The Influence of Abdominal Obesity on Specific Biomarkers and its Role in Metabolic Syndrome

Fiona O'Dwyer[1] Dr O Mac Ananey[1]

[1]Technological University Dublin

Introduction

- Metabolic syndrome (MetS) is a range of obesogenic, metabolic, and/or cardiovascular abnormalities.
- Global prevalence: 11.9% - 49%, influenced by geography, environment, population & diagnostic criteria[1,2]
- Abdominal obesity precedes risk factors, defined by waist circumference (WC) (>102cm males, >88cm females) or by having a waist-to-hip ratio (WHR) (>0.90 for males and >0.85 for females)[3]
- WC influenced by height, age, and ethnicity, making a singular cut-off challenging
- Waist-to-height ratio (WtHR) is an alternative indicator with a universal cut-off (>0.5)[4].
- Visceral adipocyte hypertrophy ➔ increased leptin, decreased adiponectin ➔ an imbalanced leptin/adiponectin (L/A) ratio and elevated CRP levels

Aim

Examine the relationship between obesogenic risk factors in a subclinical population, in individuals with and without MetS IDF, specifically exploring the relationship between the indices of MetS (IDF) and anthropometric measures of abdominal obesity with the specific biomarkers, leptin, adiponectin, L/A ratio and hs-CRP. The secondary aim of the present study is to examine the overlap of MetS diagnosis using the three criteria: IDF, WHO and NCEP.

Diagnostic criteria for MetS as classified by the International Diabetes Federation, Word Health Organisation and the National Cholesterol Education Program

	IDF	WHO		NCEP	
Person must have:	Central obesity (Waist > 94 cm (men) or > 80 cm (women))	Presence of insulin resistance or glucose > 6.1 mmol/L, 2 h glucose > 7.8 mmol		Presence of any three or more of the following:	
	Along with any two or more of the following:	Along with any two or more of the following:			
Raised Triglycerides	≥ 1.7 mmol/L	Raised Triglycerides	> 1.7 mmol/L	Raised Triglycerides	> 1.7 mmol/L
Reduced HDL Cholesterol	< 1.03 mmol/L in males < 1.29 mmol/L in females	Reduced HDL Cholesterol	< 0.9 mmol/L in men < 1.0 mmol/L in women	Reduced HDL Cholesterol	< 1.0 mmol/L in men < 1.3 mmol/L in women
Raised Blood Pressure	systolic BP ≥ 130 or diastolic BP ≥ 85 mmHg	Raised Blood Pressure	> 140/90 mmHg	Raised Blood Pressure	> 130/85 mmHg
Raised Fasting Plasma Glucose	(FPG) ≥ 5.6 mmol/L	Elevated Waist to Hip Ratio	> 0.9 (men) > 0.85 (women) or BMI > 30 kg/m²	Altered Blood Glucose	> 5.6 mmol/L or drug
				Elevated Waist Circumference	> 102 cm (men) or > 88 cm (women)

Methods

- 198 participants (92 M, 106 F).
- Inclusion ➔ non-smokers, moderate alcohol intake.
- Exclusion ➔ U29, specific medical conditions, and medication use.

- Anthropometric, hemodynamic, glucose & lipid profiles analysed
- hs-CRP, leptin and Adiponectin ➔ Fasting venous samples
- Obesity, abnormal WHR and body fat % ➔ WHO[5]
- Abnormal WC ➔ HSE[6]
- Abnormal WtHR ➔ The British Heart Foundation[7]

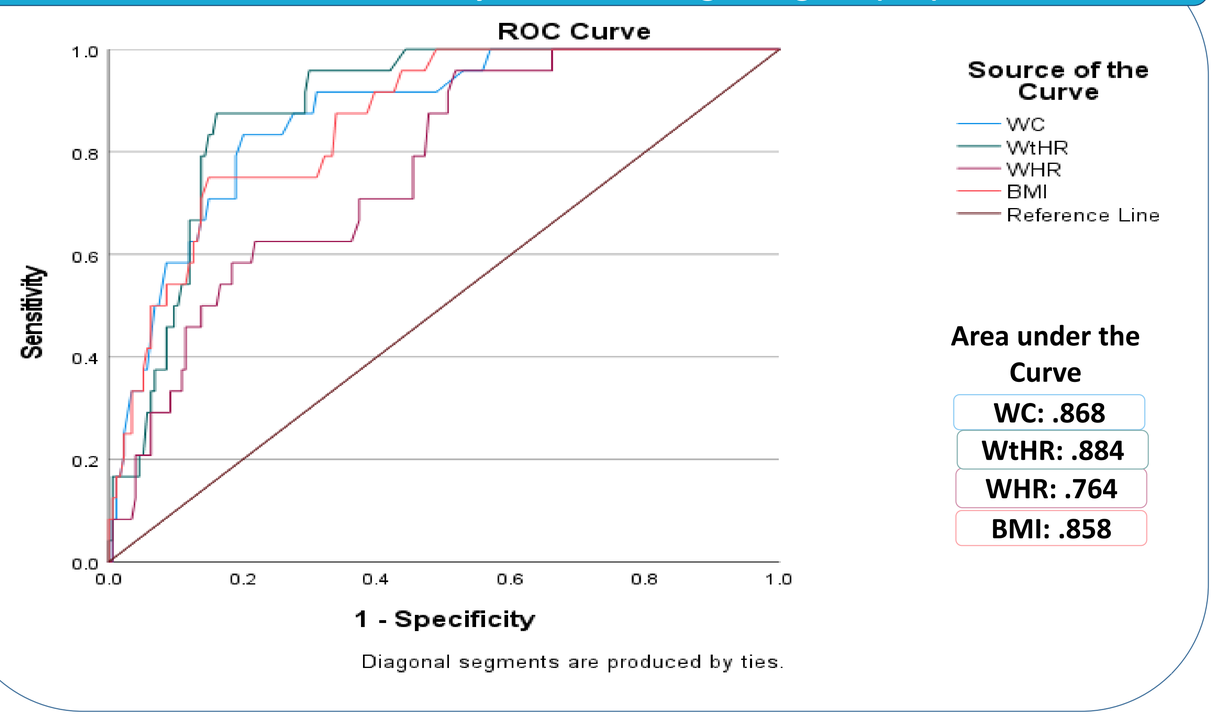
- SPSS – Non parametric T-Test, Chi Square, Univariate and ROC Curve analyses were used to examine the data. Data was presented as mean with standard deviation.

Results

Mean (SD) subject characteristics of the Healthy and Metabolic Syndrome (IDF) cohorts

Characteristics	Healthy N=171	Metabolic Syndrome (IDF) N=24
Gender		
Male	77	12
Female	94	12
Age (years)	41.5(± 9.7)	41.3 (± 6.5)
Physical Characteristics		
Waist Circumference (cm)	86.0 (± 11.2)	103.1 (± 11.1) **
Waist to Height Ratio	.506 (± 0.06)	.597 (± 0.06) **
Body Fat Percentage (%)	27.0 (± 8.4)	33.6 (± 9.1) **
Haemodynamic Profile		
Blood Pressure Systolic (mmHg)	122 (± 12)	138 (± 9) **
Blood Pressure Diastolic (mmHg)	73 (± 8)	80 (± 7) **
Lipid Profile		
Total Cholesterol (mmol/L)	4.8 (± 0.8)	4.7 (± 0.7)
Glucose Profile		
Glucose Pre (mmol/L)	5.0 (± 0.4)	5.3 (± 0.6) *
Biomarkers		
hs-CRP (mg/L)	1.7 (± 2.4)	3.6 (± 5.4)
Leptin (pg/mL)	13349.0 (±9940.7)	25186.5 (± 23663.6)
Adiponectin (ng/mL)	6620.1 (± 3925.0)	5133.6 (± 3449.0)
Leptin/Adiponectin Ratio	3.3 (± 6.5)	6.8 (± 7.8) *

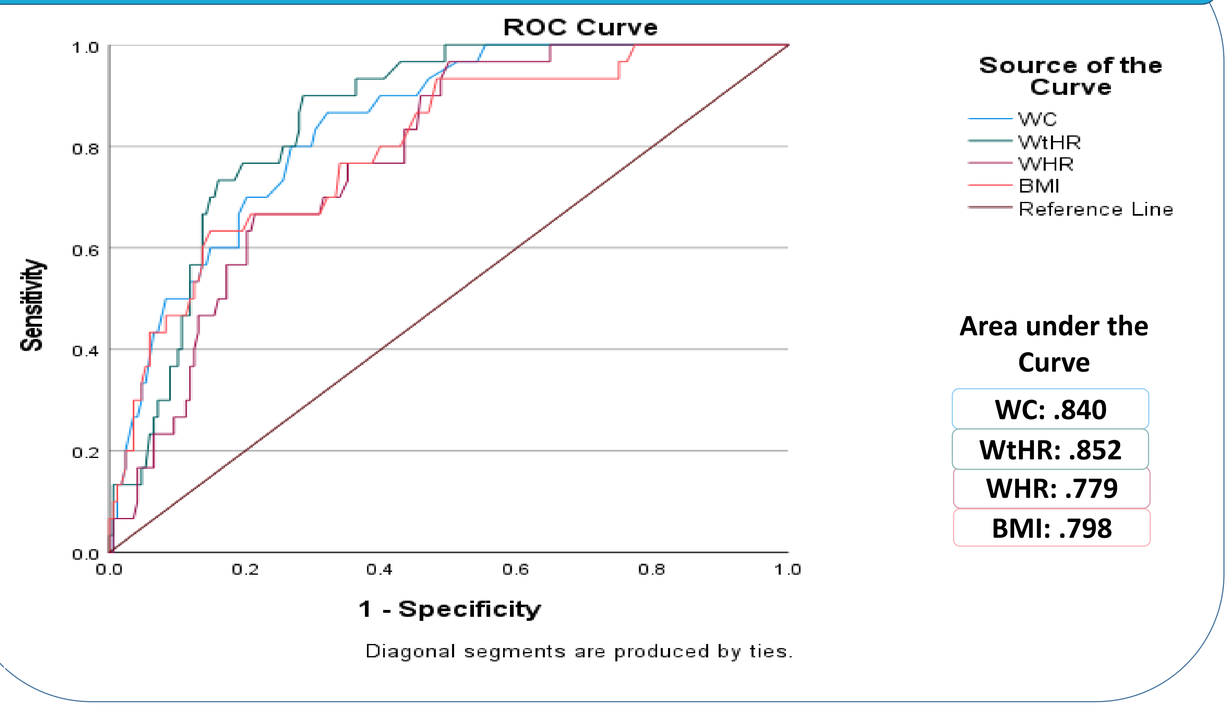
ROC Curve of WC, WtHR, WHR and BMI to assess the validity of anthropometrical abdominal obesity markers in diagnosing MS (IDF)



Area under the Curve

- WC: .868
- WtHR: .884
- WHR: .764
- BMI: .858

ROC Curve of WC, WtHR, WHR and BMI to assess the validity of anthropometrical abdominal obesity markers in diagnosing MS (IDF) (new)



Area under the Curve

- WC: .840
- WtHR: .852
- WHR: .779
- BMI: .798

Univariate analysis between anthropometrical abdominal obesity markers and Leptin, Adiponectin, L/A ratio and hs-CRP.

	Leptin		Adiponectin		L: A Ratio		hs-CRP	
	Healthy	MS IDF	Healthy	MS IDF	Healthy	MS IDF	Healthy	MS IDF
WC	0.12	0.11	-0.35**	-0.67**	0.30**	0.60*	0.13	0.47*
BMI	0.16	0.29	-0.29**	-0.58*	0.31**	0.64**	0.15	0.69**
WHR	0.04	-0.19	-0.28**	-0.43	0.20*	0.11	0.14	-0.18
WtHR	0.28**	0.32	-0.33**	-0.69**	0.44**	0.70**	0.17*	0.76**
Trunk Fat	0.41**	0.42	-0.06	-0.20	0.42**	0.48	0.18*	0.52*

Discussion

- The present study highlights the potential of using the L/A Ratio and WtHR, to identify individuals at a higher risk of developing MetS.
- Previous studies suggest that the L/A ratio is a superior biomarker for MetS
- Universally applicable threshold value is underreported due to conflicting cut off values across sex, age groups, and race[8].
- WtHR is recognised as a more accurate MetS marker than WC, BMI, and visceral fat measures[9]
- A novel predictive score, was proposed, that combines the L/A Ratio and WtHR to aid in identifying MetS in the general population.
- Strengths ➔ focus on a subclinical cohort. Limitations ➔ missing data for some participants and biases introduced during the recruitment process

Conclusion

In summary, the present findings suggest that WtHR and L/A ratio are useful diagnostic tools for identifying MetS in the subclinical population. The present data strongly supports the use of WtHR as the primary measure for diagnosing abdominal obesity and MetS, with potential value in early detection, however, larger studies are needed to confirm their applicability for a general population.

References

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