Original Research Article

Height and BMI profiles of rural adolescents in 3 schools in Nashik district

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Abstract

Objectives: This study aims to estimate stunting levels in rural school going adolescents. The cross sectional study in 2016 involved 261 students from 8th and 9th class with average age of 13 to 14 completed years from three rural schools in Nashik district (m 128, f 133). The height and weights were taken using standard procedures with a stadiometer and a bathroom digital scale. WHO and IAP growth charts were used to estimate and compare stunting and BMI values of the study population. **Results:** 31.51% adolescents 4 were stunted by WHO standards (<-2SD), while 15.71% adolescents were found below 3rd percentile of IAP charts. The mean heights and SD of students were as follows: 8th class, Girls 146.05(5.99), Boys 148.15(7.81), 9thclass Girls 142.4 (5.9), Boys 145.8 (7.8). BMI mean values also are below 25th percentile of IAP charts and around 15th percentile of WHO height charts. **Conclusion:** High level of malnutrition was prevalent despite years of ICDS and Mid-Day Meal programme. The study population has a high level of stunting at 32% and 16% by WHO and IAP standards and concurs with similar studies from the state. Multi-pronged actions are required to mitigate rural adolescent stunting and low BMI.

Key Words: Adolescents, stunting, BMI.

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INTRODUCTION

India has a high rate of childhood stunting. The National Family Health Survey (NFHS4 2015-16) estimated combined rural and urban under5 (U5) stunting at 38.4%, with 41.2% for rural.(1)The National Nutrition Mission (NNM) drafted by NITI Ayog in 2017 aims to achieve 6% reduction in stunting from 38.4 per cent as per the NFHS 4 by 2022.(2)The NNM rightly argues for a life cycle approach since height gain is affected from factors antenatal, in-utero to adolescence, not to mention the parental heights. Prevention of stunting is very important to overall growth and development of individuals and the society. Height is a robust indicator of long term growth and India is rightly focusing on under2 (U2) height gain through Infant and Young Child feeding (IYCF) Angnawadis and better nutrition of U2 population by targeted schemes.[3] The RTE (Right to Education) has ensured Mid Day Meal Scheme (MDMS) across states, with 450 calories and 12 gm protein for 1st to 5thclass and 600 calories and 20 gm protein for 6thand 7thclass; mainly through rice and dal.[4] Adolescent heights are a good indicator of achievement of growth and nutritionpotentials and also socio-economic development. After the publication of WHO 2007growth standards, Indian Academy of Pediatricians (IAP) has also published Indian growth standards, allowing for somewhat lower growth parameters.[5,6]. The NFHS statistics does not offer adolescent growth data but ICMR has published growth standards for 3-18year children.[7] Although abundant data on heights and weights from schools are available through Rashtriya Bal Swasthya Karyakram (RBSK), there is no reporting of comparative statistics to facilitate more targeted action at individual or community level. Some reports regarding stunting in adolescents are

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available. A recent Bengal rural study reported 56% stunting among of adolescents.[8] A study from Wardha (Maharashtra) reported that 34.5% of the adolescents were stunted[9] This study aims to estimate height attainments in rural adolescents from Nashik district from 8th and 9thclass in reference to IAP and WHO standards.

MATERIAL AND METHODS

This cross sectional study was conducted in parts of Nashik district having both tribal and non-tribal population. Igatpuri block is mainly a tribal rural hilly block with rice farming as main occupation for 80% people. The selected schools were from three villages in the field practice area of a rural Medical College. No urban high school or convent schools existed within 30 km perimeter of this institute in 2016-17 and hence most students attended local schools run by Zillaparishad or grant-in-aid schools run by charitable trusts. All three schools were under Maharashtra State board of Secondary Education. Prior approval from Ethics Committee was obtained for the study. Consent of school authorities was taken for the study. Oral assent of the students was obtained after explaining the procedure.

Sample Size Calculation: The desired sample size was estimated on Open-Epi version 3, using proportion of stunting among rural adolescents students to be (p):54%+/-5%[10] Confidence limits as percentage of 80%, design effect (for cluster surveys-DEFF):1.3.The desired sample size was 211. **Inclusion Criteria:** The study included 8th standard and 9thclass, and the median age is assumed to be about 13Y6m and 14Y6m years respectively. This age is commensurate with pubertal spurt of growth. All students attending on the visit day in the selected classroom division were included. Out of 305 students 236 participated in the study in first visits and 25 of absent students were included subsequently. Some student absentees were reported to be habitual either because of long walking distances or un-supporting families. The visits were conducted in mid-week to ensure maximum attendance. In one school, absentees in 9thclass were remarkable (31 absentees out of 109); hence the school was revisited to cover missing students. In other schools and divisions the absentee was less than 10% and hence no repeat visit was done. Together the study included 128 students from 8th and 135 from class 9th. **Time frame:** This study was undertaken in August and September 2016, nearly two months after schools opened in second fortnight of June 2016, **Anthropometry:** Body weight was recorded on a digital bathroom weighing scale, with usual school clothes on but no footwear and belt. The digital weighing machine (OmronHN-283 serial number 201109-02704F) did not show variation once adjusted for plane with spirit level. The adult weighing machine was tested each day against a pre-measured weight of sandbag wrapped inplastic to retain moisture if any for weight accuracy. The weighing scale did not show error of >0.1 kg. The job of weighing was done by a single observer throughout who was trained to level the scale with a spirit level and allow the reading to settle. Only one reading was taken as it was found that repeated reading with this procedures were nearly consistent. The height was taken by a separate observer with a stadiometer fixed on wall and head, toes and buttocks and shoulders touching the wall. Age was taken as 13yrs 6months and 14 years 6months for 8th and 9thclass respectively. Statistical analysis was done with Excel and Epi-Info7.2software.

RESULTS

Students from three rural schools participated. A total of 261 (Class 8th: girls 62, boys 64 and Class 9th: girls71, boys 64). Table 1 depicts the heights of adolescents in 8th and 9thclass, with commensurate height percentiles and stunting by WHO and IAP growth curves. It was seen that the stunting was 31.51% and 15.71% with WHO and IAP standards. Table 2 depicts BMI values of girls and boys in 8th and 9thclass, with commensurate BMI percentiles from WHO and IAP growth curves.

Table 1: Height and stunting of rural adolescents

Class, and (age)	Gender	Observed Height cm mean (SD)cms	IAP values for 3rd percentile (SD)cms	Students below -3rd percentile of IAP standards (%)	-2SD value in WHO Growth charts (SD)cms	Students below -2SD of WHO standards (%)
8th (13Y6M)	Girls (62)	146.05 (5.99)	139.9(6.0)	10(16.12)	144.4 (6.95)	23 (37.1)
	Boys (64)	148.15 (7.81)	140.9 (8.4)	11(17.18)	144.5 (7.57)	21 (32.8)
9th (14Y6M)	Girls (71)	150.15 (5.48)	142.4(5.9)	13(20.63)	147.1 (6.92)	17 (23.9)
	Boys (64)	153.73 (8.83)	145.8(7.8)	7(9.86)	150.3 (7.76)	20 (31.3)
	Total			**41(15.71)**		**83 (31.51)**

Table 2: BMI of rural adolescents

Class, and (age)	Gender	BMI Mean (SD)	Observed BMI in ref to IAP ref charts	Observed BMI in ref to WHO ref charts
8th (13Y6M)	Girls (62)	16.85 (2.99)	Below 25th percentile	>15th percentile
	Boys (64)	15.93 (1.93)	Below 25th percentile	<15th percentile
9th (14Y6M)	Girls (71)	17.91 (2.47)	Below 25th percentile	>15thpercentile
	Boys (64)	16.31(2.20)	Below 25th percentile	>5thpercentile

DISCUSSION

Stunting as an important measure of human development: Malnutrition is a major problem among children, but adolescent malnutrition is often overlooked because of current emphasis to U5 malnutrition. Height is a robust indicator of long term growth of children and adolescents up to 18 years and shows the overall impact of several factors like nutrition, health care, sanitation and parental heights. Height gains therefore are important to both human development and socio-economic development and there is also a bidirectional cause and effect relationship between heights and socio-economic development. The problem of high stunting and programmatic interventions: The NFHS4 estimate of rural U5stunting at 41.2% is understandably higher than the urban figure of 34.8%.6 National and State level factsheets of the Rapid Survey on Children (RSoC) that was conducted in 2013-14 jointly by the Ministry of Women and UNICEF estimated that U5 stunting by WHO set levels have reduced but still about at the level of 31% at national level.[11] The NFHS4 in 2015-16 confirm these improving trends. Even then the stunting levels continue to be high. The adolescent study population has high degree of stunting at 31.51% by WHO -2SD level and 15.71% by IAP standards.[5,6] Even by the less demanding IAP standards the heights of adolescent girls and boys are closer to 10th to 20th percentiles, which is disturbing. This suggests chronic under nutrition of the study population and may have been influenced by several factors including health care, sanitation and protein-energy intakes; in short the multi-dimensional poverty. There exists a considerable debate about adopting for India the ideal heights prescribed by WHO standards.5 IAP and ICMR have published their own tables and curves.[6,7]. The IAP and ICMR standards are pegged somewhat lower than the WHO and hence there is observed difference between stunting percentages between WHO (31.51%) and IAP (15.71%). The authors tend to support the IAP standards since they are adopted for local conditions. Parental heights as an influential factor for offspring heights have been reported among Indian diaspora in various countries. The stunting levels in Maharashtra have been reported by various studies. A Wardha district study indicates that 34.5% were stunted in age group 11-19.[9] In another study from the sugar belt block of Maharashtra reported the prevalence of stunting in 10-15years age group to be 16.9% among boys and 6.3% in girls by and an overall prevalence of 11.6% by WHO standards and using a cut off level of <3 percentile.[12] A Bengal rural study reported in 2016 high rate of stunting at 56% in adolescents. Thus India has high rate stunting among adolescents despite various targeted and general programmes. Except parental height, most of these are amenable to life cycle approach which includes the 1000 days' window, IYCF, complimentary feeding from 6m-2y, preschool nutrition programsesp Anganwadi, MDMS, Kishori Shakti Yojna.[2] Also there is the RBSK program since 2011-11.[13] Weight and hence BMI is subject to both short term and long influences and also are linked to height. There are also the other larger programs of water safety, sanitation (Swatch Bharat), annual national deworming day (NDD) etc. Low Bmi Of Study Population: The BMI findings from table 2 are also suggestive of chronic malnutrition as BMI values for the study population are below 25th percentile by IAP standards and just above 10th percentile by WHO standards. RSOC report estimated that 54% of adolescent girls in Maharashtra were in the low BMI category in 2013-14.11 This corroborates to the high stunting levels. Have ICDS, MDM been effective: The Integrated Child Development Scheme (ICDS) was launched in 1978 in most of Maharashtra and the coverage of the Angwnawdies was extended to villages and padas in a few years. That makes four decades of the ICDS services. The MDMS was improved so that every child in every Government and Government aided primary school was to be served a prepared cooked meal with a minimum content of 300 calories of energy and 8-12 gram protein per day for a minimum of 200 days. The scheme was extended to 7th and 8th classes with 450 calories and 20 gram protein.4 The study population is beneficiary of MDMS right from school enrolment till 8th standard since the revised MDMS is operating for a decade from 2007. RBSK is operative since 2010 and involved health and anthropometry checkup of all schoolchildren.13 Thus there are major schemes for children and adolescents and the study population has had all these services. Adolescent girls have had IFA supplementation through ICDS. MDM is a supplementary meal providing nearly a third of calorie and protein requirements, and

schoolchildren eat stomach full of the same for minimum 200 days in year. Thus the students in this study population have benefited from both the targeted schemes of ICDS and MDM. Despite these two services, the stunting levels are high both by global and Indian standards. The food served in MDM is mainly carbohydrates (rice with little of moong dal as khichdi) and occasional vegetables. In childhood and adolescence the protein requirement is about 1.6gms per kg bodyweight to ensure growth in height and adequate muscle mass. The prevalent operation of MDMS is unlikely to give the desired protein content of 20gm unless pulse portion reaches about 60-70 gms/ student in 7th and 8th class.

CONCLUSIONS

The rural adolescent population in this study group is bordering on mild malnutrition- with 16% stunted as per IAP curves and 32% stunting by WHO cut off points of <-2SD.The study population had low BMI. It seems years of several targeted schemes have not helped tolessen or prevent high stunting levels in these rural children and there could be other factors contributing to this undernutrition including overwork, lack of sanitation and timely health care.

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