Comparison of Lipid and Thyroid Profile among non-obese, overweight and obese children of 4-14 years age group

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Abstract

Background: Obesity is an important pediatric public health problem associated with risk of complications in childhood and increased morbidity and mortality throughout adult life. It results due to imbalance in energy intake and energy expenditure, the latter is linked to sedentary lifestyle. This is in particular associated due to excessive television watching, computer use, and insufficient outdoor playing. Childhood obesity is associated with unfavorable lipid profiles, suggesting that obese children should be screened for hypercholesterolemia. In recent years there has been increasing focus on thyroid function in obese children. There is controversy whether the changed thyroid profile in obesity is cause or consequence. The aim of this study was to evaluate the lipid and thyroid profile in non-obese, overweight and obese children of 4-14 years age group.

Methods: This prospective study was carried out on pediatric patients attending OPD in a tertiary medical centre for a period of 1 year. At least 50 samples from each group were taken for analysis. Fasting blood samples of all eligible children were sent to the biochemistry laboratory for analysis of lipid profile (TG, cholesterol, HDL, LDL, VLDL) and thyroid profile (T3, T4, TSH). At the end of the study, the data was collected and analyzed by using SPSS20.

Conclusion: The study concluded that mean levels of LDL, VLDL, and total cholesterol were significantly increased in obese children while triglycerides were slightly on the higher side, the levels of thyroid hormones were not affected and found to be completely in the normal limits suggesting normal thyroid functioning. Obesity was equally prevalent in all the strata of society and socio economic status didn't seem to influence it.

Keywords: Obesity, Public health problem, Lipid, Thyroid

Access this article online

Quick Response Code:

Website: www.innovativepublication.com

DOI: 10.5958/2454-6712.2016.00003.1

Introduction

Obesity is an important pediatrics public health problem associated with risk of complications in childhood and increased morbidity and mortality throughout adult life. Obesity in children results due to imbalance in energy intake and energy expenditure, the latter is usually on the lower hand as consequence of a sedentary lifestyle. This is in particular associated due to excessive television watching, computer use, and insufficient outdoor playing. The prevalence of childhood obesity has increased, and the prevention and treatment of obesity has emerged as an important focus of pediatric research. Mortality rises exponentially with increasing body weight. Childhood obesity is associated with unfavorable lipid profiles[(1)]. However, the prevalence of hypercholesterolemia in childhood obesity, and the effect of the degree of obesity on lipid profile, is unknown[(2)]. Unfavorable lipid levels were relatively common among obese children, suggesting that obesity should be considered a risk factor for hypercholesterolemia, and that screening obese children for hypercholesterolemia should be considered[(3)]. In recent years there has been increasing focus on thyroid function in obese children. There is controversy concerning whether the change in the levels of thyroid hormones and TSH in obesity are cause or consequences of weight status and whether these subtle differences merit treatment with thyroxine[(4)]. The purpose of this study was to bring about adverse biochemical changes occurring in overweight/obese child if any.

Materials and Methods

This prospective study was carried out on pediatric patients attending OPD of tertiary medical centre for a period of one year. A pre-informed consent was obtained from parents of children who were enrolled for the study. Ethical clearance was obtained from the institutional ethics committee.

Inclusion criteria: All non-obese, overweight and obese children of age 4-14 years attending OPD.

Exclusion Criteria

1. Children out of above age group.
2. Children with familial hyperlipidaemia, storage disorders.

3. Obesity secondary to genetic, chromosomal, major endocrinal, metabolic syndrome or psychological disorders.
4. Children on medications that can alter lipid and thyroid functions
5. Patients with goitre or known thyroid disease.
6. All sick children requiring intensive care.
7. Children with obvious short stature

Methodology

Eligible children at OPD visit were enrolled for study after obtaining an informed consent. For BMI calculation the weight was determined using weighing balance nearest to 100 grams. For height stadiometer was used to an accuracy of 5mm.

$$BMI = \frac{\text{Weight (in kg)}}{\text{Height } (m^2)}$$

1. BMI < 85 percentile for the age = non obese
2. BMI between 85-95 percentile for the age = over weight
3. BMI >95 percentile for the age = obese

Sample size

At least 50 samples from each group were taken for analysis.

Fasting blood samples of all eligible children were sent to the biochemistry laboratory within ½ an hour of collection for analysis of lipid profile (TG, cholesterol, HDL, LDL, VLDL) and thyroid profile (T_3,T_4,TSH).

Baseline data on demographic and clinical characteristics was collected prospectively throughout the course of study on a predesigned proforma.

Outcome Variables

Primary Outcome: The primary outcome was comparison of lipid and thyroid profile among three groups (non-obese, overweight, obese) of children.

Secondary Outcome

1 Incidence and prevalence of obesity in pediatric population.
2 Incidence and prevalence of thyroid abnormalities in obese children.

Statistical analysis

At the end of the study, the data was collected and analysed by using SPSS20.

Results

In our study; majority of children belonged to 6-10 years age group i.e. 46%; 78% and 62% in group I, II & III respectively followed by >10 years age group i.e. 22%; 22% and 38% respectively. Mean age in group I, II and III was 7.52±3.11; 8.52±2.47 and 10.12±2.18 respectively. When compared statistically by using multi-group comparison i.e. ANOVA, the difference between all the groups was found to be statistically significant (p <0.001).

Table 1: Age distribution

Age range (years)	Group I (Non-Obese)	Group II (Overweight)	Group III (Obese)
Upto 5 years	16 (32%)	5(10%)	0
6-10 years	23(46%)	34(78%)	31(62%)
> 10 years	11(22%)	11(22%)	19(38%)
Total	50(100%)	50(100%)	50(100%)
Mean±SD	7.52±3.11	8.52±2.47	10.12±2.18
Range	4-14	4-14	6-14
Statistical analysis	F=12.53; p <0.001 Significant		

Table 2 shows anthropometric profile of the children in all the three groups. In our study, mean weight was much higher in obese group as compared to obese and non-obese children. When compared BMI of all the children; it was found to be 17.11±1.68 in group I; 19.89±2.23 in group II and 24.26±2.22 in group III. When compared statistically weight, height and BMI of all the children by using multi-group comparison i.e. ANOVA, the difference found to be statistically significant (p <0.001).

Table 2: Mean comparison of Weight/Height/BMI

Parameters	Group I (Non-Obese)	Group II (Overweight)	Group III (Obese)	Statistical Significance
Weight (kg)	28.02±9.40	35.17±10.30	48.13±11.25	F=48.77; p<0.001 Significant
Height (cm)	126.18±14.79	131.78±11.29	139.70±10.24	F=15.51; p<0.001 Significant
BMI	17.11±1.68	19.89±2.23	24.26±2.22	F=153.87; p<0.001 Significant

Table 3: Daily hours of playing

Parameters	Group I (Non-Obese)	Group II (Overweight)	Group III (Obese)
<2	8(16%)	15(30%)	46(92%)
2-4	21(42%)	33(66%)	4(8%)
>4	21(42%)	2(4%)	0
Statistical analysis	$\chi^2 = 92.57$; p = <0.001 VHS		

Above table shows that overweight and obese children were not playing regularly as compared to non-obese children. In this study; we found that 30% in group II and 92% in group III children playing <2 times a day. Similarly 42% in group I; 66% in group II and 8% in group III were playing 2-4 times in a day. When compared statistically; the results were found to be statistically very high significant (p <0.001).

We compared biochemical analysis of all the children with regard to their non-obese; overweight and obese and found that those children who were overweight and obese; their lipid profile and other investigations were much higher as compared to normal children and found to be statistically significant as shown in Table 4.

Table 4: Mean comparison of biochemical parameters

Parameters	Group I (Non-Obese)	Group II (Overweight)	Group III (Obese)	p value
Total cholesterol (130-230 mg/dL)	172.02±20.12	177.26±23.62	209.46±23.32	F=40.90; p <0.001 VHS
Triglycerides (60-160mg/ dL)	156.22±29.23	132.48±23.81	177.98±183.18	F=2.22; p 0.112 NS
HDL (30-60 mg/ dL)	39.58±7.65	43.58±6.91	40.4±7.21	F=4.22; p <0.01 S
LDL (upto 160 mg/dL)	93.46±20.82	128.54±47.79	138.22±24.10	F=25.21; p <0.001 VHS
VLDL (16-32 mg/dL)	25.64±4.45	27.54±4.41	28.5±5.66	F=4.44; p <0.01 S
SGOT (males:<35U/L, females:<31U/L)	62.96±19.65	59.94±17.98	63.42±20.07	F=0.482; p 0.619 NS
SGPT (males:<42U/L, females:<32U/L)	62.24±15.59	62.84±16.36	62.12±15.20	F=0.030; p 0.970 NS
ALP (<500U/L)	241.36±67.37	262.9±67.23	278.14±70.98	F=3.63; p 0.02 S
S. Protein (6-8.3 g/ dL)	6.96±0.810	6.98±0.851	7.01±0.750	F=0.066; p 0.936 NS
A/G (1.0-2.0)	1.47±0.320	1.57±0.43	1.56±0.38	F=0.465; p 0.629 NS
Blood urea (13-43 mg/ dL)	28.94±8.19	28.34±8.85	30.06±8.10	F=0.541; p 0.583 NS
S. Creatinine (0.3-1.0 mg/ dL)	0.63±0.24	0.61±0.26	0.64±0.28	F=0.532; p 0.589 NS
S. Uric acid (males: 3.6-7.7 mg/dL, females:2.5-6.8 mg/ dL)	5.14±1.17	5.01±1.16	5.07±1.29	F=0.181; p 0.835 NS

We also compared thyroid functions test of all the children and we found T3 127.98±28.45 in group I; 131.29±33.04 in group II and 125.81±28.18 in group III. Similarly T4 in group I was 9.19±2.08; 9.38±1.95 in group II and 9.25±2.21 in group III and TSH was 1.99±1.12; 1.91±1.30 and 2.03±1.06 in group I, II and III respectively. We didn't find any significant difference with regard to thyroid profile of all the children.

Table 5: Mean comparison of thyroid profile

Parameters	Group I (Non-Obese)	Group II (Overweight)	Group III (Obese)	Statistical significance
T3 (70-200ng/dL)	127.98±28.45	131.29±33.04	125.81±28.18	F=0.424; p 0.655 NS
T4(5.5-13.5µ/dL)	9.19±2.08	9.38±1.95	9.25±2.21	F=0.253; p 0.777 NS
TSH(0.3-5.0µIU/mL)	1.99±1.12	1.91±1.30	2.03±1.06	F=0.086; p 0.917 NS

Discussion

Obesity is a major public health problem resulting in serious social, physical and psychological damages. Individual obesity is the result of a complex interplay among genetically determined body habitus, appetite, nutritional intake, physical activity, and energy expenditure. The rapid rise in obesity prevalence relates to dramatic environmental changes, but genetic determinants may be important for individual susceptibility. The present study was an observational study including 50 obese children, 50 overweight and 50 control (non-obese individuals), matched with age. The main objective was to assess thyroid and lipid profiles among obese children. To identify obesity among children we used Body mass index as an indicator which increases proportionately with obesity. The lipid Profile of the subjects was basically studied by using various parameters like LDL, VLDL, total Cholesterol, HDL and Triglycerides. Among these, the mean levels of total cholesterol, LDL and VLDL cholesterol were found to be significantly increased in overweight and obese as compared to non-obese children. These findings are in accordance with the previous studies addressed by Ramos et al[5] and others[6,7,8]. The levels of triglycerides were not marginally elevated but they were slightly on the higher side. The lipid disturbance observed in the current study could be attributed to the development of insulin resistance in obese children. Garcés et al found that insulin resistance was significantly higher in obese children[9]. Hyperinsulinemia is known to enhance hepatic very low density lipoprotein synthesis and thus may directly contribute to the increased plasma triglyceride and LDL cholesterol levels. Resistance to the action of insulin on lipoprotein lipase in peripheral tissues may also contribute to elevated triglyceride and LDL cholesterol levels[10]. Concerning physical activity in terms of daily hours of playing (outdoor), the present study results revealed that the number of obese and overweight children doing physical activity was significantly lower than non-obese children. This indicates that physical activity has a preventive effect on obesity. Yu et al pointed particularly to the potential benefit of increasing physical exercise time relative to sedentary activities to reduce the prevalence of childhood obesity[11]. This is in accordance with Hills et al and others[12,13,14]. In addition, in the context of etiology of obesity, Afridiand Khan, reported that obesity develops as a result of a complex interaction between a person's genes and the environment characterized by long-term energy imbalance due to excessive caloric consumption, insufficient energy output (sedentary lifestyle, low resting metabolic rate) or both[15].

In the present study, on comparing consumption of high energy diets it was found that consumption of energy-dense foods leads to obesity. This is in accordance with the previous studies like those conducted by Johnson et al[16] and others[17,18]. As opposed to the traditional view, the frequency of meals had no significant effect over obesity among all the groups. This is not in accordance to the study conducted by Toschke et al[19].

In obese children, the levels of hormones indicating thyroid function i.e. thyroid stimulating hormone (TSH) remain unaltered in both study and control group. According to the data presented in this study there is no effect of obesity over the thyroid hormones level, though levels are on higher side in morbidly obese cases. These results are consistent with the study conducted by Rotondi et al in 2009[20]. Even though numerous studies have been conducted earlier to link the thyroid profile parameters, namely thyroid stimulating hormone (TSH), to those with lipid profile, a clear cut relationship between TSH and lipid profile has not been established so far. Latest researchers tried to link thyroid abnormalities with body weight, but the results seem to be normal in euthyroid subjects. The present study assessed the relation of Thyroid Profile with the studied biochemical parameters including total cholesterol, triacylglycerol, LDL and HDL. There was no significant relation between different levels of TSH and the studied parameters. It is justifiable as we had already excluded hypothyroid patients from our study. No significant association could be traced in terms of family history of obesity in cases and controls. Reporting a family history depends on the prevalence of the diseases, the number of family members, availability of diagnostic facilities, health seeking behavior of patients, and on how familiar they are with diagnoses among their family members. Most of these factors are unlikely to be common in the rural environment; recall is likely to be clearer among people who are more health conscious (i.e., better educated and living in an urban environment).

Conclusion

The mean BMI of obese children was 24.26±2.22, in overweight 19.89±2.23 and in control 17.11±1.68.The frequency of meals had no direct effect over the outcome of obesity. The physical activity of child in terms of daily hours of playing marginally influenced the prevalence of obesity. It had an inverse relationship with obesity. The mean level of LDL, VLDL, and total cholesterol was significantly increased in obese children while triglycerides were slightly on the higher side. The levels of thyroid hormones viz. TSH, T3 and T4 were not affected and were completely in the normal limits suggesting normal thyroid functioning. Obesity was equally prevalent in all the strata of society and socio economic status didn't seem to influence it.

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