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EVALUATION OF NUTRITIONAL STATUS OF NAMASUDRA CHILDREN OF RURAL WEST BENGAL

Anthropology

KEYWORDS: Anthropometry, Nutritional Indices, Body Dimensions, Malnutrition, Namasudra, West Bengal.

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ABSTRACT

A cross sectional study on 1080 school going Namasudra boys aged 6 to 17 years was conducted in 24 Parganas (N) district of West Bengal. From body mass index (BMI) different grades of chronic energy deficiency (CED) were assessed. Weight deficit, height deficit, Korperfulle index (KI), Pelidisi index (PI), MUAC, UAMA, UAFA and % Body fat were computed from various body dimensions.

The mean BMI ranges from 10.39 to 30.11 KgM-2 from lower to higher ages. Significantly high magnitude of CED was noticed wherein 83.05 % of the children suffered from malnutrition out of which more than 80 % of children of lower ages (6 – 10 years) had low BMI. There has been an increased trend in BMI from lower to higher age groups. MUAC classification showed that 30.93 % of children suffered from malnutrition. About 47.64 % of children suffered from weight deficit while 24.87 % failed to attend optimum height to those particular ages.

Korperfulle index portrays that 62.92 % suffered from malnutrition to very mild undernutrition. Based on Pelidisi index about 82.04 % of children suffered from low state of malnutrition to mild malnutrition. Mean values of UAMA increased steadily from 6 to 14 years but a reverse trend has been observed from 15 to 17 years. The mean values of UAFA and % Body fat increased gradually from lower to higher ages.

The frequency of all indices suggests that the Namasudra children were lean and thin leading to poor health and high magnitude of malnutrition.

INTRODUCTION

Different body dimensions necessarily contribute equally in assessing morphological and anatomical features designing a complete body structure of human being. The bony structure and muscular deposition beautify the personality which is often influenced by the nutrition. Therefore the study of body fat and its distribution is important to evaluate the pattern of nutrition of populations. Different techniques were more emphasized for measuring body composition, yet, anthropometry is being most widely used method for estimating fat distribution (Goran et al, 1998; Moreno et al, 1997, 2002; McArdle et al, 1986; Bolzano et al, 1999; Musaiger et al, 2000, Ghosh and Bharati, 2006; Urade and Chakravarty, 2008, 2012). Studies especially on measurements of body fat among children are few and limited in India. Weight, height, and BMI are the most common indicators usually used to assess nutritional status of the children (Naidu and Rao, 1994; Reddy, 1998; Zsoffay et al, 1998; Vishweswara Rao et al, 1991; Khongsdier, 2001; Gaur et al, 2002; Urade et al, 2004; Urade and Chakravarty, 2008, 2012). According to WHO (1986) arm areas and indices are used for better interpretation of growth and body composition. BMI, % body fat, upper arm fat area (UAFA), upper arm muscle area (UAMA) are responsible indicators of adiposity in adults and children (Micozzi et al, 1986; Moreno et al, 2002). BMI, triceps skin fold and upper arm fat area are indicative of the child's calorie reserve (Cole, 1986; Roland-Cachera, 1993). Anthropometry has been used to estimate fat distribution (Goran et al, 1986; Moreno et al, 1997, 2001; Urade and Chakravarty, 2008, 2012; Urade et al, 2004). Upper arm muscle area (UAMA) was employed to evaluate organic protein pool (Frisancho, 1974; Sann et al, 1988; Bagenholm et al, 1990). Weight deficit, height deficit, Pelidisi index and Korperfulle index are also best indicators to assess nutritional status (Urade et al, 2004; Urade and Chakravarty, 2012).

Most of the studies on body mass index were carried out from South India and North-eastern region (Rao et al, 1990, 1995; Shetty, 1984; Naidu and Rao, 1994; Bharati 1989; Khongsdier, 1997, 2001; Urade and Mukherjee, 2009) but very few from Central and Western India (Singhrol and Mitra, 1984; Urade et al, 2004; Urade and Chakravarty, 2008, 2012).

MATERIAL AND METHODS

The sample was drawn from rural area of Bagdah block of 24 Pargana (N) district in West Bengal. The area of study defined by Indo-Bangladesh border is very poorly connected with kachha roads where transport facilities are badly affected. Sanitation and drainage systems are very poor. The economy of Namasudra people revolves around daily wage and marginal agriculture. The area is heterogeneous as far as the ethnic composition and socio-economic aspects are concerned. The study was conducted on 1080 unrelated school going boys aged 6 to 17 years of ages. The age of each child was ascertained from school records as well as from birth certificate. Data was collected after obtaining prior permission from the school authority, children and parents. Anthropometric measurements like weight (Kg), height (cm), sitting height (cm), mid-upper arm circumference (cm), skin fold at triceps (mm) and sub-scapular (mm) were taken employing techniques recommended by Weiner and Lourie (1969) and Singh and Bhasin (1968). Different anthropometric tools were used to measure different body dimensions.

To evaluate the distribution of muscle mass and body fat of Namasudra boys, UAMA and UAFA were calculated from mid-upper arm circumference, triceps and sub-scapular skin folds using the formulae given by Jelliffe (1966) and McArdle et al, (1986). NIN standards were used as reference value in the present study. Various formulae like BMI, weight deficit, height deficit, Korperfulle index, Pelidisi index (Malson, 1932) were used to evaluate the nutritional assessment of Namasudra children. The data was reduced in to various statistical constants using the Micro-Soft Excel Package.

RESULTS

The mean BMI was increased with advancement of age (Table-1). CED-III was more remarkable (54.35 %) among children. Mere 16.11 % of them were found normal. An appreciable higher frequency of CED was noticed in lower age groups (6- 12 years) where 80.18 % of the children suffered

Table-1 Distribution of BMI among Namasudra children

Age, yrs	No.	<16	16.1–16.99	17-18.49	18.5-24.99	>25 & above	M ± SD
		CED-III	CED-II	CED-I	Normal	Overweight	14.42 ± 1.47
6	80	73 (91.25)	5 (6.25)	1 (1.25)	1 (1.25)	-	14.11 ± 0.95
7	80	78 (97.5)	1 (1.25)	1 (1.25)	-	2 (2.38)	14.33 ± 1.26
8	79	69 (87.34)	9 (11.39)	1 (1.27)	-	-	15.07 ± 2.41

9	84	66 (78.57)	9 (10.71)	5 (5.95)	2 (2.38)	-	14.83 ± 1.45
10	99	81 (81.82)	11 (11.11)	6 (6.06)	1 (1.01)	-	15.72 ± 2.31
11	111	78 (70.27)	10 (9.0)	14 (12.61)	8 (7.20)	1 (0.9)	15.94 ± 2.18
12	108	69 (63.89)	18 (16.67)	11 (10.19)	9 (8.33)	1 (0.92)	16.29 ± 2.05
13	95	38 (40.0)	25 (26.31)	23 (24.21)	8 (8.42)	1 (1.05)	17.67 ± 2.23
14	83	18 (20.33)	14 (16.28)	28 (32.56)	25 (29.07)	1 (1.16)	18.34 ± 2.39
15	95	10 (10.52)	17 (17.89)	29 (30.52)	38 (40.0)	1 (1.05)	18.33 ± 1.6
16	83	3 (3.61)	15 (18.07)	25 (30.12)	40 (48.19)	_	19.01 ± 2.21
17	83	4 (4.82)	6 (7.23)	29 (34.94)	42 (50.60)	2 (2.41)	
Total	1080	587 (54.35)	140 (12.96)	170 (15.74)	174 (16.11)	9 (0.83)	

(Figures in parentheses are per cents)

from this category alone. Table-2 portrays the distribution of classification of MUAC according to grades of malnutrition where the frequency of normal category increased steeply from severe and moderate form of malnutrition. Around 69.07 % of children had normal distribution of muscles and fat. The frequency of severe malnutrition was negligible (2.13 %). However, 30.93 % of them suffered from various forms of malnutrition. Ironically, the impact of malnutrition was higher at lower age (6-10 years) where 41.94 % of children failed to deposit optimum muscles and fat in arms.

Table-3 exhibits the distribution of weight deficit classification. The individual frequency distribution increased from grade IV to normal category. About 47.64 % of the children were failed to attain optimum weight for their ages. Table-4 shows the distribution of height deficit classification. Of the total number of children 24.87 % of them suffered from mild retardation. It means that in every four children one child failed to attain an optimum height. Unlike height deficit, a greater number of the children suffered from weight deficit. The lower age groups were more vulnerable to both weight and height deficit.

Table-2 Distribution of MUAC among children

Age, yrs	No.	75 % Severe malnutrition	75.1- 80 % Moderate malnutrition	80.1-85 % malnutrition	85.1 & above Normal
6	80	-	6 (7.5)	18 (22.5)	56 (70.0)
7	80	2 (2.5)	16 (20.0)	21 (26.25)	41 (51.25)
8	79	2 (2.53)	9 (11.39)	21 (26.58)	47 (59.49)
9	84	3 (3.57)	13 (15.48)	29 (34.52)	39 (46.43)
10	99	3 (3.03)	12 (12.12)	22 (22.22)	62 (62.63)
11	111	2 (1.8)	11 (9.91)	31 (27.93)	67 (60.36)
12	108	2 (1.85)	14 (12.96)	22 (20.37)	70 (64.81)
13	95	3 (3.16)	13 (13.68)	10 (10.52)	69 (72.63)
14	83	4 (4.82)	4 (4.82)	9 (10.84)	66 (79.52)
15	95	1 (1.05)	2 (2.1)	10 (10.52)	82 (86.31)
16	83	1 (1.2)	3 (3.61)	7 (8.43)	72 (86.74)
17	83	-	1 (1.2)	7 (8.43)	75 (90.36)
Total	1080	23 (2.13)	104 (9.63)	207 (19.17)	746 (69.07)

(Figures in parentheses are per cents)

Table-3 Distribution of Weight deficit among children

Age, yrs	No.	50 % Grade IV	51-60 % Grade III	61-70 Grade II	71-80 Grade I	81-100 Normal	>100 % Obesity
6	80	-	-	18 (22.5)	36 (45.0)	25 (31.25)	1 (1.25)
7	80	-	4 (5.0)	20 (25.0)	33 (41.25)	22 (27.5)	1 (1.25)
8	79	-	1 (1.27)	21 (26.58)	24 (30.38)	28 (35.44)	5 (6.33)
9	84	1 (1.19)	2 (2.38)	29 (34.52)	21 (25.0)	25 (29.76)	6 (7.14)
10	99	1 (1.01)	2 (2.02)	16 (16.16)	35 (35.35)	35 (35.35)	10 (10.1)
11	111	-	2 (1.80)	19 (17.12)	26 (23.42)	48 (43.24)	16 (14.41)
12	108	-	3 (2.78)	21 (19.4)	37 (34.3)	27 (25.0)	20 (18.5)
13	95	-	6 (6.31)	18 (18.95)	19 (20.0)	30 (31.58)	22 (23.16)
14	83	1 (1.20)	3 (3.64)	9 (10.84)	10 (12.05)	33 (39.76)	27 (36.14)
15	95	-	2 (2.1)	4 (4.21)	14 (14.74)	55 (57.89)	20 (21.05)
16	83	-	-	1 (1.2)	16 (19.28)	59 (71.08)	7 (8.43)
Total	997	3 (0.3)	25 (2.51)	176 (17.65)	271 (27.18)	387 (38.81)	135 (13.54)

(Figures in parentheses are per cents)

The Korperfulle index (Table-5) shows higher frequency of low state of malnutrition to very mild undernutrition. It means nearly two-third of Namasudra children suffered from this category alone followed by normal/satisfactory state of nutrition (31.39%). Overweight was negligible among Namasudra children. Unlike BMI, weight deficit and height deficit, the Korperfulle index showed a reverse trend of nutritional status where higher age children suffered more from low state of malnutrition to very mild undernutrition. Table-6 exhibits the frequency distribution of Pelidisi index. The frequency shows decrease trend of malnutrition from distinctly low state of malnutrition to normal state of nutrition. This indicates that more than four-fifth of total children were malnourished. It means that in every five children, four children were malnourished. The means of UAMA, UAFA and % BF are given in Table-7. The mean value of UAFA and % BF increased with advancement of age from lower to higher ages while no clear tendency was observed in UAMA.

Table-4 Distribution of Height deficit among the children

Age, yrs	No.	80 % Poor	81-90 % Mild retardation	91-100 % Normal
6	80	-	31 (38.75)	49 (61.25)
7	80	-	24 (30.70)	56 (70.0)
8	79	-	21 (26.58)	58 (73.42)
9	84	2 (2.38)	28 (33.33)	54 (64.29)
10	99	1 (1.01)	25 (25.25)	73 (73.73)
11	111	-	23 (20.72)	88 (79.28)
12	108	-	32 (29.6)	76 (70.4)
13	95	-	24 (25.26)	71 (74.74)
14	83	-	19 (22.89)	64 (77.11)
15	95	1 (1.05)	9 (9.47)	85 (89.48)
16	83	-	8 (9.64)	75 (90.36)
Total	997	4 (0.4)	244 (24.47)	749 (75.13)

(Figures in parentheses are per cents)

Table-5 Distribution of malnutrition grades of Korperfulle index

Age, yrs	No.	Low state of malnutrition to very mild undernutrition (Up to 1.20)	Normal/Satisfactory State of nutrition (1.21-1.50)	Overweight 1.51-1.6	High overweight > 1.61
6	80	17 (21.25)	56 (70.0)	5 (6.25)	2 (2.5)
7	80	31 (38.75)	48 (60.0)	-	1 (1.25)
8	79	42 (53.16)	36 (45.57)	1 (1.26)	-
9	84	50 (59.52)	31 (36.90)	-	3 (3.57)
10	99	76 (76.77)	22 (22.22)	1 (1.01)	-
11	111	82 (73.87)	23 (20.72)	3 (2.7)	3 (2.7)
12	108	85 (78.7)	21 (19.44)	1 (0.92)	1 (0.92)
13	95	78 (82.1)	16 (16.85)	-	1 (1.05)
14	83	65 (78.31)	16 (19.28)	1 (1.2)	1 (1.2)
15	95	67 (70.52)	26)27.37)	-	2 (2.1)
16	83	64 (77.11)	19 (22.89)	-	-
17	83	55 (66.27)	25 (30.12)	3 (3.61)	-
Total	1080	712 (65.92)	339 (31.39)	15 (1.39)	14 (1.30)

(Figures in parentheses are per cents)

Table-6 Distribution of Pelidisi index

Age, yrs	No.	≤ 92 % Distinctly low state of malnutrition	92.1-95 % State of mild undernutrition	95.1-100 % Normal state Of nutrition	100.1-105 % Mild over weight	>105.1 Distinctly Over weight
6	80	32 (40.0)	32 (40.0)	13 (16.25)	2 (2.5)	1 (1.25)

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7	80	48 (60.0)	21 (26.25)	9 (11.25)	2 (2.5)	-
8	79	36 (45.57)	37 (46.83)	6 (7.6)	-	-
9	84	43 (51.20)	29 (34.52)	10 (11.9)	1 (1.19)	1 (1.19)
10	99	43 (43.43)	47 (47.48)	7 (7.07)	1 (1.01)	1 (1.0)
11	111	51 (45.94)	35 (31.53)	18 (16.21)	4 (3.6)	3 (2.7)
12	108	55 (50.92)	24 (22.22)	22 (20.37)	7 (6.48)	-
13	95	44 (46.31)	35 (36.84)	14 (14.73)	1 (1.05)	1)1.05)
14	83	43 (51.81)	24 (28.91)	12 (14.46)	2 (2.41)	2 (2.41)
15	95	42 (44.21)	32 (33.68)	17 (17.89)	3 (3.6)	1 (1.05)
16	83	40 (48.19)	33 (39.76)	10 (12.05)	-	-
17	83	41 (49.4)	19 (22.89)	20 (24.1)	3 (3.61)	-
Total	1080	518 (47.96)	368 (34.07)	158 (14.63)	26 (2.41)	10 (0.93)

(Figures in parentheses are per cents)

Table-7 Distribution of mean ± SD of indices

Age, yrs	No.	UAMA (cm^2)	UAFA (cm^2)	% Body fat
		M ± SD	M ± SD	M ± SD
6	80	39.38 ± 5.8	10.87 ± 8.9	11.32 ± 1.33
7	80	34.0 ± 7.06	13.58 ± 5.31	11.05 ± 1.26
8	79	33.48 ± 8.88	15.35 ± 4.68	11.04 ± 1.12
9	84	42.62 ± 7.44	13.97 ±10.86	11.57 ± 2.02
10	99	33.33 ± 16.96	19.31 ± 5.22	11.16 ± 1.09
11	111	50.63 ± 9.64	16.39 ± 12.53	12.15 ± 2.66
12	108	49.85 ± 9.23	18.26 ± 12.08	11.91 ± 2.5
13	95	47.71 ± 8.53	20 ± 7.86	11.81 ± 2.55
14	83	48.25 ± 6.31	29.24 ± 11.36	12.42 ± 2.52
15	95	37.01 ± 10.93	36.01 ± 9.09	12.23 ± 1.92
16	83	35.11 ± 6.32	36.45 ±12.27	12.19 ± 1.92
17	83	36.17 ± 9.71	39.76 ± 7.69	12.38 ± 2.18

DISCUSSIONS

The Namasudra children were very poor nutritionally as evident from BMI, Korperfulle and Pelidisi indices. More than fifty per cent of children were suffered from CED-III category alone. An almost a similar trend was seen in CED-I and normal category of BMI. Thus, the magnitude of CED was very high leading to very poor nutritional status as most of the children were underweight. Around fifty per cent of children were underweight while one-quarter of them were stunted. This situation indicates that weight deficit is more sensitive than height deficit. Small body size attributed to underweight and stunting which contribute to low physical fitness (Benefice and Malina, 1996) and was employed as a general index of nutritional status of the Namasudra children. The present study shows conformity with earlier studies (Frisancho and Tracer 1987; Stickland and Ulijaszek, 1994). Though the magnitude of malnutrition was appreciably high as evident from UAFA and % body fat, UAMA does not substantiate the severity of undernutrition in Namasudra children. It means that UAFA is more sensitive than UAMA and can be considered as good indicator of malnutrition than UAMA.

The Namasudra children accumulate relatively more muscles but low fat. It is noteworthy that the chronic energy deficiency does not affect UAMA and UAFA. The environmental conditions can play an adaptive role in development of arm muscles and fat area as shown by Manshande et al. (1985). The evaluation of nutritional status of Namasudra children by the present anthropometric indices indicated poor health status. This study suggests that evaluation of undernutrition by BMI, UAMA, UAFA and % body fat proved to be more sensitive than weight deficit and height deficit. Weight and height are aspects of good personality that the former develops the muscle, the later grows the skeletal. Yet different anthropometric indices proved to be different for evaluation of nutritional status. Evaluation of nutritional status from different approaches is an appropriate method for nutritional assessment as suggested by Frisancho and Tracer (1987).

The Namasudra children belonging to marginal agriculture and landless labourers show low BMI. The present study is in conformity with the earlier studies (Khongsdier, 2001; Naidu and Rao, 1994; Urade et al, 2004). The CED severely affects the body size and health. The impact of CED was higher up to 13 years suggesting most vulnerable period for malnutrition. The present study is in conformity with earlier studies (Urade and Chakravarty, 2008; Urade et al, 2004) that the Namasudra were heavier than Khaire kunbi children of Maharashtra. The high proportion of malnourished children was due to low weight as reflected by Pelidisi and Korperfulle indices attributing to disproportionate tissue and skeletal muscles (Urade and Chakravarty, 2008, 2012).

The present study can be useful for the purpose of taking some intervention and management programmes to combat the menace of malnutrition. Along with this direct method of evaluation of nutritional status, some other aspects of assessment of nutritional status may be taken in to cognizance.

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