HIGH-SENSITIVITY C-REACTIVE PROTEIN IN OBESE CHILDREN

By
Mohamed NG*, Aboul.Fotoh LE*, Ahmed AF**,
Abd Elnaem EA***and Reyad AN**
Departments of *Pediatric, **Radiology and ***Clinical Pathology Faculty
El-Minia of Medicine

ABSTRACT:

Background: High-sensitivity C-reactive protein (hs-CRP) may predict the development of type 2 diabetes mellitus (T2DM), metabolic syndrome (MS) and cardiovascular diseases (CVD) in adult, but few reports on relevant studies in children are available.

Aim: The present study aimed to understand possible correlation between serum hs-CRP levels and obesity in children**.**

Patients and methods : Forty obese children and (age 4 - 12 years) and 25 non-obese healthy controls (age 7-11) were enrolled into this study. The levels of serum parameters including hs-CRP, lipid profile and fasting insulin were determined. SPSS 10.0 was used for statistical analysis.

Results: There was significant increase of serum hs-CRP level in obese children the mean was 2.73 (1.5-4.5) mg/L; the level of control group was 0.38 (0.20-0.60) mg/L.

(1) Pearson correlation analysis showed that there was a positive correlation between serum WC and BMI ($r = 0.90$; $p = 0.0001$).
(2) There was no statistically significant difference found in terms of total cholesterol, LDL-cholesterol, HDL-cholesterol and TG between obese and control group.

Conclusion: There may be a chronic low-grade inflammation in obese children.

KEYWORDS:

Obesity
Inflammation
Waist circumference (WC).
High sensitive C reactive protein
Body mass index (BMI)

INTRODUCTION:

Obesity is generally defined as excessive body fat that results in increased risk for morbidity and mortality in children (Ogden et al., 2007). Now reaching epidemic proportions in both developed and developing countries and is affecting not only adults but also children and adolescents. The obesity epidemic has been blamed on numerous factors, (Vos and Welsh., 2010). including TV/screen time, decreased physical activity, increased intake of calorie-dense foods and drinks, poor dietary choices, and the consumption of snacks while watching TV. Childhood obesity predisposes to insulin resistance and type 2 diabetes, hypertension, hyperlipidemia, liver and renal disease, and reproductive dysfunction. It also increases the risk of adult-onset obesity and cardiovascular disease (Cali Anna and Caprio Sonia., 2008).

Obese children of all ages have evidence of a low-grade chronic inflammatory state. In this sense, even the very youngest obese children do not differ from obese adults. In some cases, the degree of inflammation, as

measured by circulating acute-phase reactants and cytokines, is correlated with the presence of several of the comorbid conditions of obesity, including insulin resistance, dyslipidaemia, non-alcoholic fatty liver disease (NAFLD), atherosclerosis and hypercoagulation. Direct clinical evidence suggests a causative role for inflammation in the pathogenesis of certain comorbidities, especially insulin resistance and atherosclerosis (Schwarzenberg and Sinaiko ., 2006).

AIM OF THE WORK:

The present study aimed to understand possible correlation between serum hs-CRP levels and obesity in children**.**

PATIENTS AND METHODS:

The study was carried out on 40 children suffering from obesity and were selected from outpatient clinic at children's university hospital Faculty of medicine El-Minia university during the period from April 2009 through April 2010.

The inclusion criteria:

Children with simple exogenous obesity having BMI exceeding 95th percentile according to the Egyptian Growth Charts, (2002) and simple exogenous obesity.

The exclusion criteria:

- Children with other chronic diseases as diabetes mellitus.
- Children with endocrinologic disorders as Cushing syndrome.
- Children with hereditary diseases, or systemic inflammation as systemic lupus erythermatosis or under any medication as corticosteroids (Giannini et al., 2008)

In addition 25 age and sex matched apparently healthy children were enrolled as a control group.

Each child was subjected to complete history taking, complete physical examination, as well as anthropometric measures. The height and weight were measured. The height was measured to the nearest 0.1 cm and the weight was determined to the nearest 0.01 kg with the patient dressed in minimal clothes and without shoes. The BMI was calculated as weight (in kilograms) divided by height (in meters) squared. Waist circumference was measured at the level of the umbilicus with the child standing and breathing normally, hip circumference at the level of the iliac crest, using a non stretchable plastic tape to the nearest 0.1 cm. The waist/hip ratio was calculated (centimeter/centimeter).

Systolic blood pressure (BP) and diastolic blood pressure (DBP) were measured twice at the right arm after 10min rest in supine position using a calibrated sphygmomanometer. Fasting venous blood samples were collected in plain tubes using a standard venipuncture aseptic technique. The samples were allowed to clot and sera were separated by centrifugation and stored in aliquots at −80°C until assays. analytic measurement of hs CRP was measured by latex-enhanced nephelometry (N high sensitivity CRP assay) on a BN nephelometer (Dade Behring Inc.) and lipid profile were performed Serum total cholesterol, HDL-cholesterol and triglycride (TG) concentrations were determined by calorimetric enzymatic method. LDL-cholesterol was calculated according to the Friedewald formula (LDL-cholesterol = total cholesterol−HDL-cholesterol−triglyceride/5). Fasting blood glucose (FBG), was assayed by using fully automated clinical chemistry auto-analyzer system Konelab 20i Konelab 20i

STATISTICAL ANALYSIS:

All data were recorded in a special chart for every patient. The statistical work of this study was done by a package of computer programs (SPSS version 17 for windows i.e. Statistical Package for the Social Science). Statistical data were presented as mean ± SD or number (percentage) as appropriate.

T-student test was used to compare independent continuous parametric data. Mann–Whitney test was used to compare independent non-parametric data. Chi-square test was used to compare independent categorical data.

Bivariate correlation was done using Pearson r-test. P-value was considered significant if it was < 0.05.

RESULTS:

Demographic and clinical characteristics of 40 obese and 25 non-obese children are shown in Table 1.

The obese and control children were similar for age, sex (p-value > 0.05).

Weight, height, body mass index (BMI), , waist circumference (WC), , hip circumference (HC), waist to hip ratio (WHR), and were significantly higher in obese children than in controls (p-value < 0.05).

Table (1): Comparison of demographic and clinical parameters of 40 obese and 25 non-obese children.

Parameters	Obese (N = 40)	Control (N = 25)	P-value	Significance
Age (years)	4-12 9.41±1.60	7-11 9.04±1.35	0.25	NS
Sex (M/F)	25M/15F	15M/10F	0.84	NS
Weight (kg)	28-81 50.65±9.44	22-38 30.24±3.93	0.0001	S
Height (cm)	100-164 134.82±10.68	116-152 104.92±53.14	0.002	S
BMI (kg/m2)	25.20-31 27.56±1.43	13.20-19.5 16.82±1.80	0.0001	S
WC (cm)	65-98 77.62±6.24	48-64 56.48±4.92	0.0001	S
HC (cm)	68-105 83.55±6.79	53-74 64.72±5.92	0.0001	S
WHR	0.88-1.28 0.93±0.06	0.82-0.95 0.87±0.03	0.0001	S

Comparison of lipid profile in 40 obese and 25 non-obese children is shown in Table2. No difference was found in terms of total cholesterol, LDL-cholesterol, HDL-cholesterol and TG between obese and control group.

Table (2): Comparison of lipid profile in 40 obese and 25 non-obese children**.**

Parameters	Obese (N = 40)	Control (N = 25)	P-value	Significance
Total cholesterol (mg/dL)	155-188 173.62±9.06	155-194 170±10.74	0.15	NS
HDL-cholesterol (mg/dL)	40-86 59.65±10.98	45-70 55±7.43	0.09	NS
LDL-cholesterol (mg/dL)	78-113 97.46±6.68	84-133.4 96.98±11.83	0.83	NS
Triglyceride (mg/dL)	65-100 82.57±8.24	59-99 79.28±12.36	0.20	NS

Data are expressed as range and mean±SD. NS = non significant.

In obese children hs-CRP was significantly higher compared to controls ($p < 0.05$) (Table3).

Table (3): Comparison of high sensitivity C-reactive protein (hs-CRP) in 40 obese and 25 non-obese children.

Parameters	Obese (N = 40)	Control (N = 25)	P-value	Significance
hs-CRP (mg/L)	1.5-4.5 2.73± 0.76	0.20-0.60 0.38±0.11	0.0001	S

Data are expressed as range and mean±SD. S = significant; NS = non significant; hs-CRP = high sensitivity C-reactive protein; PFG-2α = urinary isoprostanes.

Correlation between BMI and WC (Pearson test) is shown in Table 4 There was a significant correlation between BMI and WC ($r = 0.90$; $p = 0.0001$).

Table (4): Correlation between BMI and WC (Pearson test).

Parameters	r-value	p-value	Significance
Correlation between BMI and WC	0.90	0.0001	S

S = significant; NS = non significant.

DISCUSSION:

Childhood obesity is a serious public health problem that has reached epidemic proportions all over the world (Ogden et al., 2008). Obesity is associated with significant health problems in the pediatric age and is an important early risk factor for much of adult morbidity and mortality (Daniels, 2006).

This study as carried out to demonstrate the association between chronic inflammatory marker (hs CRP) and obesity in children.

An important finding in the study of childhood obesity is that inflammation that present in children

without comorbidities at the onset of obesity (Vincent et al., 2009).

In our study we found that hs-CRP was significantly higher in obese children compared to controls confirming our findings Manu Raj 2012, Giannini et al., 2008 who demonstrated that hs-CRP values represent accurate and sensitive indices of chronic inflammatory status available for identifying individuals at higher risk, even in pediatric population. Two specific mechanisms involving hs-CRP which have been described related to monocyte activation and to promotion of synthesis of adhesion molecules that recruit leukocyte to endothelial surface, increase the inflammatory alteration in the vascular endothelium and promote early stage of atherogenesis.

In accordance to the results of Abdelghaffar et al., (2010) and Vardi et al., (2007), this study found a positive correlation between BMI and waist circumference in obese children.

There was no statistically significant difference found in terms of total cholesterol, LDL-cholesterol, HDL-cholesterol and TG between obese and control group in agreement with Giannini et al., (2008) in contrast to Holst-Schumacher et al., 2009 who found higher mean serum concentrations of triglycerides but lower mean serum levels of HDL cholesterol in obese children compared to controls as these changes depending on whether obesity is associated with metabolic syndrome or not as pediatric metabolic syndrome" includes a cluster of cardiovascular risk factors such as insulin resistance, dyslipidemia (including increased triglycerides and decreased HDL cholesterol), hypertension, and obesity in children.

CONCLUSIONS:

Obese children in this representative sample already had measurably elevated markers of inflammation. Additional research should determine whether inflammation incites a cascade that over many years leads to cardiovascular damage and subsequent cardiovascular events and whether earlier exposure to inflammation causes cumulative damage. If such processes were confirmed, inflammation may transform the current epidemic of childhood obesity into a future epidemic of cardiovascular morbidity and mortality in adults, further justifying early obesity prevention efforts.

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