Original Article

Relationship of Nutritional Status with Tuberculin Sensitivity

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ABSTRACT

Objective. To estimate the prevalence of under- nutrition among school children and to find out the relationship between nutritional status and tuberculin sensitivity.

Methods. A cross sectional study was carried out among 3335 children between 5-8 years of age, attending 60 schools in Bangalore city, selected by stratified random sampling. The nutritional anthropometric indices were calculated using reference median as recommended by World Health Organization, classified according to standard deviation units termed as Z-scores. The nutritional status of the children was assessed by weight for age, height for age and bio-mass-index (BMI).

Results. Depending upon the method for classifying nutritional status, the prevalence of under-nutrition (including mild and severe under-nutrition) varied between 14.9-29.8%. The prevalence of severe under-nutrition varied from 2.9-6.7%. The frequency distributions of reaction sizes to tuberculin were found to be similar among children classified by nutritional status. The differences in proportions of significant reactions (≥10mm) and mean tuberculin reaction sizes between children classified by nutritional status were not found to be statistically significant.

Conclusion. Tuberculin sensitivity was not influenced by nutritional status among apparently healthy school children. **[Indian J Pediatr 2009; 76 (6) : 605-607]** *E-mail: vin_chadha@yahoo.com*

Key words : *Under-nutrition; Prevalence; Tuberculin sensitivity*

Tuberculin skin test is commonly used as a diagnostic aid for tuberculosis in children and as an epidemiological tool for estimating Annual Risk of Tuberculous Infection (ARTI). Tuberculin sensitivity has been known to be reduced in the presence of certain conditions that compromise cell mediated immune response in the body. Under- nutrition is one of the physical states that affect immune response. However, there is limited evidence on the relationship of nutritional status with tuberculin sensitivity. Therefore, a study was undertaken among school children in Bangalore city. (1) to estimate the prevalence of under-nutrition among children attending I and II standards of primary schools in Bangalore city, and (2). to find out the relationship between nutritional status and tuberculin sensitivity.

MATERIALS AND METHODS

The study was carried out during 2006 in 60 primary schools located within the jurisdiction of Bangalore Municipal Corporation and selected by stratified random sampling, the basis of stratification being Government, government-aided and private schools. All children attending I and II standards were included in the study. Prior written informed consent was obtained from the parent of each child. Date of birth of each child was recorded from school register and BCG scar status was recorded on inspecting the upper thirds of both the arms. The height was measured by making each child stand upright barefoot on a wooden platform fixed with the vertical scale marked in centimeters. Weight was recorded using a digital balance to the nearest of one-tenth of a kilogram. Tuberculin testing was carried out using 1TU PPD RT 23 with Tween 80 on the mid-volar aspect of left forearm. Ready to use PPD vials were procured from Statens Seren Institute, Copenhagen (SSI). Each test was recorded as 'satisfactory' if it raised a flat pale weal with clearly visible pits and well-demarcated borders. It was labeled 'unsatisfactory' in case of leakage or if it was given subcutaneously. Reading of tuberculin reactions was undertaken about 72 hours later. Reader identified the margins of induration by careful palpation and recorded its maximum transverse diameter using a transparent ruler. Tuberculin testing and reading were

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carried out by experienced field personnel of National Tuberculosis Institute, Bangalore (NTI).

Children with reactions of ≥ 10mm with symptoms suggestive of tuberculosis (TB) or history of contact with the TB case were referred to the nearest health centre for further investigations and treatment if required.

The study protocol was approved by Institutional Ethics Committee (IEC) of NTI.

Statistical Methods

Complete results in terms of tuberculin reaction size and weight and height measurements were available for 3335 children (5-8 years of age). Their nutritional status was assessed using three different methods: (i). Weight for age, (ii). Height for age, and (iii). Bio-mass-index [weight in kilograms/height in centimeters^2]

The nutritional anthropometric indices were calculated using reference median, as recommended by World Health Organization and classified according to standard deviation units termed as Z-scores, for months of age and sex[1]. For each of the methods, children with Z-scores of ≥(-) 2 were labeled as normal, those with Z-scores between –2 and -3 were labeled as suffering from mild under- nutrition and those with z-scores of ≤(-3) were labeled as suffering from severe under- nutrition.

Frequency distributions of tuberculin reaction sizes were compared between children classified by nutritional status, using Chi-square test for trend. Prevalence estimates of significant tuberculin reactions (≥10mm) were compared using Chi-square test with

$$CI = p \pm 1.96\sqrt{\frac{\sum_s \sum_i (p_{si} - p_s)^2}{k(k-s)}}$$

continuity correction. One-way ANOVA was applied to compare means of tuberculin reactions. P-values of < 0.05 were considered as significant.

The 95% confidence intervals (CI) of the estimates of prevalence of under-nutrition and significant tuberculin reactions were estimated using the following formula:

(*p*- overall prevalence, p_{si} – Prevalence in cluster *i* of stratum *s*, p_s- Prevalence in stratum; *k* - Total number of clusters, s- Number of strata)

RESULTS

Depending upon the method for classifying nutritional status, the prevalence of under-nutrition (including mild and severe under-nutrition) varied between 14.9-29.8% (Table 1). The prevalence of severe under-nutrition varied from 2.9-6.7%.

Frequency distributions of reactions, by 5-mm range and nutritional status for each of the methods of classifying nutritional status are presented at table 2. The proportions of significant reactions (≥10mm) among children by nutritional status are presented in table 3. The differences in these proportions were not statistically significant. Similarly, the differences in mean tuberculin reaction size were not statistically significant (Table 4).

Table 1. Nutritional Status of Children (N=3335)

Nutritional status	No.	(%)
By Weight for Age		
Normal	2340 (70.2)	[66.7-73.7]
Mild under- nutrition	772 (23.1)	[20.5-25.9]
Severe under-nutrition	223 (6.7)	[4.8-8.6]
By Height for Age		
Normal	2599 (77.9)	[74.2-81.7]
Mild under- nutrition	575 (17.2)	[14.6-19.9]
Severe under-nutrition	161 (4.8)	[3.1-6.6]
By BMI		
Normal	2840 (85.2)	[83.3-87.1]
Mild under- nutrition	399 (12.0)	[10.3-13.6]
Severe under-nutrition	96 (2.9)	[2.0-3.8]

( ): Percentages; [ ]: 95% confidence intervals.

DISCUSSION

The prevalence of under-nutrition in the present study varied between 14.9-29.8%, depending upon the method used for classifying nutritional status. The prevalence of severe under-nutrition was between 2.9-6.7% by different methods. Varying rates of prevalence of under-nutrition have been observed in other studies perhaps owing to variations in age group of the study population, study area (rural /urban) and geographical location.

In the present study, tuberculin sensitivity was not influenced by nutritional status among apparently healthy school children 5-8 years of age. Similar observations have been reported from earlier community based studies carried out among children 0-14 years of age during 1970s.[2-4] However, all these studies have been carried out in Southern parts of India. Therefore, similar studies if carried out in varied geographical and socio-cultural settings shall help to firmly understand the relationship between nutritional status and tuberculin sensitivity among children.

A limitation of the present study could be that the height was measured to the nearest of each cm. Its measurement to the nearest of each millimeter would have given more precise calculation of BMI. However, this is not expected to have altered the results to a significant extent.

Table 2. Frequency Distribution of Tuberculin Reactions by Nutritional Status

Nutritional status	Number of children	Proportions of reactions (%)				P-value*
		0-5 mm	6-9 mm	10-14 mm	=15 mm	
By Weight for Age						
Normal	2340	83.7	4.4	4.6	7.3	-
Mild under- nutrition	772	83.5	3.5	3.4	9.6	0.41
Severe under-nutrition	223	87.4	4.0	2.2	6.3	0.18
By Height for Age						
Normal	2599	83.4	4.4	4.4	7.8	-
Mild under-nutrition	575	84.9	3.5	4.0	7.7	0.80
Severe under-nutrition	161	88.8	1.9	1.2	8.1	0.26
By BMI						
Normal	2840	87.3	3.9	4.2	4.6	-
Mild under-nutrition	399	85.2	5.3	3.3	6.3	0.27
Severe under-nutrition	96	86.5	5.2	6.3	2.1	0.78

*compared with frequency distributions among normal children

Table 3. Proportions of Children with Significant and Non-significant Reactions by Nutritional Status

Method of nutritional assessment	Normal		Mild under-nutrition		Severe under-nutrition	
	<10 mm	≥ 10mm	<10 mm	≥ 10mm	<10 mm	≥ 10mm
Weight for Age	2061	279	672	100	204	19
	88.1	(11.9)	(87.0)	(13.0)	(91.5)	(8.5)
		[9.7-14.1]		[10.0-15.9]		[4.8-12.2]
P-value*		-		0.45		0.13
Height for Age	2283	316	508	67	146	15
	(87.8)	(12.2)	(88.3)	(11.7)	(90.7)	(9.3)
		[9.9-14.4]		[8.3-15.0]		[4.3-14.3]
P-value*		-		0.74		0.28
BMI	2488	352	361	38	88	8
	(87.6)	(12.4)	(90.1)	(9.9)	(91.6)	(8.4)
		[10.5-14.3]		[6.4-12.6]		[1.7-14.9]
P-value*	-			0.10		0.23

( ): percentages; [ ]: 95% confidence intervals; *compared with proportions of significant reactions among normal children

Table 4. Mean Tuberculin Reaction Size (Excluding 'zero' Reactions) in mm by Nutritional Status

Nutritional status	Number	Mean reaction size (mm)	Standard deviation	P-value
By Weight for Age				
Normal	1368	5.3	5.9	0.09
Mild under- nutrition	615	5.6	6.2	
Severe under-nutrition	193	4.7	5.6	
By Height for Age				
Normal	1639	5.3	5.9	0.90
Mild under- nutrition	438	5.8	6.5	
Severe under-nutrition	99	5.4	6.5	
By BMI				
Normal	1260	5.4	6.2	0.07
Mild under- nutrition	438	5.1	5.7	
Severe under-nutrition	167	5.4	5.8	

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