio economic status, environmental conditions and maternal education operative over long periods of time could account for a higher prevalence of stunting amongst children of ORs.

On the other hand, underweight and wasting reflect an acute phenomenon and do not appear to be related to socioeconomic status of the family. Earlier studies have demonstrated relationship between the salaries of the father and one or more indices of malnutrition [21,22].

In the present study family size was significantly associated with all three indices of malnutrition. Similar results have been reported by Gopaldas et al [20]. NFHS I [3] survey also showed that children with three or more older siblings were more likely to suffer chronic malnutrition than children from smaller families.

This study shows that maternal educational status, socio-economic status and family size are important determinants of the nutritional status of the child. Efforts directed towards improvement of female literacy, socio-economic status and restricting family size will have a positive impact of the nutritional status of school children.

### Conflicts of Interest

None identified

### Intellectual Contribution of Authors

*Study Concept* : Lt Col S Chaturvedi

*Drafting & Manuscript Revision* : Maj R Mukerjee,

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*Statistical Analysis* : Maj R Mukerjee

*Study Supervision* : Lt Col S Chaturvedi



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