PREVALENCE OF METABOLİC SYNDROME İN CHİLDREN AND ADOLESCENTS

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DISCLOSURE

- We don’t have any financial and personal relationships with other people or organizations.
- There are no conflicts of interest.
- I have nothing to declare

INTRODUCTION

- Obesity causes several co-morbidities.
- Insulin resistance, type 2 diabetes mellitus (T2DM) and cardiovascular impairment are the most important obesity-related complications.
- The prevalence of obesity in childhood today is more than 10 times compared to the 1970s.

INTRODUCTION

•Metabolic syndrome (MS) is one of the most important complications of obesity.

•MS is defined as a clinical condition intertwined with T2DM, cardiovascular disease, hypertension, dyslipidemia, and insulin resistance.

•Genetic and environmental factors also have a role in its development.

- Khunti K, et al. BMJ 2005;331:1153-1154.

INTRODUCTION

- MS prevalence varies according to diagnostic criteria and populations.
- In Turkey, MS prevalence was reported to vary between 2.2 and 20% in childhood.
- In a previous study by using modified WHO criteria, we found the MS prevalence as 27.2% in children and adolescents.

- Hatun et al. Cocuk Sağlığı ve Hastalıkları Dergisi 2005;48:257-265.
- Agirbasli et al. M Metabolism 2006;55:1002-1006.
- Atabek et al. Diabetes Res Clin Pract 2006;72:315-321.

AIM

•Our aim in this study was to determine the prevalence of MS in the urban area of Konya and to compare the results with previous findings to clarify that does it still matter in obese children?

METHODS

- One hundred and forty three obese children (75 females and 68 males, aged 12.4±2.39 years), who presented to the outpatient clinic were included in our study.
- Inclusion criteria: age, 8-17 years, BMI greater than the 95th percentile for age and gender, absence of a prior major illness, absence of a history of medication known to influence metabolism.
- Informed consent and assent were obtained from all parents and children, respectively.

METHODS

- Each child underwent a complete physical examination, including anthropometric measures.
- Their pubertal development stages were assessed using the criteria of Tanner.
- Height and weight, waist and hip circumference and blood pressure were measured and BMI was also calculated in each patient.

METHODS

- An OGTT was performed in obese children and adolescents using a dose of 1.75 g/kg body weight.
- Normal glucose tolerance is defined as a 2-hour post-load glucose (2 hour PG) level of <140 mg/dL.
- Plasma concentrations of total cholesterol, triglycerides, LDL-cholesterol and HDL-cholesterol were also measured in the initial samples.

METHODS

- Criteria for abnormal glucose homeostasis were defined according to the modified WHO criteria adapted for children
- IGT as a 2 hour PG level between 140 mg/dL and 200 mg/dL, and a diabetic state as a 2 hour PG ≥200 mg/dL.
- Following ADA recommendations, a fasting glucose ≥100 mg/dL is defined as IFG and ≥126 mg/dL as diabetes.

- *American Diabetes Association, Diabetes Care 2015*
- Lancet 1999;354:617-621.

METHODS

- Insulin resistance was defined as a HOMAIR of greater than 2.5 in the prepubertal group and greater than 3.16 in the pubertal group
- Hyperinsulinism was defined from norms for pubertal stage: prepubertal >15 mU/L and midpuberty (stages 2-4) >30 mU/L.

•Conwell et al. Diabetes Care 2004;27:314-319.
•Keskin et al. Pediatrics 2005;115:500-503.

METHODS

•MS was defined according to the WHO criteria adapted for children, a definition which requires three or more of the following components.

(1)Obesity: BMI >95th percentile for age and sex.

(2)Abnormal glucose homeostasis: Any of the following

(a)Fasting hyperinsulinemia;

(b)IFG;

(c)IGT.

•Alberti et al.Diabet Med 1998;15:539-553.

METHODS

(3)Hypertension: Systolic blood pressure >95th percentile for age and sex.

(4)Dyslipidemia: Any of the following

(a)high triglycerides (>105 mg/dL in children <10 years of age, and >136 mg/dL in children ≥10 years of age);

(b)low HDL-cholesterol (<35 mg/dL ;

(c)high total cholesterol (>95th percentile).

•Alberti et al.Diabet Med 1998;15:539-553

METHODS

•The IDF criteria for MS in children and adolescents

Age 6 to <10 years include

•Metabolic syndrome cannot be diagnosed, but further measurements should be made if family history of metabolic syndrome, type 2 diabetes mellitus, dyslipidaemia, cardiovascular disease, hypertension, or obesity

•*Zimmet P, Pediatr Diabetes 2007*

METHODS

- **Age 10 to <16 years include (IDF)**
- **Abdominal or central obesity** (90th percentile or above of WC or adult cut-off if lower) plus at least two of the following features:
- **Trigylicerides** ≥150 mg/dL,
- **HDL-cholesterol** <40 mg/dL,
- **SBP** ≥130 mmHg and/or **DBP** of ≥85mmHg,
- **FPG** of ≥100 mg/dL, or known **type 2 diabetes** mellitus.

•Zimmet P, Pediatr Diabetes 2007

STATISTICAL ANALYSIS

- Data were expressed as mean ± standard deviation.
- IGT, insulin resistance, T2DM and MS prevalence rates were estimated by chi-square and Fisher tests.
- The differences between data were estimated using the student's t-test.
- Statistical significance was taken as $p<0.05$.

Table:Clinical characteristics of the study population

	Pubertal	Prepubertal	P
n	112	31	
Sex (F/M)	65/47	10/21	**0,014**
Age (years)	13,25±2,09	9,41±1,72	**<0,001**
BMI (kg/m^2)	30,47±7,77	26,07±3,77	**0,003**
BMI-SDS	2,07±0,29	2,18±0,30	0,075
Waist-to-hip ratio	0,90±0,07	0,93±0,04	0,077
Systolic blood pressure (mmHg)	118,56±17,07	112,4±11,17	0,084
Diastolic blood pressure (mmHg)	74,65±12,47	72,39±10,45	0,381
Total cholesterol (mg/dl)	164,38±44,40	164,45±29,60	0,994
Triglycerides (mg/dl)	114,72±59,47	106,23±70,13	0,513
HDL-cholesterol (mg/dl)	40,32±10,03	41,36±9,56	0,620
LDL-cholesterol (mg/dl)	101,36±38,50	97,51±31,37	0,627
Fasting glucose (mg/dl)	90,98±10,88	91,33±8,98	0,689
Fasting insülin (µU/ml)	16,69±12,41	9,80±5,11	**0,003**
HOMA-IR	4,14±3,71	2,34±1,21	**0,009**

RESULTS

•According to our results, Insulin resistance (HOMA-IR >3.16) was observed in **52.4%**, hyperinsulinemia in **15.3%**, IFG in **27.2%**, and IGT in **13.2%**.

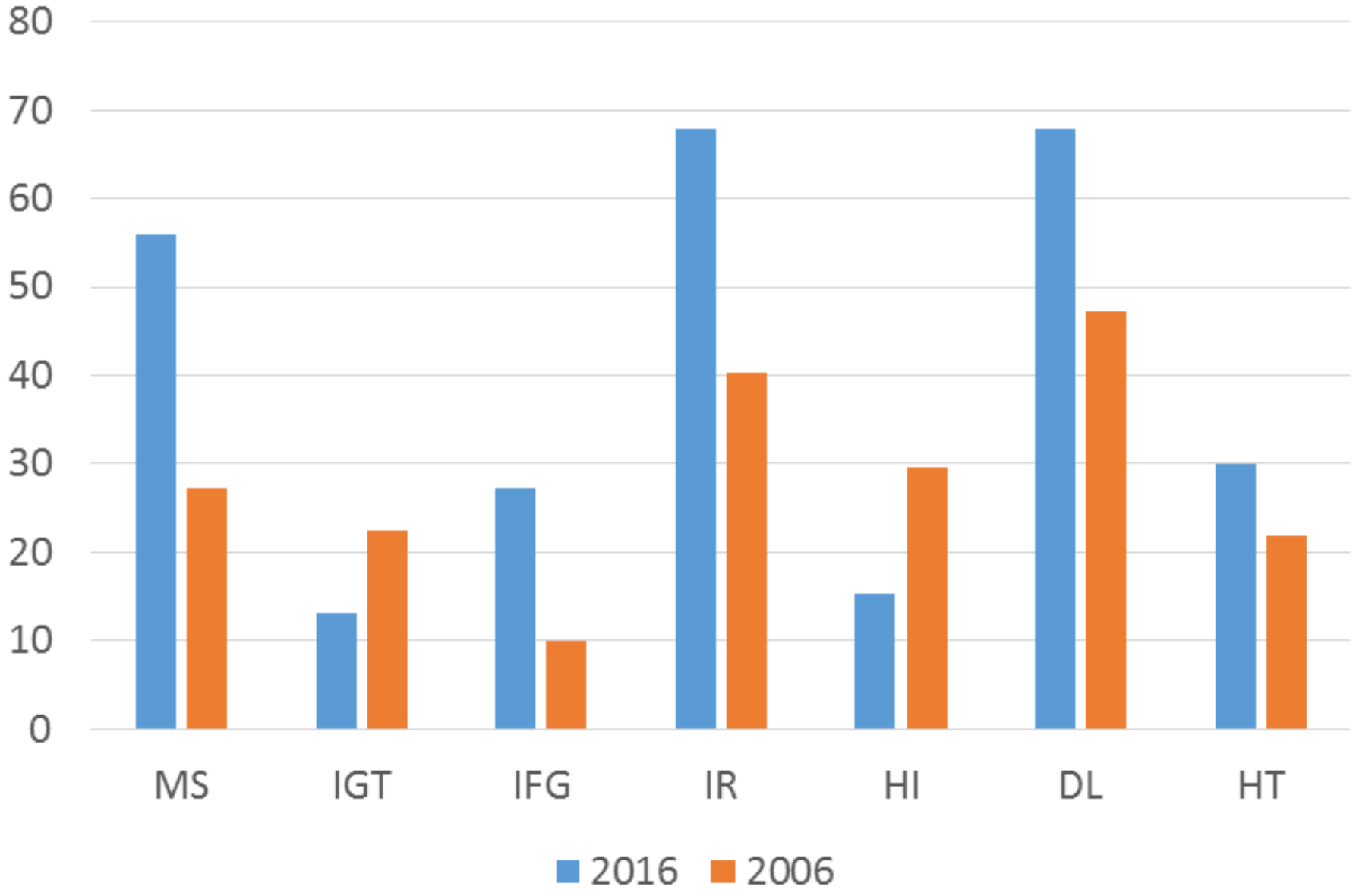
•Dyslipidemia was found in **67.8%** and hypertension in **30%.**

•MS, defined as WHO criteria, was found in 80 subjects **(55.9%)**, with a significantly higher rate than IDF criteria found in 65 subjects **(45.5%).**

Table: Comparison of risk factors and metabolic syndrome in 2006 to 2016

	2006 n= 169(%)	2016 n= 143 (%)
Hyperinsulinemia	50 **(29.5)**	22 **(15.3)**
Impaired glucose tolerance	38 **(22.4)**	18 **(13.2)**
Impaired fasting glucose	17 **(10)**	39 **(27.2)**
Dyslipidemia	80 **(47.3)**	97 **(67.8)**
Hypertension	37 **(21.8)**	43 **(30)**
Insulin resistance	68 **(40.2)**	75 **(52.4)**
Type 2 Diabetes	5 **(2.9)**	1 **(0.6)**
METABOLİC SYNDROME	46 **(27.2)**	80 **(55.9)**

Figure : Prevalence of MS and its components in obese children and adolescents according to years



DISCUSSION

- It is known that obesity is a global problem and leads to increased morbidity and mortality.
- Many studies report an increased prevalence of glucose abnormalities and especially MS in obese children.
- MS prevalence varies according to diagnostic criteria and populations.

DISCUSSION

•Cizmecioglu et al., **38.8%** of obese children in Turkey were diagnosed as having MS.

•We found **55.9 and 45.5%** of obese children and adolescents to have evidence of MS for WHO and IDF criteria, respectively.

•It is problematic to compare the prevalence of Metabolic Syndrome using multiple different definitions across countries and settings.

•Cizmecioglu et al. Turk J Pediatr 2008;50:359-365.
•Isomaa et al. Diabetes Care 2001;24:683-689.
•Cruz et al. J Clin Endocrinol Metab 2004;89:108-113.

DISCUSSION

- **Ten years ago**, we found MS prevalence as **27.2%** in obese children and adolescents for WHO criteria.
- According to our data, we found that the prevalence of MS had increased in obese children and adolescents and the prevalence had **doubled in ten years.**
- We attribute this increase **to changes in lifestyle and nutrition behaviors** and spending more time in front of television and computer screens.

•Atabek et al. Diabetes Res Clin Pract 2006;72:315-321.

DISCUSSION

- In our study, the prevalence rates of T2DM and IGT were **0.6** and **13.2%**, respectively.
- In our study, the rate of IR was **52.4%** in obese children and adolescents.
- Our findings of a high prevalence of IGT and IR but a low prevalence of T2DM reflect the range of abnormalities of glucose homeostasis associated with obesity in childhood.
- The prevalence of IR is very high among obese children, but T2DM is yet to develop in this age group.

DISCUSSION

- Elevated triglycerides and low levels of HDL-cholesterol characterize the dyslipidemia in MS.
- Increased triglycerides in the presence of IR and hyperinsulinemia result from increased circulating free fatty acids.
- Dyslipidemia frequency was **67.8%**, which is higher than our previous data with **47.3%**.

•Atabek et al. Diabetes Res Clin Pract 2006;72:315-321.

DISCUSSION

•In our study, **30%** of all patients had hypertension which is higher than our previous data with **21.8%.**

•Maggio et al. were reported **47-60%** for hypertension prevalence with **ambulatory** blood pressure monitoring.

•Since we took **one measurement** of blood pressure, we might have observed a low frequency.

•These findings show that preventing obesity is one of the important factors for the development of hypertension and related end-organ damage in early ages.

•Maggio et al. J Pediatr 2008;152:489-493.
•Atabek et al. Diabetes Res Clin Pract 2006;72:315-321.

DISCUSSION

•In conclusion, the prevalence of MS in the clinic referral sample **that used WHO criteria** had approximately **doubled** over the last ten years, and we found increased rates of morbidity.

•The prevalence of MS in childhood obesity has **increased** at an **alarming** rate that is assuming epidemic proportions throughout the world.