International Journal of Contemporary Pediatrics
Patil LGC et al. Int J Contemp Pediatr. 2019 Jan;6(1):185-190
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20185206

Original Research Article

Comparison of clinical and biochemical profile of obese and nonobese children

Lingaraja Gowda C. Patil[1]*, Srinivas S[2].

[1]Department of Pediatrics, JJM Medical College, Davanagere, Karnataka, India
[2]Consultant Gastroenterologist, Kanchi Kamakoti Childs Trust Hospital, Chennai, India

Received: 11 November 2018
Accepted: 12 December 2018

***Correspondence:**
Dr. Maya Vikas Kshirsagar,
E-mail: doclcp81@rediffmail.com

ABSTRACT

Background: We compared clinical and biochemical parameters of obese children aged 6 to 18 years with normal controls visiting to outpatient department in a tertiary care hospital. It was a prospective case control study.
Methods: Obese children with Body Mass Index > 2 standard deviation according to WHO chart were included. Endocrinological and syndromic obese children were excluded. We described risk factors for obesity and compared clinical and biochemical parameters between cases and controls. Student's t test, Chi-square test and ANOVA (analysis of variance) were used for statistical analysis.
Results: We noted higher prevalence of intake of junk food and sedentary lifestyle in obese group. Anthropometric parameters including BMI, skin fold thickness and abdominal circumference were higher in obese children compared to control group. Both systolic and diastolic blood pressures were high in obese children compared to control group. We observed higher prevalence of insulin resistance and dyslipidaemia among obese children.
Conclusions: This study reemphasises that junk foods and sedentary lifestyle are important risk factors for obesity. Always screen for glucose intolerance, hypertension, insulin resistance and dyslipidaemia in obese children.

Keywords: Insulin resistance, Junk foods, Obesity, Sedentary lifestyle

INTRODUCTION

Obesity has reached epidemic proportions globally. Moreover, Obesity is increasing rapidly in developing countries undergoing rapid nutrition and lifestyle transition and it often coexists with under-nutrition.[1] Community based interventions are needed for providing a conducive environment for children to follow a healthy lifestyle, promote healthy food alternatives, and bring awareness and need about an increase in physical activity.[1] Indians, as an ethnic group are particularly at high risk for insulin resistance and central obesity, both forerunners of diabetes, CHD (coronary heart disease) and other 'life style' disorders. It is now emerging convincingly that these disorders begin in childhood (or even earlier, in fetal life) and manifest due to interactions and accumulation of various risk factors, throughout the life course Pediatricians, therefore, have an important role in the prevention and control of this 'epidemic'.[2]

METHODS

Study was conducted at Kanchi Kamakoti Childs Trust Hospital, a tertiary care centre between September 2012 to September 2013.The study was descriptive study and case control study in its design.

Inclusion criteria

- Children between 6 to18 years with BMI >2 SD (standard deviation) according to WHO growth chart are included.

Exclusion criteria

- Obesity secondary to endocrinological causes and syndromic obesity.

Children with obesity (body mass index, BMI >2SD of WHO Chart for age and gender presenting to the Pediatric outpatient department were included in the study as cases.

Age and gender matched children without obesity (BMI in normal range for age and gender according to WHO chart), attending outpatient department for minor illnesses were included as controls.

Study proforma included family history of obesity (based on BMI of either of parent/sibling), diabetes mellitus and hypertension, socioeconomic status (based on modified Kuppuswamy classification), awareness of obesity and its complications and whether seeking medical attention for the same.

Detailed history of food habits, intake of energy dense foods, regular consumption: if consumed more than 3 times a week was enquired.[3]

Physical activity was ascertained by asking for daily physical activity (running, playing) for at least 60 minutes/day 3 days during the past 7 days. Any involvement in sports at school or in the community and the time spent at home in sitting activities like watching T.V(television) and video games (> 2 hours /day) was enquired.[2]

Anthropometric measurements including weight, height, BMI, waist and hip circumference, waist / hip ratio were recorded. Skin fold thickness was measured using HERBEDENS caliper (triceps and sub scapular). Blood pressure was recorded; hepatomegaly and clinical evidence of insulin resistance such as acanthosis nigricans were looked for.

Anthropometry: Body weight was measured to the nearest 0.1 kg with a balance scale and height was measured to the nearest 0.1 cm with stadiometer with subjects lightly dressed and without shoes.

BMI was calculated by standard formula:

- Weight in kilograms / (height in meters) 2

Waist circumference (WC) was measured midway between the lateral lower rib margin and the uppermost lateral border of iliac crest, and hip circumference was measured at the widest point over the great trochanters.

Both circumferences were measured in the standing position and at the end of gentle expiration. The waist-to-hip ratio (WHR) was calculated. A non-elastic flexible tape was employed to measure the waist circumference with the subject in the standing position.[4] All measurements were taken 3 times at each site, and the mean of 3 values was used. Children in case and control groups were plotted over centile groups based on abdominal circumference reference values and analyzed.[5] Skin fold thickness was measured at triceps and sub scapular region by the same person to avoid interpersonal variations using HERBEDENS caliper.[6]

Children in both cases and control groups were plotted in centiles based on skin fold thickness using reference values and compared.[7] Blood pressure >95th centile was considered to be hypertension.

Laboratory investigations including fasting glucose, lipid profile, insulin levels and blood samples were taken after an overnight fast. Glucose, total cholesterol (TC), TG (triglycerides) measurements were performed using enzymatic assays, HDL-C (High density lipoprotein - cholesterol) was measured by a direct enzymatic assay without precipitation.

Low density lipoprotein cholesterol (LDL-C) was estimated by Friedewald formula.[8] Insulin measurement was done by using solid phase chemiluminescence immunoassay.

Fasting glucose=100-125mg/dl was considered as prediabetic range and >126mg/dl was considered as diabetic range.

Homeostasis model assessment for insulin resistance (HOMAIR) was estimated by = FI (fasting insulin) × FG (fasting glucose)/22.5.9 HOMAIR >2.5 was defined for insulin resistance.

Lipid profile:

- Cholesterol >200mg/dl
- LDL cholesterol>130mg/dl
- HDL cholesterol >40mg/dl
- Triglycerides >100 mg/dl in <15 years age and >125mg/dl in >15 years age considered as abnormal. 10.

We have described risk factors, clinical and biochemical parameters in obese children and controls with normal body mass index and later compared various parameters between cases and controls.

Statistical analysis

Data was recorded on a predesigned proforma and managed on an Excel spreadsheet. Student's t test was used to compare mean values for age and lipid parameters between cases and age and sex matched controls. Chi-square test was used to compare various non-quantitative parameters between cases and controls, ANOVA (analysis of variance) was used to compare when more than 2 groups were involved. SPSS (statistical

package for social sciences) for windows statistical software version 17 was used for data analysis. P value less than 0.05 was considered significant.

RESULTS

We have included 107 obese children in present study of which 7 children were excluded of which 3 children had hypothyroidism, 2 had Cushing's syndrome, 1 with Prader willi syndrome and 1 with Bordet beidl syndrome. 100 obese children with simple obesity were included as cases.

50 children without obesity included as controls. Mean age among cases was 9.9 year with a range from 6 year to 18 year and Mean age among control group was 8.2 year with a range from 6 year to 15 year.

Intake of high calorie food >3 times a week in 87% of cases compared to 26% in control group, sedentary life style in the form of outdoor play <1hr/day in 83% of cases as compared to10% in controls and indoor games >2hr/day in 82% of cases compared to 46% in control group. P value for risk factors between cases and controls using chi square was statistically significant. We observed 71% of cases had family history of obesity compared to 6% in controls,40% of cases had family history of hypertension as compared to 14% in control group and 25% of cases had family history of diabetes mellitus as compared to 10% in control group.Mean BMI among cases was 25.6 with a range from 16 to 37.

Mean BMI among controls was 16.6 with a range from 15 to 18. Triceps skin fold thickness (TFT).We found higher percentage of obese children in the 50th to 75th centile and >75th centile group and maximum children in the control group were in the 5th to 10th centile group. Using chi square test p value.

Sub scapular skin fold thickness (SFT)

We found higher percentage of obese children in the 50th to 75th centile and >75th centile group and maximum children in the control group were in the 5th to 10th centile group.

Abdominal circumference

We found higher percentage of obese children in the 50th to 75th centile and >75th centile group and maximum children in the control group were in the <5th centile group.

Mean of Ratio of Abdominal circumference and Hip circumference was high among cases compared to controls.

Systolic blood pressure

We found higher percentage of obese children in the 50th to 90th centile and >90th centile group and maximum children in the control group were in the 50th to 90th centile and < 50th centile group.

Diastolic blood pressure

We found higher percentage of obese children in the 50th to 90th centile and >90th centile group and maximum children in the control group were in the 50th to 90th centile and < 50th centile group.

Comparison of various clinical parameters between cases and controls: For normally distributed data, standard statistics (Student´s t-test and Pearson correlation coefficients) were used for analysis. For data not normally distributed, non-parametric statistics were employed.

For skin fold thickness, abdominal circumference and blood pressures we plotted the children in cases and controls in centile groups and used chi-square test for analysis which was statistically significant (p value <0.05) between cases and controls. P value was significant in all clinical parameters in obese group except in AC/HC ratio (Table 1 and 2).

Table1. Statistical analysis of anthropometric parameters in obese and control group.

Variables	Cases Mean ± SD	Controls Mean ± SD	T value	P value
BMI(kg/m^2)	25.6±3.7	16.5 ±1.2	16.6	0.001
AC/HC ratio abdominal circumference/ hip circumference ratio	0.92±0.04	0.73±0.05	21.6	0.39

Mean values of cholesterol, triglycerides, LDL-C and HDL-C were higher in cases compared to controls. Among cases Hypercholesterolemia was seen 15%, hypertriglyceridemia was seen in 51%, and high LDL-C was seen in 17% of obese children and 44% had low HDL-C values.

No significant difference was noted between mean fasting blood sugar of cases and controls. Mean insulin value of cases was higher than controls indicating hyperinsulinemia among cases. Mean of Insulin resistance (HOMA –IR) was higher in cases compared to control.

Serum total cholesterol, triglycerides, and LDL-cholesterol levels were significantly higher in obese children compared to controls. HDL-cholesterol levels were not significantly different in the two groups.

There was no difference in fasting blood glucose levels of obese and control children. While FBS was not significant between two groups both insulin and insulin resistance were high in obese group (Table 3).

Table 2: P value of clinical parameters in obese and control group.

Variables	P value
Triceps SFT (skin fold thickness)	0.001
Sub scapular SFT (skin fold thickness)	0.001
Abdominal circumference	0.001
SBP(systolic blood pressure)	0.001
DBP (diastolic blood pressure)	0.001

Table 3: Statistical analysis of various laboratory parameters in obese and control group.

Variables	Cases Mean ± SD	Controls Mean ± SD	T value	P value
CHL	171.21±82.86	133.57±14.78	3.18	0.018
TGL	128.57±96.99	68.37±10.14	4.36	0.001
LDL-C	102.74±69.67	71.61±9.45	3.14	0.001
HDL-C	43.03±12.89	39.56±11.01	1.62	0.33
FBS	89.25±12.94	92.08±16.64	1.14	0.243
Insulin	21.27±15.72	9.6±6.71	5.01	0.001
IR	4.69±3.53	2.27±1.64	4.61	0.001

DISCUSSION

Majority of obese children were boys (58%) compared to girls (42%). This observation was similar to a prevalence study done by Kotian et al in south India.[11] We observed more number of obese children in the age group of 6-10 years. Previous prevalence studies done by Kotian et al and Ramesh et al noted a higher prevalence of obesity in the age group of >14.[11,12] Perhaps our observation of high prevalence of obesity in the younger age group related to minor medical illness in this age group for which they came for medical attention and ours was a hospital-based study.

Even in city like Chennai awareness regarding childhood obesity was less and only 23% were aware of obesity and consequences hence came for medical attention while rest came for minor illness and were evaluated for obesity. We observed higher prevalence of obesity in upper socioeconomic group. A similar observation was made by a previous study done by Kotian et al where a higher prevalence of obesity was noted in higher socio-economic group.[11]

Among obese children the parental history of obesity was seen in 71% which was much higher than control group. We also observed higher percentage of family history of hypertension (40%) and diabetes mellitus (25%) in obese group. Our observations were consistent with previous study done by Nageswar Rao et al which demonstrated higher percentage of obese children with positive family history of obesity.[13] These observations confirm a role of genetic influence for childhood obesity. We observed positive correlation of obesity with intake of high calorie foods.87 percent of obese children had a history of high calorie dense food intake compared to 26 % of control group. This finding was consistent with previous study done by Keerthan kumar et al in south Indian children.[3]

Physical activity in the form of playing outdoor < 1hr was seen in higher percentage of children with obesity. Indoor activity like TV watching, playing video games was seen in significant percentage of obese children. An earlier study done by Rebecca kuriyan et al showed eating in front of TV as a significant risk factor for obesity.[14] Higher percentage of sedentary life style habits was seen in obese children compared to control group a finding similar to an earlier study done by Keerthan kumar et al in south Indian children.[3] All anthropometric parameters including BMI (which was natural as per diagnostic criteria), skin fold thickness and abdominal circumference were higher in obese children compared to control group. These observations were consistent to earlier studies done by Nageswar Rao et al and Dubey et al.[13,15] Both systolic and diastolic blood pressures were high in obese children compared to control group. Data reported in present study was consistent with observations of previous study who noted higher systolic and diastolic blood pressure in obese children done by Nageswar Rao et al.[13] Significant increase in serum cholesterol, triglycerides and LDL cholesterol were observed in obese children. Higher percentage of dyslipidemia was seen in obese children. No significant difference was found with respect to HDL cholesterol. All these findings were similar to earlier studies done by Nageswar Rao et al and Dubey et al.[13,15] No significant difference was seen in fasting blood glucose in obese children compared to control groups. A similar finding was noted in previous studies done by Nageswar Rao et al and Dubey et al.[13,15]

There was a significant higher serum insulin level and higher percentage of insulin resistance was seen in obese children compared to control group. Similar observations were noted in an earlier study where serum insulin levels correlated with obesity and there was a higher risk of insulin resistance in obese children.[16] We observed 5% of obese children had hypertension. This was less compared to previous study done by Raj s et al who found 17% of children with obesity having hypertension.[17]

Blood sugars in Diabetic range was seen in 1% and Prediabetic range in 13% of obese children which was which was slightly lower to the observations of Jin et al who found type 2 diabetes in 2.2% and blood sugars in prediabetic range in 19.6% of obese children.[18] Insulin resistance (IR) was seen in 73% of obese children which was slightly higher in comparison with previous study done by Kortoglu et al.[19] Dyslipidemia was seen 72% of obese children which was much higher compared to previous study done by Allemand et al.[20] Metabolic syndrome' was seen in 15% of obese children which was less compared to previous study done by Andrabi et al who found 30% of obese children who had metabolic syndrome.[21]

CONCLUSION

This study reemphasises that junk foods and sedentary lifestyle are important risk factors for obesity. Always screen for glucose intolerance, hypertension, insulin resistance and dyslipidaemia in obese children.

ACKNOWLEDGEMENTS

Authors would like to thank Dr. Porchelvan for the statistical assistance provided and also to Miss Vasanthi for her secretarial support.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Bhardwaj S, Misra A, Khurana L, Gulati S, Shah P, Vikram NK. Childhood obesity in Asian Indians: a burgeoning cause of insulin resistance, diabetes and sub-clinical Inflammation. Asia Pac J Clin Nutr 2008;17(S1):172-5.
2. Bhave S, Bavdekar A, Otiv M. IAP national task force for childhood prevention of adult diseases: childhood obesity. Indian Pediatr. 2004;41(6):559-76.
3. Kumar MK, Kavy PK, Rao KR, Umarkrishna BK, Hegde K, Kumar M et al Prev Alence Of Obe Sity Among High School Children In Dakshina Kannad A And Udupi Districts, Hegde Medical Academy. 2011;1(4):575.
4. Cole TJ, Bellini MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: International survey. BMJ. 2000;320(7244):1240-3.
5. Kuriyan R, Thomas T, Lokesh DP, Sheth NR, Mahendra A, Joy R, Sumithra S, Bhat S, Kurpad AV. Waist circumference and waist for height percentiles in urban South Indian children aged 3-16 years. Indian Pediatr. 2011;48(10):765.
6. Owen GM. Measurement, recording, and assessment of skinfold thickness in childhood and adolescence: report of a small meeting. The American Journal of Clinical Nutrition 35: March 1982, pp. 629-638
7. Addo OY, Himes JH Reference curves for triceps and subscapular skinfold thicknesses in US children and adolescents1. Am J Clin Nutr. 2010;91(3):635-42.
8. Roman Alberty, Dáša Albertyová. Serum lipid growth curves for children and adolescents in predicting adult dyslipidemia (Data from the Slovak Lipid Community Study). Advan Biol Chem 2013;3(05):419-26
9. Matthews DR, Hosker JP, Rudenski AS, Naylor BA, Treacher DF, Turner RC. Homeostasis model assessment: insulin resistance and beta-cell function from fasting plasma glucose and insulin concentration in man. Diabetologia 1985;28(7): 412-4.
10. Abbott MB, Vlasses CH. Nelson textbook of pediatrics. JAMA. 2011;306(21):2387-8.
11. Kotian MS, Kumar GS, Kotian SS. Prevalence and Determinants of Overweight and Obesity Among Adolescent School Children of South Karnataka, India. Indian J Community Med V 2010;35(1):176-8.
12. Ramesh K. Prevalence of overweight and obesity among high school students of Thiruvananthapuram City Corporation, Kerala, India. Austral Med J. 2010;3(10):650-61.
13. Rao GSN, Gurumurthy P, Gururajan P, Arumugam SB, Saibabu, V. Kirthivasan, Cherian KM. Clinical and Biochemical Parameters in Relation to Serum Leptin Levels in South Indian Children and Adolescents. Indian J Pediatr. 2010;77:555-9.
14. Kuriyan R, Thomas T, Sumithra S, Lokesh DP, Sheth NR, Joy R, Bhat S, Kurpad AV. Potential factors related to waist circumference in urban South Indian children. Indian Pediatr. 2012;49(2):124-8.
15. Sudhisha Dubey, Madhulika Kabra, Anurag Bajpai,Pandey RM, Mahmood Hasan,Gautam RK et al. Serum Leptin Levels in Obese Indian Children: Relation to Clinical and Biochemical Parameters. Indian Pediatr 2007;44:257-62
16. Rao GS, Prema G, Priya G, Arumugam SB, Kirthivasan V, Saibabu R, et al Comparison between Serum Insulin Levels and Its Resistance with Biochemical, Clinical and Anthropometric

Parameters in South Indian Children and Adolescents, Ind J Clin Biochem. 2011;26(1):22-7.
17. Raj M, Sundaram KR, Paul M, Deepa AS, Kumar RK. Obesity in Indian children: Time trends and relationship with hypertension. Natl Med J India 2007;20(6):288-93.
18. Jin YY, Liang L, Fu JF, Wang XM. The prevalence of type 2 diabetes mellitus and prediabetes in children. Zhongguo Dang Dai ErKeZaZhi 2011;13:138-40.
19. Kurtoğlu S, Hatipoğlu N, Mazıcıoğlu M, Kendirici M, KeskinM, Kondolot M. Insulin Resistance in Obese Children and Adolescents: HOMA-IR Cut-Off Levels in the Prepubertal and Pubertal Periods. J Clin Res Pediatr Endocrinol 2010;2(3):100-6.
20. I'Allemand D, Wiegand S, Reinehr T, Müller J, Wabitsch M, WidhalmK, et al. Cardiovascular risk in 26,008 European overweight children as established by a multicenter database. Obesity (Silver Spring) 2008;16(7):1672-9.
21. Andrabi SM, Bhat MH, Andrabi SR, Kamili MM, Imran A, Nisar I, Nisar U. Prevalence of metabolic syndrome in 8–18-year-old school-going children of Srinagar city of Kashmir India. Indian J Endocrinol Metabol. 2013;17(1):95.

Cite this article as: Patil LGC, Srinivas S. Comparison of clinical and biochemical profile of obese and nonobese children. Int J Contemp Pediatr 2019;6:185-90.