

Waist to height ratio 0.5 as global screening tool for cardiovascular risk factors

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“KEEP YOUR WAIST CIRCUMFERENCE TO LESS THAN HALF YOUR HEIGHT”

Abstract

Introduction:

BMI does not distinguish central obesity; waist circumference (WC) requires different cut-offs for men, women and children. Can a single boundary value of the waist to height ratio (WHtR) be a global screening indicator for central obesity and CVD risk?

Method: National Diet and Nutrition Survey data* used to examine associations with CVD risk factors in 1776 adults aged 19 to 64 years.

Results: WHtR was more highly correlated with total, HDL, non-HDL cholesterol and BP than BMI and WC.

Classification by BMI (above or below 25kg/m²) and WHtR (above 0.5='apples' or below 0.5='pears') showed 'apples' had higher levels of all measured CVD risk factors than 'pears' who had similar levels of risk factors, whether they were overweight or not.

Most interesting, non-overweight 'apples' are at higher CVD risk than overweight 'pears'; (non-HDL cholesterol + 0.3mmol/l, SBP +4mmHg, DBP + 3mmHg, while 17% of all men and 6% of all women would be misclassified as without risk if screened by BMI alone.

Conclusion: WHtR is a simple, effective, non-invasive screening tool for CVD risk factors.

We propose a simple public health message "Keep your waist circumference to less than half your height" (WHtR<0.5).

Aim

How strong is the association between various indices of obesity, central obesity and cardiovascular risk factors using British nationally representative adult survey data?

Methods

Data* were obtained from the UK Data Archive and analysed using SPSS v 16 and 17 (SPSS UK Ltd). Measurements were taken twice by trained fieldworkers, Weight was in light clothing without shoes. Waist circumference measurement was taken at the midway point between the iliac crest and the lower rib at the end of a normal expiration.

Partial correlations were adjusted for age and sex. ANCOVA was used to assess differences between groups classified according to BMI and WHtR. Bonferroni correction was used for multiple pairwise comparisons.

*Ruston D, Hoare J, Henderson L, Gregory J, Bates CJ, Prentice A, Birch M, Swan G, Farron M (2004): The National Diet and Nutrition Survey: adults aged 19-64 years. Volume 4: Nutritional status (anthropometry and blood analytes), blood pressure and physical activity. London, The Stationery Office

Results

Details of subjects

1776 adults provided data for weight, height and waist circumference. Their mean age (42 years, SD 12) was identical to that of the total sample (n =2251).

Relationship of anthropometric indices with each other

BMI, waist circumference and waist to height ratio were all strongly correlated with each other (P<0.0001). Age and sex adjusted coefficients: 0.844 (BMI vs waist), 0.86 (BMI vs. WHtR), 0.95 (waist vs. WHtR).

Relationship of anthropometric indices with CVD risk factors

Correlation coefficients were higher for WHtR than for BMI in both men and women. Correlations were fair (r>0.25) for HDL cholesterol and systolic blood pressure, weaker for non-HDL cholesterol and weakest for total plasma cholesterol.

Four groups defined according to BMI and waist to height ratio (% sample)

non-overweight 'pears' (BMI < 25, WHtR< 0.5) (32%),
overweight 'pears' (BMI >25, WHtR< 0.5) (6%),
non-overweight 'apples' (BMI< 25, WHtR>0.5)(9%)
overweight 'apples' (BMI>25, WHtR>0.5) (53%)

Shape is more important than weight for CVD risk**

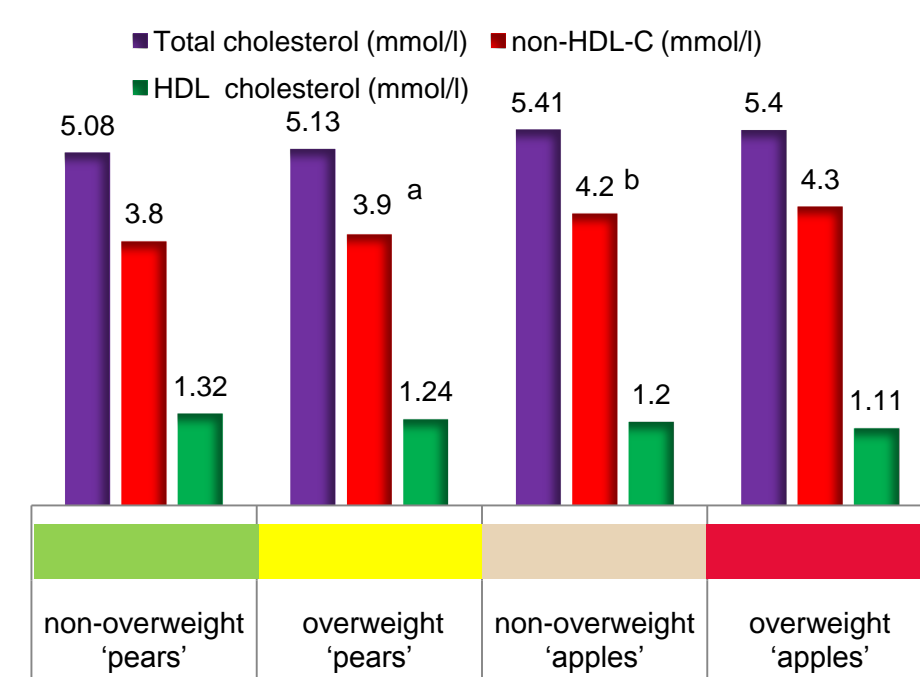
BMI and WHtR group#	non-overweight 'pears'	overweight 'pears'	non-overweight 'apples'	overweight 'apples'
	1	2	3	4
Number of subjects	562	114	154	946
Age (years) prior to adjustment	38	38	45	45
% men/%women	30/70	22/78	60/40	55/45
Total cholesterol (mmol/l)	5.08 ^a	5.13 ^a	5.41 ^b	5.40 ^b
Non-HDL cholesterol (mmol/l)	3.8 ^a	3.9 ^a	4.2 ^b	4.3 ^b
HDL cholesterol (mmol/l)	1.32 ^a	1.24 ^{ab}	1.20 ^b	1.11 ^c
Systolic BP (mmHg)	121 ^a	121 ^a	125 ^b	128 ^c
Diastolic BP (mmHg)	68 ^a	68 ^a	71 ^b	72 ^b

^{a,b,c} For each risk factor, values sharing the same superscript are not significantly different (P>0.05)

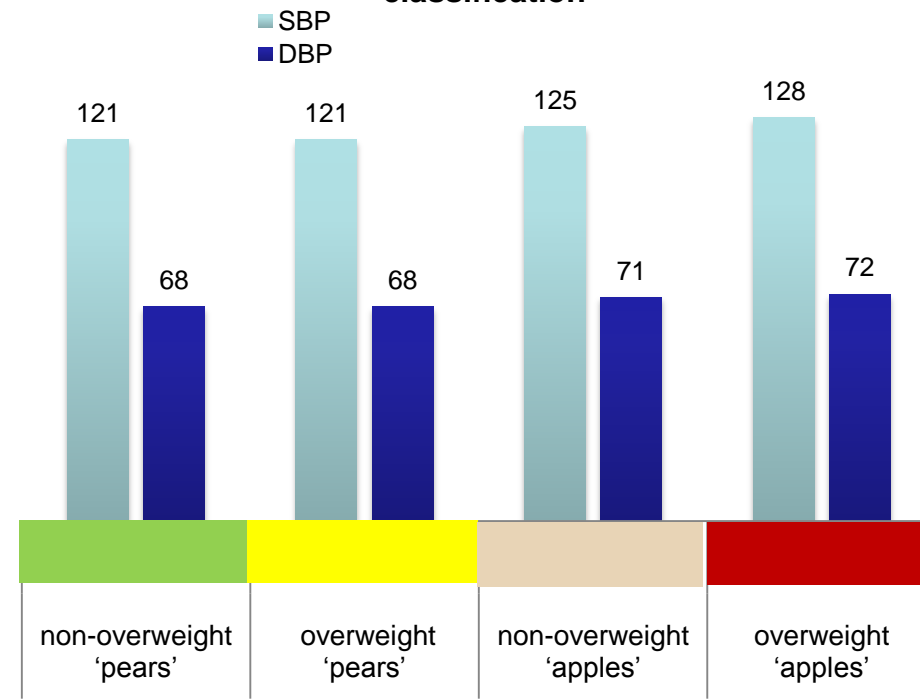
See box for definitions of groups according to BMI and WHtR

**estimated means were adjusted for age (to mean age 42 yrs) and sex. n=1249 for cholesterol measurements

Blood lipids according to BMI and WHtR classification



Blood pressure according to BMI and WHtR classification



'Apples' (groups 3 and 4) had higher levels of all risk factors than 'pears' (groups 1 and 2). By contrast, the differences attributable to weight (gp 1 vs 3; gp 2 vs 4) were smaller.

'Pears' (groups 1 and 2) had similar levels of risk factors irrespective of whether they were overweight or not (ie BMI status).

Most interesting, non-overweight 'apples' (Group 3) appeared to be at higher risk than overweight 'pears' (Group 2). Thus non-HDL cholesterol was 0.3mmol/l (7%) higher, while SBP and DBP were 4mmHg and 3mmHg higher in Group 3 compared with Group 2. These differences are clinically significant.

Conclusions

More than one in three normal weight men and one in seven normal weight women, may be at increased health risk on account of their central fat distribution.

In the total population this equates to 17% of all men and 6% of all women who would be inadequately screened by BMI alone.

An action point based on WHtR 0.5 could be a simpler and more effective global screening tool for health promotion than tools based on BMI or waist circumference.