SEX-RELATED DIFFERENCES AND EFFECT OF PUBERTY ON METABOLIC SYNDROME IN OBESE CHILDREN AND ADOLESCENTS

Chiara Guzzetti, Anastasia Ibba, Letizia Casula, Sabrina Pilia, Sandro Loche
SSD Endocrinologia Pediatrica e Centro Screening Neonatale,
Ospedale Pediatrico Microcitemico "A. Cao", AO Brotzu, Cagliari, Italy
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AO BROTZU

INTRODUCTION

Metabolic syndrome (MS) is a known complication of obesity. It is still unclear whether sex and puberty influence the prevalence of MS in children and adolescents.

OBJECTIVE

Aim of the study was to evaluate the effect of sex and puberty on the prevalence of MS and on cardiovascular risk factors (CVRF) in obese children and adolescents.

SUBJECTS AND METHODS

1437 obese children and adolescents (Table 1) were included in this retrospective analysis. Subjects were stratified according to Tanner pubertal staging (prepubertal (PREP), pubertal stage 2-3 (PS2-3), pubertal stage 4-5 (PS4-5)). Waist circumference (WC), systolic and diastolic blood pressure (SP, DP), fasting plasma glucose (GLU) and insulin (INS), post Oral Glucose Tolerance Test glucose (OGTT GLU) and insulin (OGTT INS), and lipids (total cholesterol (tCHO), HDL, LDL, and triglycerides (TG)) were evaluated in all subjects. HOMA index (GLU(mmol/L) x INS(mU/L) / 22.5) was calculated as insulin resistance index. MS was defined according to the IDEFICS criteria in 2-10 ys patients (Group 1) and IDF criteria in patients ≥10 ys (10-16 ys=Group 2, ≥16 ys=Group 3, Table 2).

Age (ys)	9.7 (2.2-17.9)
Sex (M/F)	660/777
BMI-SDS	2.06 (1.65-4.17)
WC (cm)	80.5 (57.3-128)
SP (mmHg)	105 (70-175)
DP (mmHg)	60 (40-100)
GLU (mg/dl)	88 (59-133)
OGTT GLU (mg/dl)	103 (51-214)
INS (mU/l)	13 (2-91)
OGTT INS (mU/l)	50.4 (2-332)
HOMA-IR	2.8 (0.3-22.6)
CHO (mg/dl)	166 (66-434)
LDL (mg/dl)	102 (16-362)
HDL (mg/dl)	50 (21-131)
TG (mg/dl)	57 (11-451)

Table 1. Characteristics of patients.

RESULTS

The overall prevalence of MS was 10.9%.

BMI-SDS (PREP, PS4-5, Figure), WC (PREP, PS4-5), SP (PREP, PS2-3, PS4-5), DP (PREP, PS2-3), GLU (PREP, PS4-5) and TG (PS4-5) were higher in males. Mean INS and post-OGTT INS were higher in PREP and PS2-3 females (Data not shown).

The CVRF more frequently abnormal in males were WC (PREP, PS4-5) and SP (PS2-3, PS4-5) while HOMA was more frequently abnormal in PS2-3 females (Figure).

WC was more frequently abnormal in PREP, while SP was more frequently abnormal in pubertal patients, regardless of sex. PS2-3 males showed more frequent abnormalities of GLU and less frequent abnormalities of HOMA. HDL was more frequently abnormal in PS2-3 female (Figure).

The prevalence of MS was higher in PREP and PS4-5 males of group 2 (Tables 3 and 4).

Age (ys)	Definition	Central obesity	Blood pressure	Dyslipidemia	Glucose intolerance
Group 1 2 - <10	IDEFICS*	WC ≥90° %ile	SP ≥90° %ile and/or DP ≥90° %ile	TG ≥90° %ile and/or HDL ≤10° %ile	HOMA-IR ≥90° %ile and/or GLU ≥90° %ile
Group 2 10 - <16	IDF**	WC ≥90° %ile	SP ≥130 mmHg and/or DP ≥85 mmHg	TG ≥150 mg/dl and/or HDL <40 mg/dl	GLU ≥100 mg/dl
Group 3 16-18	IDF**	WC ≥94 cm in M and ≥80 cm in F	SP ≥130 mmHg and/or DP ≥85 mmHg	TG ≥150 mg/dl and/or HDL <40 mg/dl in M and <50 mg/dl in F	GLU ≥100 mg/dl

Table 2. MS definition according to IDEFICS and IDF age criteria. *At least 3 abnormal variables. TG, HDL, HOMA-IR and GLU are considered individually. **Central obesity plus at least 2 others abnomal vasiables. TG and HDL are considered individually.

	PREP			PS2-3			ps4-5		
	M	**F**	**p**	**M**	**F**	**p**	**M**	**F**	**p**
Group 1 n=753	16.1% 48/299	14.5% 53/365	0.58	20.8% 5/24	24.6% 16/65	0.71	-	-	
Group 2 n=616	11.1% 2/118	0% 0/36	0.43	6.5% 9/139	3.6% 3/82	0.37	**13.1%** **8/61**	1.7% 3/180	**<0.01**
Group 3 n=68	-	-		-	-		26.3% 5/19	10.2% 5/49	0.09

Table 3. Differences in MS prevalence according to sex. Data are numbers and percentage of patients with MS.

Group 2	PREP	PS2-3	PS4-5	p
M n=318	11.1% 2/118	6.5% 9/139	13.1% 8/61	**0.009**
F n=298	0% 0/36	3.6% 3/82	1.7% 3/180	0.37

Table 4. Differences in MS prevalence according to pubertal status in Group 2. Data are numbers and percentage of patients with MS.
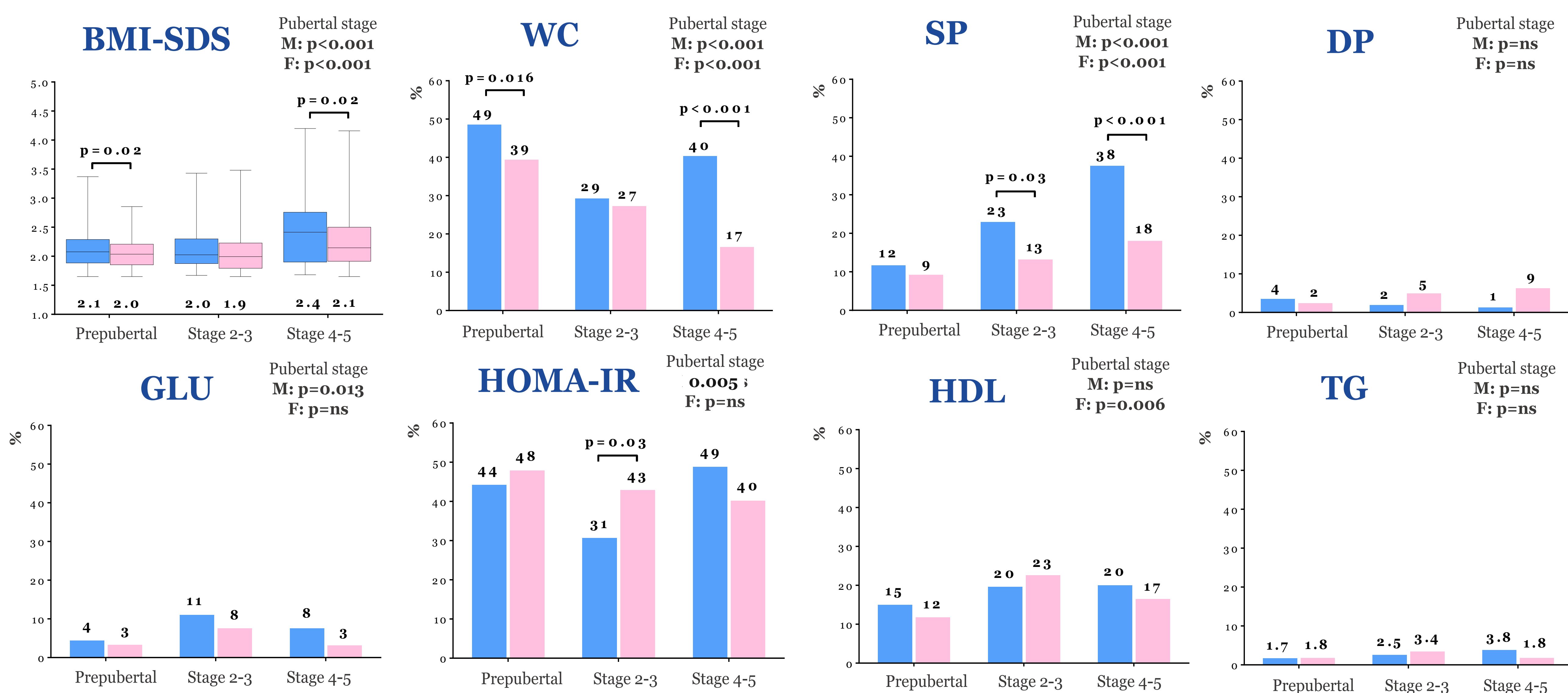

Figure. Differences in frequencies of parameters abnormalities according to sex and pubertal status.

CONCLUSIONS

Sex and pubertal status influence the prevalence of MS and the frequency of abnormalities of CVRF in obese children and adolescents. CVRF are already present in prepubertal age, and their prevalence is higher in male. Identifying patients with higher risk of metabolic complications and cardiovascular risk factors is important to design targeted and effective prevention strategies.