

Deranged Lipid Profile - A Cardiovascular Risk Factors Among Adolescents

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Abstract

Background: The magnitude of overweight and obesity has been on the increasing trend among Indian children that range to 9 to 27.5% and 1 to 12.9% respectively. Enhanced obesity in adolescents induces morbidities like hypertension, respiratory diseases, diabetes mellitus, orthopedic disorders, heart diseases and cardiovascular risks and elevated serum lipid concentrations especially of VLDL and high LDL-C. **Objective:** The study focused on cardiovascular disease risk factors to determine the prevalence of cardiovascular disease risk factors (pre-hypertension/hypertension, borderline-high/high LDL-C, low HDL-C, and pre-diabetes/diabetes) by weight status (normal weight, overweight, obese) and their trends among Indian adolescents aged between 12-19 yrs. **Methodology:** A school based cross sectional study was carried out in Raichur involving 200 students. Study subjects were selected by systemic random sampling method. With the help of preselected proforma data regarding our study parameters were collected. The study was undertaken in the month of July and August. After getting detailed information and consent by the guardians of students, the blood sample was collected and sent to biochemistry department for analysis of lipid profile. **Results:** Out of 200 subjects, 24% each were from 12 to 13 and 14 to 15 years age group and 26% each from 16 to 17 and 18 to 19 years age group. Majority i.e. 56% was males and 44% were females. Distribution of study population according to BMI where 78% were normal, 10% were obese and 12% were overweight. Prevalence of hypertension was observed in 6% population where almost 11.5% were from 18-19 years age group. Prevalence of diastolic hypertension was 2.5% and seen in males (3.6%). Diastolic hypertension seen in 2.5% and majority i.e. 3.8% were from 18-19 yrs age group. High level of triglycerides was observed in 2% of subjects which belongs from 18-19 yrs age. Comparison between male and female with respect to various study parameters revealed that mean age & mean LDL difference was observed statistically significant (<0.05) whereas in other variables the mean difference was not proved to be significant (>0.05). **Conclusion:** With this study we would like to place a take home message that the overweight and obesity is highly prevalent among adolescents. Among the overweight and obese it is found that in few dyslipidemia and hypertension has already set in. Hence we would suggest the late adolescents is the best time to identify the adolescents with obesity and other risk factors and to adopt necessary life style modifications.

Keywords: Overweight; Hypertension; Orthopedic Disorders; Triglycerides.

Introduction

Studying trends of changes in prevalence of overweight and Obesity has become an important anthropometric study as it allows researches and

policy makers to design specific and targeted programs aimed at checking physiological abnormalities in adolescents in India. The magnitude of overweight and obesity has been on the increasing trend among Indian children that range to 9 to 27.5% and 1 to 12.9% respectively [1,2,3].

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Developed and developing countries across the globe has shown nutritional disorder among children and adolescents especially hypertension, diabetics and CVD [4,5,6,7,8,9,10,11]. Studies reveal that overweight children have a greater chance of becoming overweight adolescents and obese adults compared to children of normal weight [12,13]. Enhanced obesity in adolescents induces morbidities like hypertension, respiratory diseases, diabetes mellitus, orthopedic disorders, heart diseases and cardiovascular risks and elevated serum lipid concentrations especially of VLDL and high LDL-C [12,14,15]. There has been studies pertaining to adolescent and teenage obesity and overweight in pockets of areas across India [16,17,18,19,20, 21,22,23,24,25,26,27,28,29,30].

Methodology

A school based cross sectional study was carried out in Raichur involving 200 students. Study subjects were selected by systemic random sampling method. With the help of preselected proforma data regarding our study parameters were collected. Students aged 12 – 19 yrs were categorized into category I (12- 13 yrs), category II (14-15 yrs), category III (16-17yrs) and category IV (18-19 yrs) for data analysis purpose. There was a 100% response from the subjects of selected group I and IV. The study was undertaken in the month of July and August 2014. After getting detailed information and consent from the subject and their guardian blood sample of the students was collected and sent to biochemistry department for analysis of lipid profile.

Statistical analysis

Total sample (n = 200) was divided into 4 age groups: group I (12-13 yrs, n = 50), group II (14-15 yrs, n = 50), group III (16-17 yrs, n = 50) and group IV (18-19yrs, n = 50). Statistical analysis was done by using SPSS 19.0 version. Data are presented as mean, standard deviation and percentages. Pearson Chi-Square test was applied to find out association between two variables. P-value <0.05 was significant and <0.001 was considered statistically highly significant. Since the outcomes within a cluster are likely to be correlated, the data were analyzed as a cluster sample to obtain correct estimates of standard deviation and standard error. Mean difference between variables (quantitative) was compared by using unpaired 't' test and one way ANOVA.

Results

Out of 200 subjects, 24% each were from 12 to 13 and 14 to 15 years age group and 26% each from 16 to 17 and 18 to 19 years age group. Of the 200 respondents 56% were males and 44% were females. Majority (31.8%) of females were from 16-17 yrs age group whereas 35.8% of females were from 18-19 yrs age group. Association between age group and sex was found statistically significant ($p < 0.05$). Distribution of study population according to BMI where 78% were normal, 12% were overweight and 10% were obese. Majority of study population (72.2%) of females and 82.1% of males were having normal BMI. Prevalence of obesity amongst females was 18.2% & amongst males was 3.6%. Association between BMI and sex was found to be statistically significant ($p < 0.05$).

Out of 20, 40% of obese were from 14-15 yrs age group and out of 24 overweight, 33.3% each were from 12-13 & 16-17 yrs age group. Association between BMI and age was found to be statistically not significant ($p > 0.05$). Distribution according to SBP & sex reveals that 92.1% of females and 83.9% of males having SBP between 120 – 130mmHg. Association between SBP & sex was not statistically significant ($p < 0.05$). Prevalence of hypertension was observed in 6% population where almost 11.5 % were from 18-19 yrs of age group. Prevalence of diastolic hypertension was 2.5% and seen in males (3.6%). Diastolic hypertension seen in 2.5% and majority i.e. 3.8% were from 18-19 yrs age group.

High level of triglycerides was observed in 2% of subjects which belongs from 18-19 yrs age.

Majority of subjects 32.5% having HDL within range of 31-40. Association between HDL and age was found to be highly significant ($p < 0.001$) More than half i.e. 57.5% having LDL between 51-100 mg/dl. 41.5% subjects have their LDL between 101-150 mg/dl, of which majority (63.5%) were from 18-19 years of age group Association between LDL and age was not found to be statistically significant ($p > 0.05$). Only 1.5% subjects were having high cholesterol (>200 mg/dl) of which 4.2 % were from 12-13 yrs age group. Association between level of cholesterol and age was not statistically significant ($p > 0.05$). Mean BMI value (23.5) were observed to be at higher side in 18-19 yrs age as compare with other age group. Comparison of mean difference between various age group was found statistically highly significant ($p < 0.001$). Mean SBP was found higher i.e. 133.85 in 18-19 yrs age.

Comparison of SBP mean difference between various age group was found statistically not significant ($p>0.05$). Mean HDL was higher in 12-13 yrs age as compared to other age group which proved to be statistically highly significant (<0.001). Comparison of mean difference in LDL level at different age group was not proved to be significant (>0.05). The difference in

mean cholesterol level in various age group was seen to be not significant statistically (>0.05). Comparison between male and female with respect to various study parameters revealed that mean age & mean LDL difference was observed statistically significant (<0.05) whereas in other variables the mean difference was not proved to be significant (>0.05).

Table 1: Distribution of study population according to BMI & sex

BMI Grades	Sex				Total
	Female	%	Male	%	
Normal	64	72.7	92	82.1	156
Obese	16	18.2	4	3.6	20
Overweight	8	9.1	16	14.3	24
Total	88	100.0	112	100.0	200

Pearson Chi-Square=12.18, df=2
P=0.002 (<0.05) Significant

Table 2: Distribution of study population according to BMI & age

Age group (years)	BMI Grades			Total
	Normal	Obese	Overweight	
12 to 13	36(23.1%)	4(20%)	8(33.3%)	48
14 to 15	36(23.1%)	8(40%)	4(16.7%)	48
16 to 17	40(25.6%)	4(20%)	8(33.3%)	52
18 to 19	44(28.2%)	4(20%)	4(16.7%)	52
Total	156(100%)	20(100%)	24(100%)	200

Pearson Chi-Square=5.94, df=6
P=0.43 (>0.05) Not significant

Majority of study population (72.2%) of females and 82.1% of males were having normal BMI. Prevalence of obesity amongst females was 18.2% & amongst males was 3.6%.

Association between BMI and sex was found to be statistically significant ($p<0.05$)

Out of 20, 40% of obese were from 14-15 yrs age group and out of 24 overweight, 33.3% each were from 12-13 & 16-17 yrs age group.

Association between BMI and age was found to be statistically not significant ($p>0.05$)

Table 3: Distribution of study population according to different variables

	N	Descriptive Statistics				Mean	Std. Deviation
		Range	Minimum	Maximum	Statistic		
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Age	200	7	12	19	15.5	0.1	2.2
Height (cm)	200	31.6	145.0	176.6	161.8	0.5	7.4
Weight (kg)	200	50.0	38.0	88.0	58.6	0.8	11.6
BMI	200	14.3	17.7	32.0	22.1	0.2	3.6
SBP	200	32	120	152	132.0	0.4	6.9
DBP	200	18	80	98	85.8	0.2	3.8
TG	200	141	77	218	142.9	2.6	37.3
HDL	200	34	18	52	34.6	0.7	10.0
LDL	200	84	66	150	94.3	1.3	19.7
Cholesterol	200	118	122	240	167.2	2.0	29.1

Table 4: Distribution according to SBP & sex

SBP	Sex				Total
	Females	%	Males	%	
120-130	81	92.1	94	83.9	175
130-140	5	5.7	8	7.2	13
140-150	0	0	10	8.9	10
>150	2	2.2	0	0	2
Total	88	100	112	100	200

Pearson Chi-Square=3.4, df=3 P=0.43 (>0.05) Not significant

Distribution according to SBP & sex reveals that 92.1% of females and 83.9% of males having SBP between 120 – 130mmHg

Association between SBP & sex was not statistically significant ($p<0.05$)

Table 5: Age wise distribution of SBP

SBP	Age				Total
	12-13	14-15	16-17	18-19	
120 - 130	44(91.7%)	41(85.4%)	48(92.3%)	42(80.8%)	175(87.5%)
130 - 140	4(8.3%)	5(10.4%)	1(1.9%)	3(5.8%)	13(6.5%)
140 - 150	0(0%)	2(4.2%)	2(3.9%)	6(11.5%)	10(5%)
>150	0(0%)	0(0%)	1(1.9%)	1(1.9%)	2(1%)
Total	48(100%)	48(100%)	52(100%)	52(100%)	200(100%)

Prevalence of hypertension was observed in 6% population where almost 11.5 % were from 18-19 years age group.

Table 6: Distribution of DBP according to Age

DBP	Age				Total
	12-13	14-15	16-17	18-19	
80-84	33(68.75%)	19(39.6%)	39(75%)	21(40.5%)	112(56%)
84-88	15(31.25%)	29(60.4%)	11(21.2%)	28(53.8%)	83(41.5%)
88-92	0(0%)	0(0%)	1(1.9%)	1(1.9%)	2(1%)
>92	0(0%)	0(0%)	1(1.9%)	2(3.8%)	3(1.5%)
Total	48(100%)	48(100%)	52(100%)	52(100%)	200(100%)

Diastolic hypertension seen in 2.5% and majority i.e. 3.8% were from 18-19 yrs age group.

Table 7: Distribution of TG according to Age

TG	Age				Total
	12-13	14-15	16-17	18-19	
<100	5(10.4%)	5(10.4%)	16(30.8%)	8(15.4%)	34(17%)
101-150	28(58.3)	19(39.6%)	20(38.4%)	24(46.1%)	91(45.5%)
151-200	15(31.3%)	24(50%)	16(30.8%)	16(30.8%)	71(35.5%)
>200	0(0%)	0(0%)	0(0%)	4(7.7%)	4(2%)
Total	48(100%)	48(100%)	52(100%)	52(100%)	200(100%)

High level of triglycerides was observed in 2% of subjects which belongs from 18-19 yrs age.

Table 8: Distribution of HDL according to Age

HDL	Age				Total
	12-13	14-15	16-17	18-19	
<20	0(0%)	0(0%)	8(15.4%)	4(7.7%)	12(6%)
21 - 30	12(25%)	12(25%)	16(30.8%)	19(36.5%)	59(29.5%)
31 - 40	0(0%)	24(50%)	28(53.8%)	13(25%)	65(32.5%)
41 - 50	36(75%)	8(16.7%)	0(0%)	16(30.8%)	60(30%)
>50	0(0%)	4(8.3%)	0(0%)	0(0%)	4(2%)
Total	48(100%)	48(100%)	52(100%)	52(100%)	200(100%)

Pearson Chi-Square=54.7, df=12 P=0.0001 (<0.001) Highly significant

Majority of subjects 32.5% having HDL within range of 31-40.

Association between HDL and age was found to be highly significant (p<0.001)

Table 9. Distribution of LDL according to Age

LDL	Age				Total
	12-13	14-15	16-17	18-19	
<50	0(0%)	0(0%)	2(3.8%)	0(0%)	2(1%)
51-100	32(66.7%)	29(60.4%)	35(67.4%)	19(36.5%)	115(57.5%)
101-150	16(33.3%)	19(39.6%)	15(28.8%)	33(63.5%)	83(41.5%)
Total	48(100%)	48(100%)	52(100%)	52(100%)	200(100%)

Pearson Chi-Square=38.3, df=12

P=0.078 (>0.05) Not Significant

More than half i.e., 57.5% having LDL between 51-100 mg/dl. 41.5% subjects have their LDL between 101-150 mg/dl, of which majority (63.5%) were from

18-19 years of age group Association between LDL and age was not found to be statistically significant ($p > 0.05$)

Table 10: Distribution of Cholesterol according to Age

Cholesterol	Age				Total
	12-13	14-15	16-17	18-19	
<100	1(2.1%)	0(0%)	5(9.6%)	2(3.8%)	8(4%)
101-150	15(31.2%)	15(31.2%)	19(36.6%)	23(44.3%)	72(36%)
151-200	30(62.5%)	32(66.7%)	28(53.8%)	27(51.9%)	117(58.5%)
>200	2(4.2%)	1(2.1%)	0(0%)	0(0%)	3(1.5%)
Total	48(100%)	48(100%)	52(100%)	52(100%)	200(100%)

Pearson Chi-Square=11.6, df=12
P=0.77 (>0.05) Not Significant

Only 1.5% subjects were having high cholesterol (>200 mg/dl) of which 4.2% were from 12-13 yrs age group.

Association between level of cholesterol and age was not statistically significant ($p > 0.05$)

Table 11: Comparison between male and female subjects with reference to various parameters

Variables	SEX	N	Mean	Std. Deviation	t	P	Inference
Age	Male	112	15.96	2.42	2.724	0.007	Significant
	Female	88	15.09	2.00		<0.05	
BMI	Male	112	21.91	3.11	-0.944	0.346	Not significant
	Female	88	22.40	4.21		>0.05	
SBP	Male	112	132.93	6.54	1.973	0.053	Not significant
	Female	88	131.00	7.24		>0.05	
DBP	Male	112	86.00	3.79	.819	0.414	Not significant
	Female	88	85.55	4.02		>0.05	
TG	Male	112	124.61	33.80	-2.433	0.060	Not significant
	Female	88	136.36	27.18		>0.05	
HDL	Male	112	34.29	9.72	-0.500	0.618	Not significant
	Female	88	35.00	10.39		>0.05	
LDL	Male	112	87.86	14.88	-5.623	0.007	Significant
	Female	88	102.59	22.07		<0.05	
Cholesterol	Male	112	155.79	23.69	-1.007	0.18	Not significant
	Female	88	161.86	28.92		>0.05	

Comparison between male and female with respect to various study parameters revealed that mean age & mean LDL difference was observed statistically

significant (<0.05) whereas in other variables the mean difference was not proved to be significant (>0.05)

Fig. 1:

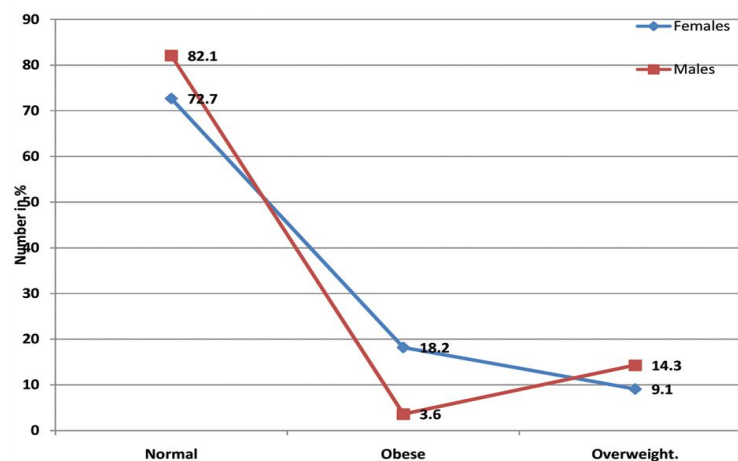
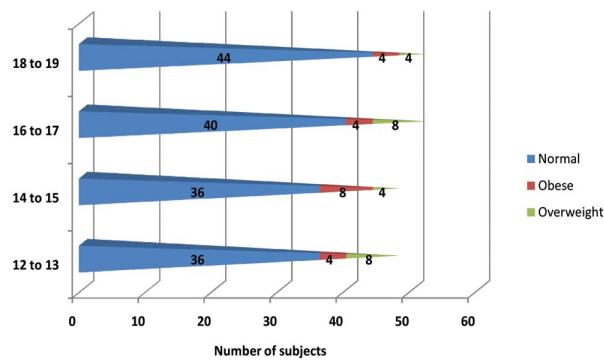


Fig. 2:



Discussion

More and more kids are at risk as per the medical research, that high levels of cholesterol are a major factor contributing to heart disease and stroke. Adolescent cholesterol levels especially with a family history of high cholesterol leads to premature heart diseases; however, problems associated with high cholesterol generally don't show up for years so making the between teenager's health and cholesterol can be difficult. Published literature on the prevalence of childhood obesity in India consists mainly of cross-sectional studies in different regions of the country, reporting its burden at a specified time. Studies from South India have reported an obesity prevalence of 3.6% in adolescents of age-group 13–18 years of Chennai in year 2002^[1] and 3.4% in children and adolescents of age-group 5–16 years of Mysore in year 2009. Several cross-sectional studies have been published from North India reporting the childhood obesity prevalence in the range of 3.6–7.0%^[45,46,42]. However, only one study, from Kerala (South India), has reported secular trend in the prevalence of childhood obesity^[47]. These authors reported a significant increase in the prevalence of overweight and obesity from 4.94% and 1.26% in 2003 to 6.57% and 1.89% in 2005, respectively, in children aged 5–16 years. The increasing trend was noted in both sexes and privately-funded schools only. However, the investigators used CDC-defined cut-offs for determining the overweight and obesity prevalence. As the reference population for CDC cut-offs did not include Asian Indians, these cut-offs may not accurately represent the burden of childhood obesity in India. On the other hand, we used ethnic-specific cut-offs for our study population, which have been previously reported in adult Asian Indian populations also^[19,48,49].

The BMI classification has four categories: (1) under-nutrition (2) normal (3) overweight and (4) obese. The levels of obesity and overweight varied

across the socio economic status. India is facing a twin epidemic (19) in the form of under- and over-nutrition in children and adolescents. The prevalence of obesity was more than 5 per cent and overweight more than 7 per cent among those belonging to upper socio economic class. The study cannot be taken as representative of the entire district; however, a number above 10% (of obese people) is very high so 16.3% of obese adolescents in an area is high (and therefore a matter of concern). 7% of those who were overweight belonged to the higher socio-economic class. Works of^[50,51,52,19] say, increasing prevalence of obesity and insulin resistance has been the tendency in Asian Indians. The twin epidemic of Indians either due to over-nutrition and/or under-nutrition; the former predisposed to insulin resistance type 2 diabetes mellitus (T2DM) and the latter a host of deficiency disorders both category end up with metabolic syndromes. According to^[19], high total fat and SFA (saturated fatty acids) intake and a low intake of MUFAs (monounsaturated fatty acids) and 3PUFAs showed imbalanced nutrition, which could be responsible for the increasing prevalence of obesity and insulin resistance in Indian adolescents and young adults.

The overall prevalence of overweight and obese adolescents among the age group was found to be 12% and 10% respectively. A study in Hyderabad showed that the prevalence of overweight was 7.2% among the 12-17 yrs age group (Laxmaiah et al., 2007)³¹ and 9.9% among the urban group of South Karnataka and Ludhiana (Aggarwal et al., 2008; Kotian et al., 2010)³². Studies by other workers in India (Ramachandran et al., 2002; Chatterjee, 2002³³; Kaur et al., 2005³⁴ and Khadiilkar and Khadiilkar, 2004³⁵) and National nutrition Monitoring Bureau surveys in 2002, rural areas, reported the prevalence of as little as 0.6%.

Our study value is nearer to the urban value indicating that the demographic profile of Raichur is marching from peri-urban sector to urban segments. Out of 20, 40% of obese were from 14-15 yrs age group and out of 24 overweight, 33.3% each were from 12-13 & 16-17 yrs age group. Association between BMI and age was found to be statistically not significant ($p > 0.05$). Overweight and obesity were marginally higher in the pubertal age groups of 13 – 16yrs, perhaps because of increased adipose tissue and overall body weight in respondents during puberty. Gender is one of the biological factors affecting the weight status. In our study the prevalence of obesity amongst females was 18.2% and amongst males was 3.6%. From the literature it is observed that the prevalence of overweight is generally higher in females than males (Gopinath et

al., 1994⁴⁰, Gopalan 1998⁴¹, Mohan et al., 2001⁴², Misra et al., 2001⁴³, Ramachandran et al., 2002, Reddy et al., 2012, Shukla et al., 2002⁴⁴,) Findings of studies conducted in India by National Family Health Survey III (2005-06) have revealed a much higher percentage for obesity/overweight in females than males.

Prevalence of hypertension was observed in 6% population where almost 11.5 % were from 18-19 yrs of age group. Prevalence of diastolic hypertension was 2.5% and seen in males (3.6%). Diastolic hypertension seen in 2.5% and majority i.e. 3.8% were from 18-19 yrs age group. Works by others reveal the value of Gupta and Gupta (1996)³⁶ 44%, Dholpuria et al.,(2007)³⁷50% and Gulati and Saxena (2002)³⁸74%.

Cholesterol adverseness is based on its categorical variations as HDL Cholesterol, LDL Cholesterol, Triglycerides, and Direct LDL Cholesterol. Our study revealed 32.5% of the respondents having HDL within range of 31-40. High level of triglycerides was observed in 2% of subjects which belongs from 18-19 yrs age. Only 1.5% subjects were having high cholesterol (>200 mg/dl) of which 4.2 % were from 12-13 yrs age group. Mean BMI value (23.5) were observed to be at higher side in 18-19 yrs age and mean SBP 133.85 higher in the same age group. Thus dyslipidemia appears to be in the group of less than 14-15yrs resembling serum lipid and lipoprotein changes induced by puberty and similar studies has been done by the STRIP study^[39]. Such studies have been important to use as a marker of future cardiovascular disease risks.

Our study revealed the prevalence of pre-hypertension and hypertension in the study population at 6%, wherein, 11.5% were from 18-19 yrs of age group. And prevalence of diastolic hypertension was 2.5% and the majority i.e., 3.8% was from 18-19 yrs age group. The present study showed elevated systolic and diastolic blood pressure in both obesity and overweight. Higher serum total cholesterol, triglycerides and LDL-cholesterol levels in both obesity and overweight. Lipid profile is used as part of a cardiac risk assessment to help determine an individual's risk of heart disease and to help make decisions about what treatment may be best if there is borderline or high risk. The results of the lipid profile are considered along with other known risk factors of heart disease to develop a plan of treatment and follow-up.

Conclusion

With this study we would like to place a take home message that the over weight and obesity is highly

prevalent among adolescents. Among the over weight and obese its found that in few dyslipidemia and hypertension has already set in. hence we would suggest the late adolescents is the best time identify the adolescents with obesity and other risk factors and to adopt necessary life style modifications.

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