

**Study of lipid profile in overweight and obese children****Priti Reddy<sup>1</sup>, Rashmi Vishwakarma<sup>1\*</sup>, K.Satyanarayana<sup>2</sup>**<sup>1</sup>*Resident, Professor and Head, Department of Pediatrics, Kamineni Hospital, LB Nagar, Hyderabad, Telangana 500068, India*<sup>2</sup>*Professor and Head, Department of Pediatrics, Kamineni Hospital, LB Nagar, Hyderabad, Telangana 500068, India***Received: 30-06-2020 / Revised: 30-08-2020 / Accepted: 06-09-2020****Abstract**

**Objective** To study lipid profile in overweight and obese children of age group 5-15 year and to find the correlation between lipid profile with obesity and overweight in children. **Methods** It was a hospital based prospective observational study in which 58 overweight and obese children were taken and studied and association of their dyslipidemia was studied with socioeconomic status, breast feeding, lifestyle, family history and their habit of junk food. **Results** Triglycerides were significantly higher in obese children (52.65%), when compared to overweight children (23.07%). Percentage of dyslipidemia was higher in high socioeconomic class, not exclusively breast fed children, children who had a positive family history of cardiovascular diseases, in children with sedentary lifestyle and in children who consumed junk food. In the present study, percentage of dyslipidemia was significantly higher in children with waist to height ratio >0.5 which was 62.5%, as compared to <0.5 which was 30.7%, statistically significant with a p value 0.009 (<0.05). **Conclusion** The combination of elevated total cholesterol, triglycerides, and LDL-C, and decreased HDL-C, with waist circumference above the 90th percentile in overweight and obese children, places them at greater risk for cardiovascular disease.

**Keywords:** Dyslipidemia, Triglycerides, overweight children, socioeconomic, cardiovascular diseases, junk food.

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**Introduction**

Childhood obesity is a public health problem worldwide. Epidemiological and clinical investigations have revealed that the association between obesity and cardiovascular risk factors begins early in life. Several cross-sectional studies have shown associations between measurements of childhood adiposity, most commonly body mass index, and cardiovascular risk. Abdominal obesity as measured by waist circumference is associated with a significant risk of incident cardiovascular events in children. The pathogenesis of arteriosclerosis, which begins in

childhood, is related to total cholesterol levels, with increased low-density lipoprotein cholesterol (LDL-C) and decreased high-density lipoprotein cholesterol (HDL-C) levels being independent risk factors for cardiovascular disease. Childhood obesity has been associated with an abnormal lipid profile similar to that observed in adults, which could contribute to further cardiovascular risk. Identifying and controlling childhood obesity is an important goal in the prevention of cardiovascular disease in adulthood [1]. Childhood obesity is a silent epidemic shaping up in India. The diagnosis of obesity is primarily based on body mass index (BMI), defined as weight in kilograms divided by height in square meters. Normal range for BMI in children varies with age and sex. The Center for Disease Control has published tables for determining obesity in children. For children and adolescents (age 2–19 y), the BMI value is plotted on the CDC growth charts to determine the corresponding

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BMI-for-age percentile. Overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile. Obesity is defined as a BMI at or above the 95th percentile. Childhood obesity can lead to life-threatening conditions like Type 2 diabetes mellitus, hypertension, dyslipidemia, obstructive sleep apnea, cancer, liver diseases, early puberty, psychiatric disorders, asthma and other respiratory problems [2]. Lipid abnormalities in children play an important role in the development of CHD in adult life. CHD is a major 2 cause of morbidity and mortality in developing and developed countries. The follow up studies have documented that obese children tend to become obese adults. Studies from developed countries have demonstrated that obesity is associated with unfavorable lipid profile. There is limited data from India on association of dyslipidemia with the obesity in school age children[3]. The early detection of dyslipidemia in obese children and adolescents may help to delay or prevent chronic complications. In this regard the aim of the present study was to evaluate the frequency and patterns of dyslipidemia in obese children and adolescents and to determine the extent of blood lipid abnormality in overweight and obese children.

**Source of data:** Obese and overweight children visiting paediatric opd Kamineni Hospitals, L.B.Nagar, Hyderabad

**Inclusion criteria:** 1.Children aged between 5 to 15 years with BMI >85th centile- overweight children BMI >95TH centile- obese children 2.Healthy children, not suffering from diabetes, hypertension, heart disease.

**Exclusion criteria:** 1.Age 15 years. 3.Children with genetic syndromes associated with obesity. 4.Overweight and obese children with any endocrine, renal, liver, heart diseases and those who are undergoing clinical nutritional care. 5.Children with acute illness, if they had undergone recent surgery or hospitalization [4-6].

**Design of study:** Hospital based prospective observational study

**Sample size:** 58 overweight and obese children reporting to pediatric department, period fulfilling the inclusion criteria during the study period

**Duration of study period:** MAY 2013-MAY 2015

## Methodology

The study approval was taken from the Research and

**Table 1: Prevalance of dyslipidemia overweight and obese**

Ethics committee. Written and informed consent was taken from the parents of the study group. Detailed and specific information about the risks and benefits of the study were explained. All the children in the group were assessed based on a predesigned proforma. The age group included was 5-15 years. Data on age, gender, birth weight, and feeding in the first 6 months (regarding exclusive breastfeeding) were obtained from the history from parents. Cardiovascular disease, type 2 diabetes, obesity and hypertension in the family (first and second degree relatives) were also recorded from the specifically asked questions in the patient reports. Height and weight were measured. Height was measured to the nearest 0.5 cm on a standard height board, and weight was determined to the nearest 0.1 kg on a standard physician's beam scale with the subject dressed only in light underwear and no shoes. BMI was calculated as weight in kilograms divided by height in meters squared. All measuring devices were weekly calibrated. Weight SDS, height SDS, BMI, and BMISDS were calculated for all patients[7-10]

BMI >85<sup>TH</sup> centile: overweight children.

BMI >95<sup>th</sup> centile :obese children.

Waist circumference was measured at the level of the umbilicus with the patient standing and breathing normally. Nutritional status was assessed by 24 hour dietary recall method for 2 days. Dietary information (non veg, kind of fats, oil used as cooking medium, use of extra salt on curds/salads/fruits/vegetables) was noted and data collected was translated into nutritional intake as per the standard information: Nutritional value of Indian food and fats, fatty acid contents of cereals and pulses. More than thrice a week intake of oily/junk foods will be taken as excess oil or junk food intake. The physical activity of the children was assessed and documented by taking history. Children should accumulate 60 minutes of physical activity each day and teens should do at least 20 minutes of vigorous activity 3 days a week and 30 minutes of moderate activity 5 days a week, otherwise were considered as having a sedentary life as per National Association for sports and physical education. In these children BMI will be documented. The percentile charts based on gender, age and height provided by IAP are used for classification. All the children should undergo an evaluation of complete lipid profile using, after 12 hours of fasting[11-14].

Sex	Dyslipidemia	Normolipidemia
Males(n=39)	20(51.28%)	19(48.72%)
Females(n=19)	8(42.10%)	11(58.92%)
Total(n=58)	28	30

Out of the total 58 children studied, 28 children(48.27%) had dyslipidemia, 30 children (51.73%) had normal lipid profile. Dyslipidemia was higher in males(51.28%) as compared to females (42.1%), which is not significant statistically with p value 0.2(>0.05).

**Table 2:Prevalance of the parameters of lipid profile**

Lipid profile parameters	Percentage
Elevated total Cholesterol	27.58%
Low HDL	22.41%
Elevated LDL	20.68%
Elevated triglycerides	32.75% (most frequent)

In the present study ,prevalence of low HDL was almost the same in overweight (23.07%), obese(21.05%) children which is statistically not significant with p value 0.44(>0.05) High LDL levels were seen more in obese children (26.31%) when compared to overweight children(17.94%), statistically not significant with p value 0.2(>0.05) Triglycerides were significantly higher in obese children (52.65%), when compared to overweight children(23.07%), which is statistically significant with a p value 0.01(<0.05)

**Table 3 : Association of dyslipidemia with exclusive breast feeding**

Breast feeding(b/f)	Dyslipidemia	Normolipidemia
Exclusive b/f(n=27)	44.44%(n=12)	55.55%(n=15)
No exclusive b/f(n=31)	51.61%(n=16)	48.38%(n=15)
Total (n=58)	N=28	N=30

In the present study, percentage of dyslipidemia in not exclusively breast fed children was 51.61% slightly higher than percentage of dyslipidemia in exclusively breast fed children which was 44.44%, statistically not significant with a p value 0.2(>0.05).

**Table 4:Association of dyslipidemia with socioeconomic status**

Socioeconomic status	Dyslipidemia	Normolipidemia
High n=47)	51.06%(n=24)	48.93%(n=23)
Low (n=11)	36.36%(n=4)	63.63%(n=7)
Total(n=58)	N=28	N=30

In the present study population, percentage of dyslipidemia was higher in high socioeconomic class which was 51.06%, as compared to low socioeconomic class which was 36.36%, statistically **not significant** with a p value 0.2(>0.05)

**Table 5: Association of family history of cardiovascular diseases and dyslipidemia**

Family history of CVD	Dyslipidemia	Normolipidemia
Positive f/h(n=26)	73.07%(n=19)	26.92%(n=7)
Negative f/h(n=32)	28.12%(n=9)	71.87%(n=23)
Total (n=58)	N=28	N=30

In the present study, percentage of dyslipidemia was significantly higher in children who had a positive family history of cardiovascular diseases which was 73.07%, as compared to negative family history which was 28.12%, statistically significant with a p value 0.0004(<0.05).

**Table 6: Association of dyslipidemia with lifestyle**

Life style	Dyslipidemia	Normolipidemia
Healthy lifestyle(n=25)	44%(n=11)	56%(n=14)
Sedentary Lifestyle(n=33)	51.51%(n=17)	48.48%(n=16)
Total=58	N=28	N=30

In the present study, percentage of dyslipidemia was more in children with sedentary lifestyle which was 51.51%, as compared to healthy lifestyle which was 44%, although statistically not significant with a p value 0.2(>0.05).

**Table 7 : Association of dyslipidemia with food habits**

Food habits	Dyslipidemia	Normolipidemia
Normal(n=24)	41.66%(n=10)	58.33%(n=14)
Junk food(n=34)	52.94%(n=18)	47.05%(n=16)
N=58	N=28	N=30

In the present study, percentage of dyslipidemia was more in children who consumed junk food which was 52.94%, as compared to those who consumed normal food which was 41.66%, although statistically not significant with a p value 0.2(>0.05)

**Table 8 : Association with waist to height ratio**

Waist to height ratio	Dyslipidemia	Normolipidemia
>0.5(n=32)	62.5%(n=20)	37.5%(n=12)
<0.5(n=26)	30.7%(n=8)	69.2%(n=18)
Total=58	N=28	N=30

In the present study ,percentage of dyslipidemia was significantly higher in children with waist to height ratio >0.5 which was 62.5%, as compared to <0.5 which was 30.7%, statistically significant with a p value 0.009(<0.05).

## Results

Dyslipidemia was higher in males(51.28%) as compared to females (42.1%), which is not significant statistically with p value 0.2(>0.05). In the study population of overweight and obese children(n=58), The most frequent dyslipidemia was elevated triglycerides (32.75%), next in order elevated total

cholesterol(27.58%), low HDL(22.41%), elevated LDL (20.68%). In the present study, total cholesterol was significantly higher in obese children(57.89%), when compared to overweight children(12.82%), with a pvalue 0.0003(<0.05).statistically significant.

In the present study, out of 39 overweight children and 19 obese children, prevalence of low HDL was almost the same in overweight (23.07%), obese(21.05%) children which is statistically not significant with p value 0.44(>0.05) High LDL levels were seen more in obese children (26.31%) when compared to overweight children(17.94%), statistically not significant with p value 0.2(>0.05).

Percentage of dyslipidemia was higher in high socioeconomic class, not exclusively breast fed children, children who had a positive family history of cardiovascular diseases, in children with sedentary lifestyle and in children who consumed junk food. In the present study, percentage of dyslipidemia was significantly higher in children with waist to height ratio >0.5 which was 62.5%, as compared to <0.5 which was 30.7%, statistically significant with a p value 0.009(<0.05).

**Statistical analysis:** Continuous data was entered in excel sheet and analyzed using SSPS windows version. Continuous data was computed as mean and standard deviation(SD). Chi-square test was used to find association between dyslipidemia and other variables. Significance level was set at 0.05).

## Discussion

The purpose of this study was 2-fold. The first objective was to study lipid profile in overweight and obese children of age group 5-15 years and the second objective was to find the correlation between lipid profile with obesity and overweight in children.

Over the last three decades, pediatric obesity has become a global epidemic. Worldwide estimates of childhood overweight and obesity are as high as 43 million, and rising. In the United States, approximately 17 % of children aged 2-19 y are obese. According to the Centers for Disease Control (CDC), the rate of obesity among US children ages 6 to 11 y tripled from 1980 to 2008 (6.5 % to 19.6%). Likewise, there is a significant rise in the prevalence of obesity in developing countries (6.8 % in India) associated with rapid urbanization resulting in a reduction in energy expenditure and an increased intake of energy-dense foods. The prevalence of high total cholesterol and triglycerides in United States pediatric population was similar to the current study. Children with high triglycerides levels had higher body weight. This result can be explained because adiposity is strongly related to higher triglycerides levels in children and adults. This relationship is weaker between adiposity and LDL-Cholesterol[15-17].

I'Allemand et al. 2008 showed higher percentage of high HDL-Cholesterol and triglycerides levels in obese than eutrophic children, but no difference for LDL-C and total cholesterol. Beyond evaluation overweight/obese through BMI, the body fat percentage is also related to blood lipid profile. A variety of expert committees, including the IOM and the White House Task Force on Childhood Obesity, have emphasized the importance of early childhood as a unique opportunity for prevention of childhood obesity.

In another study, Vinciguerra F et al. recently showed a prevalence of low HDL-C >80% in a population of obese American children. Another important aspect in this study is that cut off points for diagnosing dyslipidemia have been adjusted by percentiles according with age, in contrast to some studies that take fixed cut-off points for all ages, which can contribute to some individuals with dyslipidemia being reported with normal lipid levels.

Because health risk increases with degree of obesity, it is crucial that one identify and counsel adolescents who may be eligible for more aggressive obesity treatment. Hence the present study was done to identify the early cardiovascular risk factors like dyslipidemia in overweight and obese children and to help these children modify their lifestyle which is the earliest and best approach to pediatric obesity.

In our study, prevalence of dyslipidemia was 48.27% near comparable to study done by Casavalle et al (50.4%), low in study done by Rinaldi et al(28%), Shashaj et al (25.1%), and very high in study done by Ruy David Arjona-Villicana et al (83.73%). This difference is due to variable number of children in different studies. Primary (genetic) causes and secondary (lifestyle and other) causes contribute to dyslipidemias in varying degrees. In familial combined hyperlipidemia, expression may occur only in the presence of significant secondary causes. Primary causes are single or multiple gene mutations that result in either overproduction or defective clearance of TG and LDL cholesterol, or in under production or excessive clearance of HDL[18-20]. The most important secondary cause in developed countries is a sedentary lifestyle with excessive dietary intake of saturated fat, cholesterol, and trans fats. The development of atherosclerosis often starts at an early age in children, and its progress is directly related to the individual's plasma lipid and lipoprotein levels. Thus early detection and rapid interventions for dyslipidemia may protect children and adolescents at increased and premature cardiovascular risk. Furthermore defining the thresholds for the

diagnosis of dyslipidemia during childhood facilitates the screening of children at high risk of cardiovascular disease. In the present study, prevalence of high total cholesterol was 27.58%, which was similar to a study conducted by Doha Taha et al (20.5%), Rinaldi et al (12%), Casavalle et al (11.5%). This discrepancy may be due to different diet, race, life style, environment, economic development in different areas of world. In the present study, prevalence of Low HDL was 22.41%, similar to a study conducted by Casavalle et al (29.4%), Doris Taha et al 15.5%, Tapia Ceballos et al 15%, Gujjaro et al 10.8%, Rinaldi et al 8.8%, very high prevalence of low HDL in study conducted by Ruy David Arjona -Villicana et al which was 61.59%, and also in study conducted by Martha L CRUZ et al which was 67%.

The second component of the lipid abnormality was related to decreased levels of HDL-C. Hepatic triglyceride lipase catabolizes the TGs, resulting in a reduction in HDL particle size and an increase in HDL-C clearance, which leads to a decrease in HDL-C levels. Many epidemiologic studies have demonstrated that low HDL-C levels are an independent risk factor for cardiovascular disease. HDL-C, which acts as protective factor against heart disease, showed borderline values in our study children. In the present study, prevalence of children with high LDL, was 20.68%, which was near similar to study conducted by Doris Taha et al which was 15.4%, 10.7% in a study conducted by Casavalle et al, 8.8 % in a study conducted by Rinaldi et al, 8.3% in a study conducted by Ruy David Arjona -Villicana et al. In the present study a higher BMI category was associated with higher LDL-C regardless of age or sex which was consistent with other studies therefore, to reduce to reduce the presence of CHD risk factors its important to prevent the children from becoming over weight. Intervention and education programs aimed at reducing over weight among school children might help improve LDL-C levels. In the present study, prevalence of high triglycerides was 32.75%, which was near comparable to study conducted by Casavalle et al which was 31.4%, 26% in a study conducted by Martha L CRUZ et al, 25.6% in a study conducted by Doris Taha et al, 15.94% in a study conducted by Gujjaro et al, 16.5 % in a study conducted by Tapia Ceballos et al, 10% in a study conducted by Rinaldi et al, very high percentage of elevated triglycerides in a study conducted by Ruy David Arjona-Villicana et al. In the present study, prevalence of dyslipidemia in children with waist to height ratio. (WHtR) >0.5 was 62.5%, when compared to The Bogalusa Heart Study conducted by Jasmeet S Mokha et al which was 21.27%. This indicates that

prevalence of dyslipidemia is more in children with central obesity with WHtR>0.5, as when compared to overweight & obese children with WHtR <0.5. These findings support the pathophysiologic role of intra-abdominal body fat distribution in determining interrelated cardiometabolic risk variables collectively recognized as metabolic syndrome. It is now well recognized that central adiposity acts as a complex and highly active endocrine organ resulting in a variety of hormones and cytokines (tumor necrosis factor- $\alpha$ , interleukin-6 etc.), which in turn can play an important role in the dysregulation of inflammatory, metabolic and hemodynamic processes in the body through various mechanisms including hepatic lipogenesis and hepatic insulin resistance, release of free fatty acids from adipocytes, macrophage infiltration into the adipose tissue, adipose renin-angiotensin-aldosterone system and sympathetic nervous system activation and ectopic lipid storage. In the present study prevalence of dyslipidemia in obese and overweight children who were not exclusively breast fed was 51.61%, which was almost similar to a study conducted by Sangun et al which was 52%. Although the long-term benefits of breast feeding on preventing cardiovascular diseases are well documented, controversies exist as to the association of breast feeding duration with such beneficial effects. In a study conducted by Vajihe Izadi et al 2013 there was no substantial evidence that longer breast feeding duration was protective against CVD risk factors among adolescents. More prospective studies are recommended to clarify this association. In the present study prevalence of dyslipidemia with a positive family history of cardiovascular diseases was 73.07% compared to 52% in a study conducted by Sangun et al. We also found that the prevalence of dyslipidemia is significantly higher in the children who have a family member with diabetes, hypertension, coronary artery disease or hyperlipidemia This can be attributed to the effect of genetic factors, but also may indicate similar environmental conditions, dietary habits, socioeconomic status and sedentary lifestyle. The lipid profile results for children in the current study highlight the risks of dyslipidemia among the over weight and obese children and its consequences for the cardiovascular system. Long-term observations from the Bogalusa Heart Study demonstrate that obesity in childhood is a major driving force for insulin resistance syndrome [21-23]. Recent studies have demonstrated that insulin resistance is implicated in the association between obesity and dyslipidemia, which contributes to an increased risk of cardiovascular disease. In summary, the present study indicates that the

combination of elevated total cholesterol, triglycerides, and LDL-C, and decreased HDL-C, with waist circumference above the 90th percentile in overweight and obese children, would place them at greater risk for cardiovascular disease. These data are consistent with previous studies in different ethnic groups. Further studies are needed in larger sample sizes to investigate if other biomarkers could be used to define obesity and overweight and the implications for early detection of increased cardiovascular risk.

### Conclusion

This study suggests that clustering of cardiovascular risk factors has its origin in childhood and they are strongly associated with obesity and overweight. Changes in the lipid profile at an early age that are unfavourable and related to the cardiovascular risk factors in obese children. In conclusion, the present study suggests that preventive screening must begin during childhood because it may identify young people at risk of developing premature coronary heart disease in future.

### What this study add to existing knowledge

Hyperlipidemia in overweight and obese children is one of the major risk factors for developing coronary heart disease in adulthood, hence a strategy to prevent coronary heart disease must include measures to improve the life style and adapt healthy food habits in children. Sedentary lifestyle, unhealthy food habits like consumption of junk food was positively associated with elevated lipid levels in overweight and obese children. These results reinforce the importance of healthy dietary habits since childhood in order to reduce the risks of cardiovascular diseases in adulthood. The metabolic syndrome in children assumes significant importance in view of current epidemic of childhood obesity. The key to obesity prevention rests with identification of subjects with modifiable risk factors. Hence it is important to screen, diagnose and intervene early. The main emphasis should be on therapeutic life style changes incorporating moderate physical activity and dietary modifications. The prevention and management of dyslipidemia and obesity should be instituted early in childhood to prevent early onset coronary heart disease. Community intervention programs have to be initiated to combat obesity and dyslipidemia in children [24,25].

### Limitations

The present study was conducted in a small sample size, hence a larger sample size is required to find a correlation between dyslipidemia and overweight and

obese children. Another limitation of the study was that normal weight individuals were not included so as to be able to discern which of the lipid phenotypes are more subjected to weight and which to genetic aspects inherent to our population.

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