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PATTERN OF BMI IN SCHOOL GOING CHILDREN FROM RURAL AREA

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ABSTRACT

Background: Though adolescent under nutrition still remains a major health problem in rural areas of India, overweight is also alarmingly increasing.
Objective: To study pattern of BMI of school children in association with socio-demographic factors, food habits and physical activity.
Methodology: Study type: cross-sectional, Study setting: Schools from rural area, Study subject: Early Adolescent School Children. Inclusion criteria: children in the age group of 10-16yrs from 5-10 std. Sample size: 1275 students. Study period: July-NOV 2011. Study tools: Self designed, pretested Questionnaire, weighing scale, non-stretchable measuring tape. Statistical analysis: Chi-Square test, Mean and SD. and ANOVA
Results: 1275 students were included in the study. The prevalence of underweight and overweight among the students is 23.1% and 6.5% respectively. There is significant association of underweight (< 5th percentile BMI) in male students (27.6%), having lower literacy of parents (39%) . The prevalence of overweight (13.8%) seen in children who use more computer, television and video games. Also those children who consume bakery products (9.8%), kurkure (9%) and non-vegetarian diet (10%) are more prone for overweight.
Conclusion: Increase consumption of dry snacks, bakery products and non-vegetarian diet along with reduced physical activity affects BMI and hamper nutritional status.

INTRODUCTION

Adolescence is transitional phase between childhood and adulthood characterized by marked acceleration in growth. Failure to achieve optimum nutrition intake at this time can potentially retard physical growth, intellectual capacity and sexual maturation[1]. Around 20% of Global population constitutes of adolescence and most of it resides in developing countries. Hence Health and well-being of such a vast resource must be of high priority. Recently health has become a major instrument of overall socio-economic development and creation of a new social order[2].

In many developing countries, progress of nutritional transition has been characterized by presence of nutritional deficiencies and also increased prevalence of obesity in adolescents. These are fundamentally associated with changes in lifestyle and eating habits simultaneously[3].

Inadequate nutrition and changing lifestyle behavior in adolescence not only leads to problems of under-nutrition and developmental deficiencies but also put them at high risk of chronic diseases. Several socio-economic and demographic factors are of prime importance which affects adolescence nutritional status. Recently, eating habits in children are changing like low consumption of fruits, green leafy vegetables and milk and at the same time increase consumption of dry snacks, bakery products and soft drinks. Thus increases adiposity in children. Moreover deep frying and refrying in the same oil are potentially injurious to health in view of the liberated oxides, peroxides and other free radicals[4]. Hence, this study was planned to find out the pattern of BMI and related socio-demographic factors, day to day activities and dietary habits.

EXPERIMENT WORK

This cross-sectional study was carried out between July-November 2011 in adolescent school going children between 10-16yrs (5th-10thstd). The study area was situated in Palus taluka of Sangli district which was selected by lottery method, which is 25km from Sangli city. Clusters of schools were selected randomly from rural area of Palus until fulfillment of effective sample size. The calculated sample size was 1256.

Data collection

Interview schedule was tool for data collection. New interview schedule suitable for study was developed by taking help of experts & colleagues.

After taking clearance from Ethical Committee, schools were identified for data collection. By paying visits to the school, written permission was obtained from school authorities. The teaching and administrative school staff was given prior orientation. Days and timing was fixed in

the schools. The schools were revisited for absent students' data collection. Before commencing the procedure of interviewing and measurements, the students had been given brief introduction about methods, to make them comfortable. No idea regarding any contributory factors was given to them to avoid any manipulation in their answers. Only the students whose guardians consented for study were included. For data collection, one medical social worker and two trained doctors assisted during interview schedule. They helped in taking anthropometric measurements of students. For collection of data, material used was interview schedule, non-stretchable measuring tape and weighing scale. Interview schedule includes socio-demographic factors like name, age, sex, standard, education and occupation of parents, type of family and ration card. Information was collected regarding day to day activities such as playing outdoor games, watching TV/ video games/ computer and going to tuitions. In dietary habits of children, frequency of eating green leafy vegetables, fruits, eggs, non-vegetarian items, dry snacks and bakery products per week is noted. Interview schedule was tested by conducting pilot study and appropriate changes were made in interview schedule. The pilot study was not included in final analysis. The height was measured to nearest of 0.1cm using a calibrated ruler fixed to the wall as child stood bare foot with heels, back and head touching the wall and head in Frankfurt plane. Weight was measured to nearest of 0.1kg using a portable weighing machine which was standardized to zero before each measurement. BMI was computed by using the standard equation: BMI (kg/m^2) = weight (kg) /height (m^2)

Percentiles of BMI for age in both sexes were calculated for each group.[5] These students were classified in three groups: <5thpercentile, 5th-85thpercentile and >85thpercentile.

As it was a cluster sample total students included in the study were 1275.

Statistical analysis: Percentage and chi-square was used for comparison and to find the association. Multinomial logistic regression was used to fit models for BMI and socio-demographic characters, daily routine and dietary habits. Statistical analysis was done by using demo version of SPSS 19.

RESULTS

Out of total 1275 students included in the study 670 were males and 605 females. Among them 295(23.1%) students were underweight (<5thpercentile), 897(70.4%) were normal (5th-85th percentile) and 83(6.5%) were overweight (> 85th percentile). There was association of BMI with socio-demographic factors like age, sex, gender, standard and parent's education. There was increasing trend of overweight with increasing age and standards. This shows there is significant association between standard and BMI. Both overweight (7.5%) and underweight (27.6%) was significantly more in males as compared to females. Underweight was seen more in children whose parents were illiterate. While on the other hand, children of parents with higher education, tend to be overweight. Ration card was included regarding socioeconomic status, but it does not show any significance. Also no significant association was noted with type of family and occupation of parents. (Table-I)

Table-Ia: Association of different socio demographic characters with BMI

Student related Parameters		Underweight	Normal	Overweight	Total	Chi square
Age	10	23(28.8%)	55(68.8%)	2(2.5%)	80(100.0%)	0.168
	11	63(25.7%)	164(66.9%)	18(7.3%)	245(100.0%)	
	12	46(23.2%)	144(72.7%)	8(4.0%)	198(100.0%)	
	13	52(26.3%)	134(67.7%)	12(6.1%)	198(100.0%)	
	14	55(23.5%)	164(70.1%)	15(6.4%)	234(100.0%)	
	15	38(17.4%)	164(75.2%)	16(7.3%)	218(100.0%)	
	16	13(15.3%)	62(72.9%)	10(11.8%)	85(100.0%)	
	17	5(29.4%)	10(58.8%)	2(11.8%)	17(100.0%)	
Std	5	66(33.5%)	124(62.9%)	7(3.6%)	197(100.0%)	0.000
	6	34(17.0%)	147(73.5%)	19(9.5%)	200(100.0%)	
	7	55(30.2%)	120(65.9%)	7(3.8%)	182(100.0%)	
	8	64(28.7%)	150(67.3%)	9(4.0%)	223(100.0%)	
	9	53(21.4%)	176(71.0%)	19(7.7%)	248(100.0%)	
	10	23(10.2%)	180(80.0%)	22(9.8%)	225(100.0%)	
Gender	Female	110(18.2%)	462(76.4%)	33(5.5%)	605(100.0%)	0.000
	Male	185(27.6%)	435(64.9%)	50(7.5%)	670(100.0%)	

Table-Ib: Association of different socio demographic characters with BMI

Parent related Parameters		Underweight	Normal	Overweight	Total	Chi square
Father's Education	Expired / Not Known	27(39.7%)	39(57.4%)	2(2.9%)	68(100.0%)	0.000
	primary	76(35.8%)	129(60.8%)	7(3.3%)	212(100.0%)	
	secondary	159(19.8%)	588(73.1%)	57(7.1%)	804(100.0%)	
	higher secondary	0(0.0%)	7(100.0%)	0(0.0%)	7(100.0%)	
	graduate and above	21(19.3%)	74(67.9%)	14(12.8%)	109(100.0%)	
Mother's Education	illeterate / not known	36(30.0%)	77(64.2%)	7(5.8%)	120(100.0%)	0.000
	primary	80(29.3%)	186(68.1%)	7(2.6%)	273(100.0%)	
	secondary	153(22.8%)	476(70.9%)	42(6.3%)	671(100.0%)	
	higher secondary	20(12.0%)	124(74.3%)	23(13.8%)	167(100.0%)	
	graduate and above	6(14.0%)	33(76.7%)	4(9.3%)	43(100.0%)	
Father's Occupation	Farmer	208(23.1%)	641(71.2%)	51(5.7%)	900(100.0%)	0.352
	Self Employeed	10(16.9%)	44(74.6%)	5(8.5%)	59(100.0%)	
	Employeed	65(25.4%)	168(65.6%)	23(9.0%)	256(100.0%)	
	Expired / Not Known	12(20.0%)	44(73.3%)	4(6.7%)	60(100.0%)	
Mother's Occupation	Farmer	106(24.9%)	296(69.5%)	24(5.6%)	426(100.0%)	-
	Self Employeed	6(35.3%)	11(64.7%)	0(0.0%)	17(100.0%)	
	House-wife	161(21.8%)	524(71.1%)	52(7.1%)	737(100.0%)	
	Employed	20(23.5%)	59(69.4%)	6(7.1%)	85(100.0%)	
	Expired / Not Known	2(20.0%)	7(70.0%)	1(10.0%)	10(100.0%)	
Type of family	Joint / Extended	176(23.7%)	513(69.1%)	53(7.1%)	742(100.0%)	0.666
	Not Known	10(18.9%)	39(73.6%)	4(7.5%)	53(100.0%)	

	Nuclear	109(22.7%)	345(71.9%)	26(5.4%)	480(100.0%)	
Total		295(23.1%)	897(70.4%)	83(6.5%)	1275(100.0%)	

Association of BMI with day to day activities was noted. No association was seen between BMI and children playing outdoor games. There was increasing trend of overweight observed in students who watch television and video games for one hour or more per day. There was significant association seen in students who use computer for more than one hour per day. Those students who attend tuitions for more than one hour per day were prone for overweight. (Table-II)

Table-II: Association of daily routine activity with BMI

		BMI			Total	Chi square
		Underweight	Normal	Overweight		
Outdoor games	No	26(18.1%)	110(76.4%)	8(5.6%)	144(100.0%)	0.521
	one time	186(24.3%)	530(69.2%)	50(6.5%)	766(100.0%)	
	more than one	83(22.7%)	257(70.4%)	25(6.8%)	365(100.0%)	
Watching T.V.	No	63(23.5%)	192(71.6%)	13(4.9%)	268(100.0%)	0.652
	one time	183(23.6%)	536(69.3%)	55(7.1%)	774(100.0%)	
	more than one	49(21.0%)	169(72.5%)	15(6.4%)	233(100.0%)	
Playing Video games	No	266(23.3%)	801(70.2%)	74(6.5%)	1141(100.0%)	-
	one time	24(21.6%)	78(70.3%)	9(8.1%)	111(100.0%)	
	more than one	5(21.7%)	18(78.3%)	0(0.0%)	23(100.0%)	
Using Computer	No	270(27.0%)	677(67.8%)	52(5.2%)	999(100.0%)	0.000
	one time	15(12.9%)	92(79.3%)	9(7.8%)	116(100.0%)	
	more than one	10(6.3%)	128(80.0%)	22(13.8%)	160(100.0%)	
Tuition	No	242(28.3%)	575(67.2%)	39(4.6%)	856(100.0%)	0.000
	one time	28(14.4%)	149(76.8%)	17(8.8%)	194(100.0%)	
	more than one	25(11.1%)	173(76.9%)	27(12.0%)	225(100.0%)	
Self Study	No	3(18.8%)	10(62.5%)	3(18.8%)	16(100.0%)	0.049
	One time	79(28.9%)	179(65.6%)	15(5.5%)	273(100.0%)	
	2 times	148(23.1%)	456(71.0%)	38(5.9%)	642(100.0%)	
	3 times	53(20.2%)	187(71.4%)	22(8.4%)	262(100.0%)	
	> 3 times	12(14.6%)	65(79.3%)	5(6.1%)	82(100.0%)	
Total		295(23.1%)	897(70.4%)	83(6.5%)	1275(100.0%)	

The percentage of underweight was more in children who do not consume green leafy vegetables (33.3%) and fruits (25.6%) though the association was not significant. No significant association was seen between consumption of milk and eggs with BMI. There was increasing trend of overweight seen in children who eat chicken/mutton (10%) more than one time per week which shows significant association. Also increasing trend of overweight seen in children who consume dry snacks such as kurkure (9%) and bakery products (9.1%) frequently which shows significant association in them. No association was found in children who consume Samosa, pizza and cold drink. (Table-III)

Table-III: Association of dietary factors with BMI

		BMI			Total	Chi square
		Underweight	Normal	Overweight		
GLV	No	19(33.3%)	37(64.9%)	1(1.8%)	57(100.0%)	0.395
	1 - 3 times per week	185(22.7%)	576(70.7%)	54(6.6%)	815(100.0%)	
	3 - 5 times per week	65(23.6%)	193(70.2%)	17(6.2%)	275(100.0%)	
	More than 5 times per week	26(20.3%)	91(71.1%)	11(8.6%)	128(100.0%)	
Fruit	No	44(25.6%)	120(69.8%)	8(4.7%)	172(100.0%)	0.77
	1 - 3 times per week	202(22.6%)	628(70.3%)	63(7.1%)	893(100.0%)	
	3 - 5 times per week	33(25.6%)	88(68.2%)	8(6.2%)	129(100.0%)	
	More than 5 times per week	16(19.8%)	61(75.3%)	4(4.9%)	81(100.0%)	
Milk	No	74(21.5%)	245(71.2%)	25(7.3%)	344(100.0%)	0.368
	1 - 3 times per week	48(19.0%)	186(73.5%)	19(7.5%)	253(100.0%)	
	3 - 5 times per week	27(25.2%)	72(67.3%)	8(7.5%)	107(100.0%)	
	More than 5 times per week	146(25.6%)	394(69.0%)	31(5.4%)	571(100.0%)	
Egg	Not Eating	94(24.0%)	278(70.9%)	20(5.1%)	392(100.0%)	0.383
	1 time per week	77(26.7%)	195(67.7%)	16(5.6%)	288(100.0%)	
	2 times per week	76(19.9%)	273(71.7%)	32(8.4%)	381(100.0%)	
	3 Times per week	20(19.6%)	75(73.5%)	7(6.9%)	102(100.0%)	
	More than 4 times	28(25.0%)	76(67.9%)	8(7.1%)	112(100.0%)	
Mutton	Not Eating	119(23.0%)	373(72.1%)	25(4.8%)	517(100.0%)	0.009
	1 time per week	101(27.7%)	245(67.1%)	19(5.2%)	365(100.0%)	
	2 times per week	53(19.0%)	198(71.0%)	28(10.0%)	279(100.0%)	
	more than 3 Times per week	22(19.3%)	81(71.1%)	11(9.6%)	114(100.0%)	
Kurkure	Not Eating	101(26.4%)	258(67.5%)	23(6.0%)	382(100.0%)	0.000
	1 time per week	72(28.0%)	170(66.1%)	15(5.8%)	257(100.0%)	
	2 times per week	87(22.3%)	281(71.9%)	23(5.9%)	391(100.0%)	
	3 times per week	21(20.8%)	76(75.2%)	4(4.0%)	101(100.0%)	
	more than 4 Times per week	14(9.7%)	112(77.8%)	18(12.5%)	144(100.0%)	
Bakery Products	Not Eating	71(22.0%)	238(73.7%)	14(4.3%)	323(100.0%)	0.031
	1 time per week	54(25.8%)	144(68.9%)	11(5.3%)	209(100.0%)	
	2 times per week	69(22.0%)	227(72.3%)	18(5.7%)	314(100.0%)	
	3 times per week	46(30.1%)	92(60.1%)	15(9.8%)	153(100.0%)	
	more than 4 Times per week	55(19.9%)	196(71.0%)	25(9.1%)	276(100.0%)	
Samosa	Not Eating	186(22.7%)	575(70.0%)	60(7.3%)	821(100.0%)	0.633
	1 time per week	38(26.4%)	100(69.4%)	6(4.2%)	144(100.0%)	
	2 times per week	52(24.4%)	149(70.0%)	12(5.6%)	213(100.0%)	
	more than 3 Times per week	19(19.6%)	73(75.3%)	5(5.2%)	97(100.0%)	
Pizza	Not Eating	186(22.7%)	575(70.0%)	60(7.3%)	821(100.0%)	0.633
	1 time per week	38(26.4%)	100(69.4%)	6(4.2%)	144(100.0%)	

	2 times per week	52(24.4%)	149(70.0%)	12(5.6%)	213(100.0%)	
	more than 3 Times per week	19(19.6%)	73(75.3%)	5(5.2%)	97(100.0%)	
Cold Drink	Not Drinking	287(23.2%)	867(70.1%)	83(6.7%)	1237(100.0%)	0.219
	Drinking	8(21.1%)	30(78.9%)	0(0.0%)	38(100.0%)	
Total		295(23.1%)	897(70.4%)	83(6.5%)	1275(100.0%)	

Using multinomial logistic regression, 3 models for socio-demographic, activity and diet were obtained with BMI as the dependent variable having following categories - i) Underweight, ii) Overweight iii) Normal (reference category). Independent factors, which are significant in univariate analysis, were chosen for analysis.

In each model, -2LL decreased in the final stage indicating a better and significant fit. In socio-demographic model, school standard and gender were better predictors for underweight, whereas in the activity model using computer and going for tuition were better predictors. In the model of diet, use of dry snacks was a better predictor. (Table-IV)

Table-IV. Results of multinomial regression.

Model	-2LL	Chi square	Significance	Overall correct percentage of model
Socio-demographic	Initial-647.763 Final-522.978	124.784	0.000	70.5
Activity	Initial-302.1 Final-200.892	101.208	0.000	70.4
Diet	Initial-404.450 Final-449.937	45.487	0.001	70.5

DISCUSSION

Proper food and good nutrition is essential for survival, physical growth, mental development, performance and productivity [6]. In our study area under nutrition is still rampant in spite of availability of Mid-Day Meal Scheme in the school. At the same time problem of overweight is also emerging. In the present study, the overall prevalence of underweight is 23.1% and overweight is 6.5%.

K. Anand et al reported thinness as BMI <5th percentile in 43.8% boys and 30.1% girls.[7] The prevalence of thinness was 52.1% among boys and 39.5% among girls noted by Venkaiah K.[8] In present study, similar trend of thinness in which adolescent boys were more affected than adolescent girls has been observed. The prevalence of thinness was higher in the early age groups in most of the cases but decreased with age. Factors like less education of parents, less income, more number of family members, poor hygiene leading to recurrent illnesses and less awareness about balanced diet are critical factors which lead to under nutrition.

In the study carried out by Rajat Vohra et al overweight and obesity was found to be 4.17% and 0.73% respectively.[9] Uma M Iyer reported the overall prevalence of obesity ranged from 0.4-0.8 % in rural setup and 0.8-3.3 % in urban setup.[10]

The important determinants of overweight were parent's education, gender, class, and eating habits. Our results are in concordance with that of previous studies since overweight was more prevalent in children of higher class/standard, better socio-economic group families, and who are eating non-veg, dry snacks and bakery products frequently. Incidence of consuming green leafy vegetables and fruits less than three times per week was 68.4% and 83.52% respectively and no significant association of these dietary factors with BMI were noted. Also eating samosa, pizza and cold drink does not show any significant association with BMI.

In present study, linear trend was observed in parent's education. Prevalence of overweight was more in males as it is most favored still in the community and their demands are easily provided. Usually the children from better socioeconomic class are having facilities like TV, computers & video games etc. Also students get easily snacks at affordable price, in and around schools and at home. As study place is nearer to district place with which it is connected with very well good transport facilities; attracts children and parents towards junk /fast food. Significant association was noted in children who use computer and attend tuitions more than one hour per day, along with those spending more time in studies. No association was seen between BMI and children playing outdoor games, watching TV and video games.

Thus overweight is increasing because of less physical activity, more tendencies for sedentary work and faulty eating habits. This is changing scenario of BMI pattern in young adolescents from rural area.

CONCLUSION

There is a need for school based efforts in the form of promotion of healthy food, expanded and intensified health curriculum regarding the importance of nutrition and physical activity. Routine height and weight records of children should be maintained in school.

Family also plays a critical role in influencing children. Parents should be educated and encouraged to induct a healthy behaviors such as consumption of a balanced, age-appropriate diet, Daily Exercise, limited sedentary activity in their children.

Thus efforts are necessary to improve nutritional status of adolescents, perhaps through short term interventions for achieving better adult size.

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