Metabolic Syndrome among overweight and Obese Children Attending Central Pediatric Teaching Hospital in Baghdad

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Abstract

Metabolic syndrome is one of the serious problems that facing children all over the word, as it can lead to multiple health problems including psychological, cardiovascular, endocrinology and school performance.
The aim of this study is to estimate the frequency of Metabolic Syndrome among overweight and obese children, and to detect the relation of age and gender,
A cross sectional study conducted on 49 children in Central teaching hospital for children in Baghdad for one year (from 1/1/2013– 1/12/2013). Weight, height, blood pressure, waist circumference were taken. Blood glucose and lipid profile (triglyceride, high density lipoprotein, and cholesterol) were done for all children.
Children mean ages were 8.28 ± 2.5 year. Percentage of Metabolic Syndrome among the study group was 28.6%.There was a high significant association of obesity, blood pressure, high density lipoprotein and cholesterol with Metabolic Syndrome (p-value<0.005), and only significant association with hyperglycemia, cholesterol and waist circumference (p-value <0.05), but no association with triglyceride.
The difference in distribution of overweight and obese children by risk factors categories was highly significant and there was no significant association between the numbers of risk factors with gender.
The prevelance of Metabolic Syndrome was 28.6%. Both age, gender and triglyceride have no significant association. The obesity, hypertension, high density lipoprotein were found to be highly significant association, while hyperglycemia and hypercholesterolemia were just significant association.

Key words: Metabolic syndrome, Overweight, Obese, Children.

متلازمة الايض بين الاطفال ذوي الوزن الزائد والبدينين المراجعين لمستشفى الاطفال المركزي التعليمي في مدينة بغداد

الخلاصة:

تقدير التكرارات لمتلازمة الايض بين الأطفال ذوي الوزن الزائد والبدينين. كما تتضمن الدراسة الكشف عن علاقة المرض مع العمر والجنس.

دراسة مقطعية اجريت على الاطفال المراجعين الى مستشفى الاطفال المركزي التعليمي في مدينة بغداد ولمدة سنة واحدة (من ٢٠١٣/١/١- ٢٠١٣/١٢/٣١). جرى فيها قياس الوزن, الطول, ضغط الدم ومحيط الخصر , ونسبة السكر بالدم ,ولمحة لمستوى الدهون لجميع المرضى المشمولين بالدراسة. تبين متوسط العمر للاطفال هو ٢.٥ ± ٨.٢٨ وكانت نسبة متلازمة الايض بين اطفال الدراسة هي ٢٨.٦%

اظهرت النتائج وجود علاقة ذات دلالة معنوية عالية بين البدانة وارتفاع ضغط الدم والدهون عالية الكثافة واالكولسترول مع متلازمة الايض (p-value <0.005) وكذلك وجود علاقة ذات دلالة معنوية بين متلازمة الايض ونسبة السكر في الدم والكولسترول ومحيط الخصر للاطفال(p-value <0.05) ,بينما لا توجد اي علاقة بين المرض والدهون الثلاثية.

اضافة الى ذلك تبين وجود علاقة ذات دلالة معنوية بين اختلاف توزيع الاطفال ذوي الوزن الزائد والبدينين مع متلازمة الايض مع فئات زيادة عوامل الخطورة بينما لا توجد علاقة بين عدد عوامل الخطورة مع الجنس.

نسبة متلازمة الايض هي ٢٨.٦% , تبين عدم وجود علاقة ذات دلالة معنوية مع العمر والجنس والدهون الثلاثية . ولكن علاقة ذات دلالة معنوية عالية مع البدانة وارتفاع ضغط الدم والكولسترول والدهون عالية الكثافة, بينما هناك علاقة هامة فقط مع ارتفاع نسبة السكر والكولسترول في الدم.

Introduction

Childhood obesity has become a worldwide public health concern [1]. The coexistence of obesity and metabolic disorders such as: hyperinsulinemia, glucose intolerance, hypertension, high serum levels of triglycerides (TG) and decreased levels of high density lipoprotein (HDL), are known as metabolic syndrome (MetS) [2]. The European Childhood Obesity Group classifies overweight as being at or above the 85th percentile of body mass index and obesity as being at or above the 95th percentile of body mass index [3]. In the United States, the prevalence of overweight among children— defined as a body mass index (BMI; weight in kilograms divided by height squared in meters) at or above the 95th percentile on age- and sex-specific growth charts—has tripled in the past 30 y [4, 5] where 15% of US children between 6 and 11 y of age are overweight, and nearly 20% of non-Hispanic black children are overweight. Obesity in childhood is a public health concern because it increases the risk of developing hypertension, elevated cholesterol, type 2 diabetes, coronary heart disease, orthopedic disorders, and respiratory disease [6,7] with a significant negative effect on childhood emotional development [8, 9]. A study conducted by Yau*etal.* found; by endocrine, MRI and neuropsychological evaluations on adolescents found that those classified as having MetS showed significantly lower math and spelling scores, as well as decreased attention span and mental flexibility. They also showed differences in brain structure and volume, presenting with smaller hippocampal volumes involved in the learning and recall of new information, increased brain cerebrospinal fluid and reductions of microstructural integrity in major white matter tracts in the brain[10] ; while other studieshave been shown to track to adult obesity; and increases the risk of adult mortality [11, 12]. Ferranti, *et al*. defined pediatric metabolic syndrome using criteria analogous to Adult Treatment Panel (ATP) III as ≥ 3 of the following: (*a*) fasting serum TG ≥100 mg/dL; (*b*) serum HDL-C <50 mg/dL, except in boys aged 15 to 19 years, in whom the cut-off point was 45 mg/ dL; (*c*) fasting blood glucose ≥110 mg/dL; (*d*) waist circumference >75th percentile for age and gender; and (*e*) systolic BP t>90th percentile for gender, age and height.[13].

Although a consensus was reached in terms of defining the metabolic syndrome [14, 15], a controversy still remains regarding the underlying etiologic factor(s). Nevertheless, the most accepted hypothesis, and one that is supported by prospective studies, is that obesity and insulin resistance [16, 17].

The Cardiovascular Risk in Young Finns Study was one of the first groups to explore the childhood predictors of the metabolic syndrome In this study, fasting insulin at baseline was related to the development of the metabolic syndrome after 6 years of follow-up in 1865 children and adolescents (6 to 18 years). The results from this study showed that baseline insulin concentration was higher in children who subsequently developed the metabolic syndrome, lending support to the view that insulin resistance precedes the development of the metabolic syndrome in childhood. Because obesity in childhood is closely associated with insulin resistance, it would have been important to establish if children and adolescents who developed the metabolic syndrome after a 6-year follow-up period was also more overweight [18].

A study suggests that obesity in adulthood that became established in

childhood may be a more harmful than obesity that has appeared in adulthood. The possible mechanism is that continuous obesity from childhood to adulthood serves as a "generator" for prolonged insulin resistance, which results in the clustering of hypertension and metabolic abnormalities in the same individual[19].

Waist circumference (WC) at or above the 90th percentile for age, ethnicity, and sex, according to the 2000 Centers for Disease Control and Prevention growth charts [2] (CDC), categorized as a risk factor for the metabolic syndrome and according to Cole's reference data [20, 21]. ATP (adult treatment panel) III uses WC as a measure of central obesity and percentiles for age and gender have been most associated with central obesity in children across genders and races [22]. We have no nomograms for WC for our population; therefore, percentiles were compared to estimated value for percentile regression for European-American children and adolescents, according to gender and age [23].

The aim of this study was to estimate the frequency of MetS among overweight and obese children; to assess the strength of association between different risk factors and MetS; and to detect the association of age and gender with MetS.

Patients and Methods

A cross sectional study was conducted on a sample of children and adolescents attending the outpatient clinic in Central teaching hospital for children CTHC presenting the metabolic abnormalities that are used as criteria for diagnosis of MetS. (49). Obese children were referred to the department of endocrinology in the CTHC in BAGHDAD for one year period; from1 / 1 / 2013 to 31 / 12 / 2013.

Children and adolescents were included if three or more of the following criteria with the cut-off values were present: Body Mass Index (BMI) ≥P85 (p=percentile), triglycerides (TG) ≥100mg/dL, HDL-cholesterol ≤45mg/dL, systolic and/or diastolic blood pressure ≥P90 for age and sex, and fasting glycemia ≥110mg/dL.

Exclusion criteria included: a presence of genetic syndromes, neurological, hepatic or pulmonary disorders detected by general and special physical examination, or in laboratory or radiological procedures, treatment for obesity or dyslipidemia during the previous 3 months, medications containing corticosteroid.

All data were collected at the first consultation. Anthropometry included: Body weight was measured with a balance scale and height was measured with non-elastic tape measure that is fixed to the wall, Height and weight measurements were rotated and performed twice for each child who was lightly dressed and without shoes.

Waist circumference (WC) is used as the distance around the abdomen at mid-point between the iliac crest and lower rib edge, by non-elastic tape measure. This measurement is used to assess the degree of abdominal obesity, which is a greater health risk if WC (male ≥ 94cm, female ≥ 80 cm) [23].

Systolic and diastolic arterial blood pressure (BP) were measured using a 2⁄3 cuffed sphygmomanometer using the auscultatory method, with the patient's right arm at rest, which was slightly flexed at heart level, and after at least 5 minutes rest for three times by resident doctors and mean reading was taken. A systolic or diastolic BP at or above the 90th percentile for height, age, and sex was considered a risk factor for the metabolic syndrome.

Blood samples were taken after 10-12 hours fasting and the lipid profile (total Cholesterol, TG, HDL-cholesterol) which determined by the enzymatic colorimetric assay, using Lab test reagents, LDL-cholesterol values were obtained through Friedewald formula (LDL=Total cholesterol –HDL-Triglyceride / 5) [24]. Fasting glycaemia

was tested using a Randox or Biomgrib kits, at the hospital laboratory. Body mass index (BMI) was calculated as weight (kg) divided by height square (m2). The degree of obesity was quantified using international cut off points for body mass index for overweight and obesity by sex between 2 and 18 years, that is recommended by the WHO curves (2007) which define obesity as the values above the 95th percentile, while overweight as the values between 85th -95th percentile

Data were analyzed by SPSS program version 20, t- test was used to compare between two means, while chi-square used to find association between categorical variables.

Results

A total of forty nine (49) overweight and obese child were included in this study, their mean ages were 8.28±2.5, no significant difference was found between the mean age of MetS cases with that of non-MetS , p-value>0.05 (Table 1), the percentage of MetS among the study group was 28.6%.

Table 1: range & mean age ±SD of the study group

Study group	No.	%	Mean age ± SD (Year)	Range (Year)
MetS	14	28.6	8.07 ± 2.3	3 –12
Non MetS	35	71.4	8.37 ± 2.6	4 – 15
Total group	49	100	8.28 ± 2.5	3 – 15

NS p- value > 0.05

Obesity, high blood pressure and high density lipoprotein were highly significantly associated with MetS, whereas hyperglycemia, hyper-cholesterolemia and WC were significantly associated with it. In this study hypertriglyceridemia show no significant association with MetS. (Table 2).

Table 2: Distribution of the study group according to the risk factors

Risk Factors (RF)	MetS				Non MetS				Total				P value
	RF +	%	RF -	%	RF +	%	RF -	%	RF +	%	RF -	%	
Obesity	13	92.9	1	7.1	15	42.9	20	57.1	28	57.1	21	42.9	< 0.01
BP	11	78.6	3	21.4	10	28.6	25	71.4	21	42.9	28	57.1	< 0.005
TG	4	28.6	10	71.4	5	14.3	30	85.7	9	18.4	40	81.6	> 0.05
HDL	6	42.9	8	57.1	2	5.7	33	94.3	8	16.8	41	83.7	< 0.005
FBS	13	92.9	1	7.1	19	54.3	16	45.7	32	65.3	17	34.7	< 0.05
Cholesterol	5	35.7	9	64.3	3	8.6	32	91.4	8	16.3	41	83.7	< 0.05
WC	11	78.6	3	21.4	16	45.7	19	54.3	27	55.1	22	44.9	< 0.05

The difference in distribution of overweight and obese children by risk factor categories was highly significant, p-value < 0.005 (Table 3)

Table 3: Distribution of study group by body mass and risk factor categories

Body mass categories	Risk factor categories										Total	%
	zero	%	one	%	two	%	Three	%	four	%		
Obese	0	0	4	33.3	11	57.9	9	100	4	80	28	57.1
Over wt.	4	100	8	66.7	8	42.1	0	0	1	20	21	42.9
Total	4	100	12	100	19	100	9	100	5	100	49	100

P value < 0.005 highly sig

Table 4 showed that the difference in distribution of risk factor categories according to gender was not significant, p- value > 0.05

Table 4: Distribution of the study group by gender & risk factor categories

Gender	Risk factor categories										total	%
	zero	%	one	%	two	%	three	%	four	%		
Female	2	50	5	41.7	10	52.6	3	33.3	4	80	24	49
Male	2	50	7	58.3	9	47.4	6	66.7	1	20	25	51
Total	4	100	12	100	19	100	9	100	5	100	49	100

NS. P _value > 0.05

Discussion

In the present study, the total & HDL cholesterol levels between MetS and Non MetS group are similar to Ayoub*et al*. [25]. This study showed no sex difference between girls and boys (49%, 51%) respectively that agree with Carolina Avalos *et al* [26].

Overall prevalence for WC, hyperglycemia and for BP. were (55.1%, 65.3% 42.9%) respectively, which is higher than (55%, 2%, 21%) that found in [27] and [28]. These large differences may due to the difference in cutoff value, size of study mass and type of lab-kits used in these studies.

The sex ratio is higher in boys than girls for overweight and obese group which was higher than study done in Egypt [29] (7% vs.18%) (16% vs.8%) respectively, while in Lebanon [30] (26% vs., 25%), (7% vs. 6%) and in Qatar [31] (28% vs.18.9%) (7.9% vs.4.7%). This wide difference may be due to difference in mass size, cutoff values, diet habit, socioeconomic state, the awareness of our families about over weight and obesity is low, as that plumpness is still considered a sign of child healthiness in Iraq.

The overall prevalence of MetS (28.6%) was compatible with Cruz and Goran (30%), [32] but it was higher than studies in Bahrain [33], in United Arab Emirates [34], Saudi Arabian [35], in Iran [36] in USA found by Ferranti et al. (10%) [37] and Cook *et al*. (4.2%) [38], in Canada by Lambert *et al* (11.5%) [39], in Turkey (2.2%) [40], in Tahran by Esmaillzadeh *et al.* (10%) [41], in South Korean by Kim *et al.* (9.2%) [42]. This wide differences may be due to difference in cutoff values, or the selection criteria and size of study group, or the number of risk factors (2-4) used for diagnosis and

addition of insulin level as a parameter in some studies.

Conclusions

1- The percentage of MetS among overweight and obese children in this study is 28.5%.

2- Obesity, hypertension, and low level of HDL found to be of high significant association, while hyperglycemia and hypercholesterolemia have just a significant association, but have no significant association with hypertriglyceridemia, age and gender.

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