Can waist circumference (WC) identify children at risk for type 2 diabetes(T2DM)?

Valeria Hirschler, M.D., Maria L Calcagno, M.S., Claudio Aranda, M.S., Gustavo Maccalini, M.S. andMauricio Jadzinsky, M.D.. [1]Nutrition, Durand Hospital, Buenos Aires, Argentina. E-mail:vhirschler@intramed.net

Abstract: As we previously described, WC is a predictor for insulin-resistance (IR) in children. This finding was explored further with elementary school children. The aim of the study was to determine the association in children between WC and T2DM risk factors including HOMA-IR, lipid profile, and blood pressure (BP). Students (530, 249 M) aged (9.12.4 y) from 5 schools were examind between April and August 2005. The results for BMI, WC, BP, glucose, insulin, and lipids were obtained. Of 530 childrenexamined 6% were OW (BMI>95%ile; z-BMI=2.55); 13.6% at risk of OW (BMI>85<95%ile; z-BMI=1.45), and 80.4% non-OW (BMI<85%ile; z-BMI=-0.14). There was not a significant difference in age and sex between these groups. Fifty seven % were Tanner stage I. Hypertension was present in 2.5%. Subjects were divided into four groups by HOMA-IR quartiles for comparison (Table). As IR increased, BMI, WC, TG, HDL., glucose and BP increased (p<0.001). Fifty three % of the children in quartile IV had WC>75th%ile vs 22% in quartile I (p<0.001). On multiple linear regression analysis, WC (p<0.001), TG (p<0.001)age (p<0.001), sex (p=0.018), and HDL (p=0.03) emerged as independent determinants of HOMA-IR (r^2=0.32). The logistic regression using HOMA-IR IV quartile as the dependent variable showed that WC, TG, sex and age were independent contributors for IR (37% of the varianceexplained, p<0.001). We conclude that WC could be a practical tool to identify children at risk for future T2DM.

Clinical and metabolic patient characteristics; HOMA-IR quartiles adjusted by age and sex.				
HOMA-IR	I (0.08-1.04)	II (1.04-1.58)	III (1.58-2.54)	IV (2.54-13.62)
Z BMI*	-0.04±0.9	-0.13±0.9	0.38±0.9	0.76±1.1
Z WC*	-0.08±0.1	0.01±0.1	0.34±0.1	0.74±1.1
TG (mg/dl)*	65.88±11.1	74.74±11.9	81.82±11.9	93.38±11.9
HDL (mg/dl)*	55.59±13.8	55.32±12.6	53.37±12.6	48.54±13.3
Systolic BP*	92.75±14.9	90.91±13.2	94.69±13.4	97.45±14.2
Glucose (mg/dl)*	80.84±8.2	83.23±7.5	85.94±7.5	89.17±7.9

MeanSD.* P<0.001; Covariance analysis

INTRODUCTION

In the adult population WC has proven to be a useful tool for insulin-resistance. In children WC ha s proven to be a predictor for insulin-resistance, as well (1). This finding was explored further with elementary school children.

OBJECTIVES

The aim of this study was to determine the association between WC and T2DM risk factors in children including HOMA-IR, lipid profile, and blood pressure (BP).

Study Design

Students (530, 249 Males) aged (9.1 ± 2.4 years) from 5 elementary schools were examined between Ap ril and August 2005. Data for: BMI, waist circumference (WC), blood pressure (BP), and Tanner stage were obtained. A lipid pr ofile, base glycaemia and base insulinemia, were performed.

STASTICALANALYSIS

Fisher exact test was used to compare proportions. When comparing more than three groups and with data that were normally distributed, one-way Analysis of Variance was used (Bonferroni's post hoc test). Multiple linear regression analysis was performed to examine the relationship between WC and other continuous variables, such as age, BMI, BP, lipids/lipoproteins, and HOMA-IR measures. P values <0.05 were considered statistically significant. Data are presented as mean ± SD. Analyses were done using the SPSS statistical software package SPS 10.0 and Info State

RESULTS

Of 478 children examined 32(6%) were OW (BMI >95%ile, z-BMI= 2.55 ± 0.61), 72(13.6%) at risk of OW (BMI >85<95%ile; z- BMI=1.45 ± 0.27) and 426(80.4%) non-OW(BMI <85%ile; z- BMI=-0.14 ± 0.74). The z-BMI scores were based on our measurements of 5103 school children.

Two hundred and fifty three (57,6%), 100 (22.8%), 68 (15.5%), and 18 (4.1%) were Tanner stage I, II , III, and IV, respectively.

Clinical and metabolic characteristics Data is expressed as mean

Table1

	N=530 (100%)	Non-Ow N= 426 (80.4%)	At risk N= 72 (13.6%)	OW N= 32 (6.0%)	Significance
Sex (males)	47.0% (249/530)	45.3% (193/426)	51.4% (37/72)	59.4% (19/32)	0.2376
Age (y)	9.15	9.18	9.24	8.51	0.2993
z-BMI	0.24	-0.14	1.45	2.55	**<0.0001**
BMI (kg/ sq m)	19.03	17.86	22.92	25.75	**<0.0001**
z-WC (cm)	0.25	-0.04	1.25	1.90	**<0.0001**
WC (cm)	64.80	62.48	73.26	76.39	**<0.0001**
HDL-C (mg/dl)	53.20	53.92	50.21	50.44	**0.0359**
HOMA-IR	1.96	1.76	2.49	3.37	**<0.0001**
GLUCOSE (mg/dl)	84.79	84.63	84.78	87.06	0.2646
TG(mg/dl)	86.61	85.17	89.70	98.91	0.2319
ALBUMINURIA Micrograms/ml	11.13	13.01	2.91	2.91	**<0.0001-**
SYSTOLIC BP	93.94	92.4	100.6	99.3	**<0.0001**
DIASTOLIC BP	54.36	53.5	58.1	57.7	**0.0027**

Low HDL (231/530;43%) , waist circumference ≥75 percentile (185/530; 35.1%) and high triglycerides (135/530;25%) were common in this sample. Hypertension (12/471;2.5%), and impaired fasting glucose (18/530;3.4%) were infrequent .None had DBT2. There were not significant differences in age or sex between groups.

All 530 subjects were divided into four groups by HOMA-IR quartiles (Table 2)

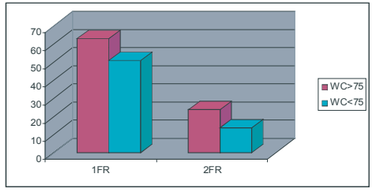
Table 2

Clinical and metabolic patient characteristics; HOMA-IR quartiles adjusted by age and sex.				
HOMA-IR	I (0.08-1.04)	II (1.04-1.58)	III (1.58-2.54)	IV (2.54-13.62)
Z BMI*	-0.04±0.9	-0.13±0.9	0.38±0.9	0.76±1.1
Z WC*	-0.08±0.1	0.01±0.1	0.34±0.1	0.74±1.1
TG (mg/dl)*	65.88±11.1	74.74±11.9	81.82±11.9	93.38±11.9
HDL (mg/dl)*	55.59±13.8	55.32±12.6	53.37±12.6	48.54±13.3
Systolic BP*	92.75±14.9	90.91±13.2	94.69±13.4	97.45±14.2
Glucose (mg/dl)*	80.84±8.2	83.23±7.5	85.94±7.5	89.17±7.9
OW (%)*	3.8	2.3	3.8	14.4
WC>75%ile (%)*	22.7	22.6	42.1	53.0
TG>75th ile(%)*	12.1	21.8	27.1	40.9
HDL<5 % ile (%)*	37.1	35.3	44.4	57.6

MeanSD.* P<0.001; Covariance analysis

Risk Factors & WC >75th

Approximately 63% of the children with WC>75th%ile, had at least 1 additional risk factor for T2DM, such as hypertension, hyperlipidemia or hyperglycemia vs. 51% in the other group (P<0.01). Two or more risk factors were present in more than 24% of the children with WC>75%ile but only 14% in the other group (WC<75%ile).



Multivariate Analysis

The logistic regression using HOMA-IR IV quartile as the dependent variable showed that WC, TG, sex and age were independent contributors for IR (37% of the variance explained, p<0.001). (Table 3)

Table 3

	OR	Confidence	Interval 95%
WC	1.10	1.07	1.13
TG	1.009	1.004	1.014
SEX	0.53	0.32	0.88
AGE	1.27	1.12	1.44

On linear regression analysis, WC (p<0.001), TG (p<0.001), age (p<0.001), sex (p=0.018), and HDL (p=0.03) emerged as independent determinants of HOMA-IR (r^2=0.32).

CONCLUSION

WC was significantly associated with insulin-resistance. Thus suggesting that WC is could be includ ed in the clinical practice as a simple tool that may help to identify children at higher metabolic risk.

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