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**Dr. J Anusha Merline,**  
Professor in Physiology,  
Dr. SM CSI Medical College  
& Hospital, Karakonam,  
Thiruvananthapuram, Kerala,  
India

**Dr. S Babu Raj**  
Professor in  
Paediatrics, Department of  
Paediatrics, Dr. SM CSI  
Medical College & Hospital,  
Karakonam,  
Thiruvananthapuram, Kerala,  
India

**Ajitha Jothis ST**  
Associate Professor, CSI  
College of Nursing, Dr. SM CSI  
Medical College & Hospital,  
Karakonam, Thiruvananthapu  
ram, Kerala, India

**Corresponding Author:**  
**Dr. J Anusha Merline,**  
Professor in Physiology,  
Dr. SM CSI Medical College  
& Hospital, Karakonam,  
Thiruvananthapuram, Kerala,  
India

## Alterations in physiological parameters in childhood obesity

**Dr. J Anusha Merline, Dr. S Babu Raj and Ajitha Jothis ST**

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### Abstract

**Background:** The changing lifestyle and the improved economical status have increased the prevalence of obesity among children. Since childhood obesity leads to a forerunner of obesity in adulthood, this study was aimed to assess the changes in the anthropometric and biochemical parameters in childhood obesity.

**Methodology:** A cross sectional study was conducted among the children studying in the public schools which cater to the affluent segment of the population in South India. A total of 75 school children studying in 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> standards in the age group of 9-12 years, who were apparently obese, were selected. The data collection was done after obtaining the informed written consent from the Head-mistress, the parents and assent from the students. The data analysis was done.

**Results:** It was found that the anthropometric measurements, blood pressure and lipid profile was significantly higher in obese children ( $P < 0.001$ ).

**Conclusion:** Thus this study has proved that obesity leads to metabolic derangements and morbidity. Proper screening and health education of children and parents can prevent onset lifestyle diseases and their complications.

**Keywords:** Physiological parameters, childhood obesity, economical status

### Introduction

India, a country with a billion people is in a state of dynamic, economic and health transformation. The fast industrialization results in rapid urbanization and economic growth. Hence, in the modern society, with the improved economic status and changing life style in the urban population, we come across increasing prevalence of obesity especially among children. Childhood obesity has a tracking correlation to the obesity in adulthood. We are aware that obesity either results in or is associated with the diseases like Diabetes Mellitus, Hypertension, Cardio Vascular disorders and psychological setbacks <sup>[1]</sup>. This study is undertaken to find the alterations in the various physiological parameters in obese school children.

### Aim of the study

To assess the changes in the anthropometric and biochemical parameters in childhood obesity.

### Methodology

The cross sectional study was conducted among the children studying in the public schools which cater to the affluent segment of the population in South India after obtaining consent from the school Head-mistress, the parents and assent from the students. A total of 75 school children studying in 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> standards in the age group of 9-12 years, who were apparently obese, were selected.

The standing height and weight were measured in them using stadiometer and standard weighing machine. BMI was calculated in these children and 50 of them were found to be obese (Group I - Boys 26; Girls 24) <sup>[2]</sup>. The other causes of obesity were excluded after obtaining the relevant history (regarding treatment) and gross physical examination. Childhood obesity has been determined after considering the standard for BMI at or above the 85 percentile for age and sex <sup>[3]</sup>.

Thus the two groups – one group (Group I) of 50 obese children and another group (Group II) of 25 control children have been selected for our study.

The circumference of the waist was measured at the level of the umbilicus. The circumference of the hip was measured as the widest part of the gluteal region. [4] Both the measurements were measured using measuring tape in both control and obese children.

The Triceps skin fold thickness was measured using Harpenden's skin fold Calipers following the standard procedure described by Owen GM. This consists of measurement of a double layer of skin and subcutaneous fat on the dorsal aspect of the arm halfway between the tip of the acromion process of the scapula and the olecranon

process of the ulna with the arm hanging by the side of the trunk [5]. A skin fold parallel to the long axis of the arm and including the subcutaneous fat was pulled away from the underlying tissue 1cm above the site at which the calipers were used to determine the thickness to the nearest mm. The reading was taken 2 to 3 seconds after the jaws of the calipers have been exerted. The procedure was repeated three times and the average of the measurements was recorded.

Lipid profile including the Total Cholesterol, Triglycerides, LDL, and HDL has been estimated in the Biochemistry laboratory by enzymatic colorimeter meter method in the fasting state.

## Results

**Table 1:** Comparison of anthropometric measurements of control and obese children

	Age in Years		Height in cm		Weight in Kg		BMI		$P < 0.01$
	Control	Obese	Control	Obese	Control	Obese	Control	Obese	
Mean	11.44	11.18	141.28	147.26	36.4	56.38	18.08	25.94	
$\sigma$	0.5831	1.0039	7.7595	9.2622	6.5256	10.2577	1.6945	2.0201	

**Table 2:** Comparison of Skin fold thickness, Hip Circumference and Waist Circumference of control and obese children.

	SFT in mm		Waist Circumference in cm		Hip Circumference in cm		$P < 0.01$
	Control	Obese	Control	Obese	Control	Obese	
Mean	16.72	27.18	71.87	81.4	81.75	92.9	
$\sigma$	1.41	4.1105	6.4115	7.7563	6.565	7.9195	

On comparison of the anthropometric measurements of obese and control children, we found that

1. The BMI of the obese children is higher than that of control children and the increase is statistically highly significant.
2. The Triceps skin fold thickness of the obese children is higher than that of the control children and the difference is statistically highly significant.
3. The Waist and hip Circumference in cm is found to be more in obese children than those in control group and the difference is statistically highly significant.

**Table 3:** Comparison of blood pressure in control and obese children

	Systolic Pressure in mm of Hg		$P < 0.01$	Diastolic Pressure in mm of Hg		$P < 0.01$
	Control	Obese		Control	Obese	
Mean	97.28	111.76		70.64	75.32	
$\sigma$	8.9234	10.7562		7.3648	7.2689	

Both systolic and diastolic blood pressure in the obese children are found to be increased as compared to those of the control children and found to be statistically highly significant.

**Table 4:** Comparison of fasting lipid profile in control and obese children

	Cholesterol in mg%		LDL in mg%		$P < 0.01$	HDL in mg%		$P < 0.01$
	Control	Obese	Control	Obese		Control	Obese	
Mean	167.32	178.28	87.24	117.7		37.28	24.02	
$\sigma$	15.0491	31.3616	17.7060	35.2781		2.9229	12.2302	

The serum cholesterol level is found to be raised in obese children, when compared to the value found in control group, but not statistically significant.

The HDL cholesterol level is found to be lower in obese children as compared with that of control children and found to be statistically highly significant.

The LDL level in the obese children is higher when compared to the LDL level in control children. This difference is found to be statistically highly significant.

## Statistical analysis

### Student "t" test

Statistical analysis was done using the "t" test. The significance was done drawn at P (probability) of 0.001, 0.01 and 0.05. This means that the results are valid to the extent of 99.9%, 99 %, 95% respectively.

**Table 5:** Anthropometrical Statistical Analysis

	BMI	SFT mm	Waist cm	Hip cm
Obese children X	***	***	***	***
Control children	0.0000107	0.000001	0.000001	0.0000001
Obese boys X	***	***	**	**
Control boys	0.0000003	0.000009	0.0018	0.00157
Obese girls X	***	***	***	***
Control girls	0.00001	0.000135	0.0001	0.00016

\*\*\*  $P < 0.001$  Very high significant

\*\*  $P < 0.01$  Highly significant

**Table 6:** Biochemical Statistical Analysis

	HDL mg%	LDL mg%	Cholesterol mg%
Obese children X Control children	*** 0.000089	*** 0.000041	0.4448
Obese boys X Control boys	*** 0.0002	0.05	0.905
Obese girls X Control girls	*** 0.001	0.2234	0.938

\*\*\*  $P < 0.001$  Very Highly Significant

\*\*  $P < 0.01$  highly significant

## Discussion

The height, weight waist circumference, hip circumference and the triceps skin fold thickness are found to be significantly increased in obese children compared with the control group. The causative factors vary from the genetic constitution to the behavioral pattern alterations among the obese children, 17 of them had the family history of parents suffering from diabetes mellitus either in one (or) both of them. This might contribute for the development of obesity in childhood. This finding coincides with the earlier study done by Bouchard *et al.* (1990) [6]. Compared with control, children in the obese group had statistically significant increase in systolic blood pressure and diastolic blood pressure. This finding is consistent with the previous study done by Moussa-MA *et al.*, on the obese school children of United Arab Emirates in September 1992-1993 [7].

The increase in blood pressure occurs due to the sympathetic nervous activity. The insulin level is increased whenever there is absorption of products of digestion. The psychological factors, when the obese children compare themselves with the peer group cause anxiety, which also can contribute to the catecholamine and glucocorticoid secretion, which in turn might cause an increase in blood pressure.

Regarding the study of lipid profile in obese and control children, the following facts are revealed - (1) The total cholesterol level and LDL level are found to be increased in obese compared to the control children (2) The HDL cholesterol level is found to be significantly lowered in obese children compared to the control children. These findings correlate well with the previous studies done by Patrick Tounian *et al.* in 2001 [8] on obese children in France and Indian population by Dr N. K. Anand *et al.* in 2000 [9].

The obese girls had higher mean total cholesterol levels and LDL levels compared to obese boys. This may be associated with the increase in adipose tissue and overall weight gain during the pubertal growth spurt, as reported by the NHANES data. It has been shown that each risk factor separately increases the risk of Coronary Artery Disease five to ten times when compared with persons having no risk factors. In this study 36 of the 50 obese children gave family history of Hypertension and Diabetes mellitus either in one or both parents. This finding is consistent with the findings of the Montreal Adoption study (1986) which pointed out that there are genetic influences on the level of blood pressures in children [9]. Widgren *et al.*, 1982 have shown that young normotensive humans with a positive family history of hypertension have significantly elevated body weight compared with those with negative family history [10].

## Conclusion

Thus this study has shown substantial evidence that obesity in childhood lays the metabolic groundwork for adult cardiovascular disease, diabetes mellitus. It is therefore

highly recommended to do baseline Biophysical profile and anthropometric measurements in suspected obese children during early adolescence to prevent life style diseases in the future. Proper health education and physical activity during childhood will prevent metabolic derangements and improve psychological wellbeing in children. Thus the health of the society on the whole improves and the burden on the health care system of the country is minimized.

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