RESEARCH ARTICLE

GROWTH PATTERN AND NUTRITIONAL STATUS OF ADOLESCENT GIRLS OF CHHATTISGARH

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ABSTRACT

Background: There are about 1.2 billion adolescents, a fifth of the world's population, and their numbers are increasing. In India the statistics shows that the adolescent population is 8.3 crores, so this large population needs special attention as this period of growth is very important and crucial span of life. Proper nutrition of children belonging to this group is essential so that optimum growth can take place, hence the present study was undertaken to assess nutritional status of adolescent girls.

Materials and Methods: Present paper aims at assessing the nutritional status of adolescent girls of Raipur district of Chhattisgarh. 1000 adolescents girls aged between 12 and 18 years were selected from various schools of Raipur district (Chhattisgarh). Anthropometric measurements including weight, height were taken following standard techniques. Body Mass Index (BMI) was calculated using international BMI cut-off point for children and adolescence from 12 to 18 years of age.

Results: Results revealed that girls of 12 years had highest (37.8%) prevalence of under nutrition. The overall prevalence of under nutrition was (64.7%). Body weight and height of the girls of present study were compared with reference data of NCHS (National Centre for health Statistics 1987), ICMR (Indian Council Medical Research 2010), CDC (Centers for Disease Control and Prevention 2007-2010) and M.Mitra (2002) which shows that the mean of the present study was lower than NCHS (1987), ICMR(2010) and CDC (2007-2010) and higher than M.Mitra (2002).

Conclusion: It was concluded that the school going girls of Raipur district were suffering from very high rate of undernutrition. Nutritional intervention programme should be planned to enhance nutritional status of adolescent girls.

INTRODUCTION

The term "Adolescence" literally means "to emerge" or "achieve identity". Its origin is from a Latin word "Adolescere" meaning, "to grow, to mature". It is a significant phase of transition from childhood to adulthood. A universally accepted definition of the concept of adolescence has not yet been established, but WHO has defined it in terms of age spanning between 10 to 19 years. Adolescence is one of the important stages because of its transitional nature to attain the highest biologically growth potential to attain adulthood. It is the period of physical, psychological and social maturity from childhood to adulthood. In India, adolescent

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girls (11-18 years) constitute nearly 16.75 % (Registrar General and Census Commissioner, India, 2001) of the total female population of 49.6514 crores which is approx. 8.3 crores. Adolescence is a significant period for mental, emotional and psychological development. Adolescence represents a window of opportunity to prepare for healthy adult life. In the developing countries scarcity of information regarding nutritional status of adolescents has been noticed. It has been observed that anthropometric data in these age groups are not interpreted in context of nutrition (De On is 1996). Human physical growth is a dynamically changeable and inherently vital phenomenon. Growth of children and youth has been recommended as one of the best indices of health and nutritional status of a community (WHO, 1978). Nutritional status is one of the strongest indicators of the standard of living in developing world (Nube *et al.*, 2003). Undernutrition among children and adolescents is a

serious public health problem and has been accepted internationally, especially in developing countries (Ghannam *et al* 2003, Venkiah 2002, Kalhan *et al*., 2010). Nutritional status of community is greatly affected by the nutritional status of adolescent girls, specifically when these girls are married at early age leading to future generation of under nourished children. Economic background has been a major determinant of nutritional status of any population, specifically girls (Chaudhary *et al*., 2009, Ghosh & Paul 1991; Goyle 2009), where as it has been reported that rural girls are at lower risk for health and nutritional problems.

MATERIALS AND METHODS

Chhattisgarh is a state in Central India. The state was formed on November 1, 2000 by partitioning 16 Chhattisgarhi speaking southeastern districts of Madhya Pradesh. For the present investigation approximately 1000 healthy adolescent girls of 12-18 years were selected from various school of Raipur (Chhattisgarh). Anthropometric measurements ie height, weight were measured and Body Mass Index was calculated. Descriptive and comparative analysis of the data was done using SPSS package version.

Body weight

Weighing machine was used for recording body weight. Weighing machine was placed on plain surface and the subject was made to stand on the center of platform bare foot without support. Extra clothing and shoes were removed. Body weight recorded in Kilogram.

Stature :

Anthropometer was used to measure the height. The subject was made to stand upright barefoot and without raising the heel from the ground. Then the horizontal bar of the anthropometer was lowered until it touches the head. The measurement was taken carefully and the bar was not allowed to press the head. The reading to the nearest half cm was recorded.

Body Mass Index (BMI) (WHO, 1995; Ferro-Luzzi *et al*., 1992)

Body Mass Index (BMI) is a method of estimating a person's body fat percentage based upon simple weight and height measurements. While the BMI calculation is an indirect measurement, it has been found to be a fairly reliable indicator of body fat measures in most people.

It is the ratio of weight (Kg) to stature (m)^2.

It is an age independent nutritional index. Following categories of nutritional status can be derived as per Ferro-Luzzi *et al*. (1992):

$$BMI = \frac{Weight\ (kg)}{Stature\ (m)^2}$$

RESULTS

Table 01 presents the mean distribution of body weight of the adolescents girls of various age group. Body weight is an important measurement, which denotes increment of body organs. Mean score range of body weight was 33.7 and 48.08 kg at 12+ years and 18+ years respectively for girls. The maximum difference between two successive ages is 4.39 kg among girls between 12+ and 13+ years. The rate of growth of weight becomes faster after pre-pubertal age (Lowery, 1978) The maximum increment during 13+ to 14+ years of age corresponds to the adolescent growth spurt. The standard deviation of the body weight exhibited the highest value 5.28 kg for the age group of 15+ years and the lowest value recorded was 2.97 kg for 12+ years group. The relative high values of SD and CV indicate difference in gaining weight, overall gain is 14.38 kg among girls during the growth period under study.

Table 2 shows the comparison of body weight of adolescents of present study with other studies ie. reference data of NCHS (National Centre for health Statistics 1987), ICMR (Indian Council Medical Research 2010), CDC (Centers for Disease Control and Prevention 2007-2010) and M.Mitra 2002.

Table 1. Distribution of Mean, SD and CV of body weight (kg) among the girls

Age	N	Mean	SD	CV	Absolute Growth	Rate of Growth(%)
12+	140	33.7	2.97	8.813		
13+	140	38.09	3.17	8.322	4.39	13.02
14+	140	40.91	4.26	10.41	2.82	7.4
15+	140	42.42	5.28	12.44	1.51	36.91
16+	160	45.16	3.96	8.76	2.74	5.82
17+	140	46.06	3.98	8.64	0.9	1.99
18+	140	48.08	4.81	10	2.02	43.85

(SD – Standard Deviation, CV – Coefficient of Variation)

Table 2. Comparison of mean of Weight of present Study with Other Studies

Age in Years	Present study	ICMR 2010	NCHS 1987	M.Mitra 2002	CDC 2007-2010
12+	33.70	39	47.10	23.60	49.0
13+	38.09	43.4	51.50	25.43	55.8
14+	40.91	47.1	54.70	27.25	58.5
15+	42.42	49.4	56.40	29.84	58.1
16+	45.16	51.3	58.20	31.82	61.3
17+	46.06	52.8	59.70	34.00	62.4
18+	48.08	53.8	60.80	36.05	61.2

It is revealed from the table that present study mean was lower than NCHS (1987), ICMR(2010) and CDC (2007-2010) and higher than M.Mitra (2002).
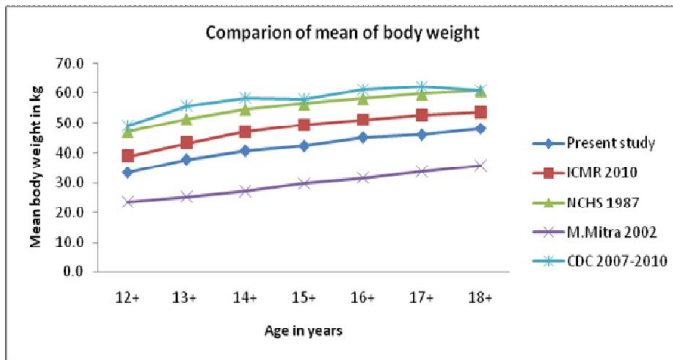

Figure 1. Comparison of body weight of present study with International (NCHS, 1987; CDC, 2007-2010) & National (ICMR, 2010; M.Mitra, 2002) studies
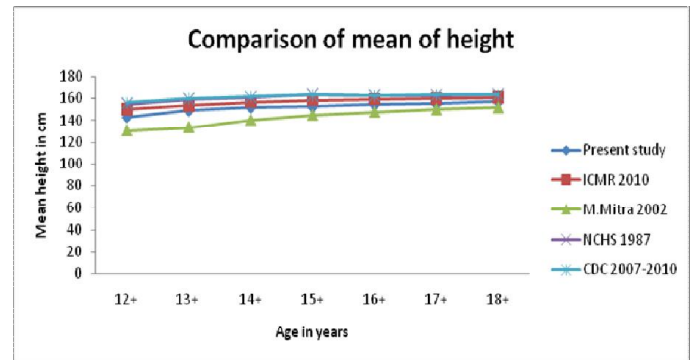
Table 3. Distribution of Mean + SE, SD and CV of height (cm) among the girls

Age	N	Mean	SD	CV	Absolute Growth	Rate of Growth(%)
12+	140	142.7	4.55	3.18		
13+	140	148.8	5.28	3.55	6.1	4.25
14+	140	151.7	4.59	3.02	3.0	1.98
15+	140	152.1	4.85	3.19	0.4	0.23
16+	160	154.1	5.44	3.52	2.0	1.29
17+	140	154.6	4.58	2.96	0.6	0.38
18+	140	156.8	5.18	3.30	2.2	1.41

(SD – Standard Deviation, CV – Coefficient of Variation)

Table 03 present the mean values SD, CV, absolute growth and rate of growth of height. Height is the second important measurement, which denotes increment of body organs. Mean score of height was 142.7 and 156.8 cm at 12+ and 18+ year of age respectively. The maximum difference between two successive ages is 6.1 cm from 12+ to 13+ years. The maximum increment during 12+ to 13+ years of age corresponds to the adolescent growth spurt. The standard deviation of the stature exhibited the highest value 7.00 cm for the age group of 17+ years and the lowest value recorded was 4.56 cm for 14+ years among girls. The overall gain is 22 cm was recorded during the growth period under study.

Table 3. Comparative Analysis of Height of present Study with Other Studies

Age in Years	Present study	ICMR 2010	M.Mitra 2002	NCHS 1987	CDC 2007-2010
12+	142.7	150.2	130.6	154.6	156.1
13+	148.8	153.8	133.7	158.8	160
14+	151.7	157	140.3	160.9	161.6
15+	152.1	158.8	145	163.2	162.9
16+	154.1	159.7	147.9	162.2	162.2
17+	154.6	160.2	150.1	162.7	163.1
18+	156.8	161.1	151.9	163	163.1

Height of the girls of present study was compared with reference data of NCHS (National Centre for health Statistics 1987), ICMR (Indian Council Medical Research 2010), CDC (Centers for Disease Control and Prevention 2007-2010) and

M.Mitra 2002. It is revealed from the table that present study mean was lower than NCHS (1987), ICMR(2010) and CDC (2007-2010) and higher than M.Mitra (2002).

Figure 2. Comparison of height of present study with International (NCHS, 1987; CDC, 2007-2010) & National (ICMR, 2010; M.Mitra, 2002) studies

Table 4. BMI (Body Mass Index) of girls (According to International standard)

			Categories of malnutrition		
Age	N	Normal >18.5	Mild Grade I 17.0-18.49	Moderate Grade II 16.0-16.99	Severe Grade III <16.00
12 year	140	10.7 (15)	25(35)	26.42(37)	37.8(53)
13 year	140	18.6(26)	30.7(43)	22.9(32)	27.9(39)
14 year	140	30(42)	29(40)	28.6(30)	12.9(8)
15 year	140	50.7(61)	20(38)	15(21)	14.3(20)
16 year	160	46.9(75)	23.8(38)	16.3(26)	13.1(21)
17 year	140	46.4(65)	23.6(33)	17.9(25)	12.1(17)
18 year	140	49.3(69)	20.7(29)	12.9(18)	17.1(24)
Total	1000	35.3 (353)	25.6(256)	19.9(199)	19.2 (192)

The body mass index (BMI) is accepted as one of the best indicator of nutritional status.

It is also considered as appropriate tool for assessment of nutritional status in a country with immense diversity like India. Therefore in the present study, body mass index was calculated to assess the nutritional status.

Table 04 shows the BMI international standard of malnutrition. BMI reveals that 35.3 % girls are be classified under the normal category. 25.6% girls suffered mild malnutrition 19.9% girls suffered from moderate grade II and 19.2% girls suffered with severe grade III category of malnutrition.

BMI Value of girls (According to Indian Standard)

		Categories of malnutrition		
Age	N	Normal >15.0	Moderate > 13.0 - <15.0	Severe <13.0
12 year	140	87.1%	12.9%	0
13 year	140	92.1%	7.9%	0
14 year	140	100%	0	0
15 year	140	100%	0	0
16 year	160	100%	0	0
17 year	140	100%	0	0
18 year	140	100%	0	0
total	1000	97%	3%	0%

DISCUSSION

The weight and height of the present data was compared with NCHS 1987, CDC 2007-2010, ICMR 2010 growth reference and all the anthropometric measurements were significantly lower among the adolescent girls of the present study. Very few previous studies described the nutritional status of adolescent girls from Raipur district Chhattisgarh state. In the present study, 192 (19.2%) girls were classified under severe grade-III category of malnutrition, 199 (19.9%) moderate form grade-II category of malnutrition and 256 (25.6%) mild grade –I. Category of malnutrition out of 1000 subjects, Only 353 (35.3%) girls had BMI within normal range according to international standard. Present study shows that 35.3% girls were found to be normal. Deshmukh *et al.* reported an overall 44% of adolescents girls in normal category. Sharma *et al* (2013) in a study reported that 42.6% girls were under-nourished (BMI<_18.5). Kapoor & Aneja (1992) reported 35.5 of adolescent girls (11-18 years) of Delhi to be under-nourished. In the Present study thinness was significantly higher in early adolescence (80.2%) than in late adolescence (53.4%).

Shahabuddin *et al* (2000) also reported that as age increased thinness decreased. National Nutrition Monitoring Bureau (NNMB 2002) also reported that under-nutrition decreased from 78% in 10-13 years to 66% in 14-17 years. A higher percentage (93.5%) of under-nourishment was reported by several of the studies from Soutnern states and Rajasthan (NNMB, Chaturvedi S.). Choudhary *et al.* (2009) have reported 68.52% of adolescents having a BMI less than 18.5 kg/square meter in rural area of Varanasi. Studies overseas in developing country like Bangladesh have also reported higher rate of prevalence (67%) of thinness among girls in the south east region (Shahabuddin, 2000). Anand *et al.* (1999) however reported lower percentage (30.1%) of thinness in north Indian rural school going girls near Delhi. One of the major reasons for thinness may be poor nutritional intake of adolescent girls and the increased physical activity, excessive energy outflows due to hard labour in agricultural activities. The frequency of overweight is low compared to that of underweight. The other possible reasons could be explained through factors such as biological, emotional, physical appearance, and behavioral factors. The reason for underweight in the present study needs to be asserted by further research.

Conclusion and Recommendations

The findings provide a base line data for planning awareness programmes for the adolescent girls. The result of the present studies indicate that a fare number of adolescent girls are undernourished. These percentages of malnourished adolescent girls are quite alarming and steps need to be taken to improve their nutritional status. The finding of the present study will help plan intervention programes for improving nutritional status of the adolescent girls.

Acknowledgement

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