Consequences of Change in Waist Circumference on Cardiometabolic Risk Factors Over 9 Years

Data from an Epidemiological Study on the Insulin Resistance Syndrome (DESIR)

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Obesity and abdominal adiposity have been shown in prospective studies to be risk factors for cardiovascular disease and particularly for diabetes (1–8). In cross-sectional studies, both are related with risk factors for these diseases (9–12), but there are few publications on the effects of changes in abdominal adiposity (13). We characterized men and women who gained and lost abdominal adiposity over 9 years and describe the incidence and the improvement in cardiometabolic risk factors according to changes in waist circumference.

RESEARCH DESIGN AND METHODS

— From the Data from an Epidemiological Study on the Insulin Resistance Syndrome (DESIR) cohort (9,14,15), 1,868 men and 1,939 women aged 30–64 years at baseline were followed over 9 years. The 73% of the baseline cohort that we studied were older, less frequently abdominally obese, hypertriglyceridemic, hyperinsulinemic, smokers, and fewer had metabolic syndrome. Cardiometabolic abnormalities and the metabolic syndrome were defined according to the National Cholesterol Education Program (NCEP) criteria (16), except high blood pressure, which included antihypertensive treatment (Table 1); hyperinsulinemia was defined by upper quartiles of fasting insulin ≥57.3 pmol/l for men and ≥52.8 pmol/l. The incidence and improvement of cardiometabolic risk factors were studied by age-adjusted logistic regression, according to waist change: ≤ −3.0 cm, −2.9 to +2.9 cm, 3.0–6.9 cm, and ≥7.0 cm. Statistical significance was defined as $P < 0.05$.

RESULTS — The median increase in waist circumference was 3 cm in men and 4 cm in women; 25 and 34% of men and women, respectively, increased their waist by ≥7 cm, 14% decreased their waist by ≥3 cm, and 29% remained stable (±2.9 cm).

Men whose waist decreased were older and had a larger waist circumference and BMI at baseline. Age was not significantly related to waist change in women; however, women who became slimmer had a larger baseline waist but similar BMI. Men who decreased alcohol intake reduced their waist circumference. Stopping smoking was associated with an increase in waist circumference, but smoking at baseline was associated with a gain in waist circumference in only men. Baseline physical activity did not influence waist change, but an increase was associated with a decreasing waist circumference.

The incidence of abdominal obesity was 10% in men and 15% in women (Table 1). Of all risk factors, high blood pressure had the highest incidence (48 and 30%, respectively), and the incidences of the metabolic syndrome were 8% for men and 7% for women. The metabolic syndrome and all cardiometabolic factors showed significant trends that became worse with an increasing waist (with one exception, LDL cholesterol in women). The odds ratios (95% CI) for an incident metabolic syndrome were 7.9 (4.4–13.9) in men and 4.7 (2.7–8.0) in women who increased their waist by ≥7 cm, compared with a stable waist circumference. Results were not changed after adjusting for baseline waist circumference or BMI. Adjusting for 9-year BMI change, only the metabolic syndrome ($P < 0.0001$) in both sexes and fasting insulin in women ($P = 0.02$) remained statistically significant. Further adjustment for change in smoking habits or physical activity did not alter these associations.

Of those abdominally obese at baseline, 19% of men and 10% of women improved at 9 years (Table 1). High blood pressure was the abnormality that improved the least. Of those with the metabolic syndrome at baseline, 47% of men and 38% of women no longer had it at 9 years. A decreasing waist circumference was beneficially associated with the syndrome, triglycerides, and insulin in both men and women and blood pressure in women. Further adjustment for baseline waist circumference or BMI did not alter these results, but after adjustment for change in BMI, relations remained significant only in women for the syndrome, triglycerides, and blood pressure. These improvements were not due to starting or continuing drug treatment (data not shown).

Table 1—*Age-adjusted odds ratios of the incidence of cardiometabolic parameters according to change in waist circumferences*

	Incidence (%)	≤−3 cm	−2.9 to +2.9 cm	3–6.9 cm	≥7 cm	P for trend
Men						
n		250	542	488	659	
Incidence						
Waist circumference >102 cm	177/1,716 (10)	No cases	1	5.00 (4.29–10.0)	21.25 (10.9–41.2)	<0.0001
Glucose ≥6.1 mmol/l	121/1,583 (8)	0.79 (0.40–1.57)	1	1.18 (0.72–1.94)	1.68 (1.03–2.72)	0.01
Blood pressure ≥130/85 mmHg or treated for hypertension	276/579 (48)	0.58 (0.32–1.07)	1	0.93 (0.61–1.42)	1.49 (0.95–2.33)	0.008
Triglycerides ≥1.7 mmol/l	181/1,498 (12)	0.78 (0.42–1.44)	1	1.21 (0.78–1.86)	2.29 (1.53–3.44)	<0.0001
HDL cholesterol <1.03 mmol/l	94/1,738 (5)	0.64 (0.27–1.50)	1	1.39 (0.79–2.42)	1.97 (1.14–3.41)	0.001
LDL cholesterol ≥4.13 mmol/l	240/1,280 (19)	0.85 (0.51–1.41)	1	1.23 (0.85–1.78)	1.39 (0.96–2.02)	0.02
Insulin ≥57.3 pmol/l	492/1,401 (35)	0.67 (0.45–1.00)	1	1.57 (1.18–2.09)	2.33 (1.73–3.14)	<0.0001
NCEP metabolic syndrome	135/1,693 (8)	0.57 (0.19–1.72)	1	2.39 (1.28–4.44)	7.87 (4.46–13.88)	<0.0001
Improvement						
Waist ≤02 cm	29/152 (19)	32.1 (6.84–151)	1	No cases	No cases	<0.0001
Glucose <6.1 mmol/l	137/285 (48)	0.69 (0.34–1.41)	1	0.62 (0.33–1.15)	0.69 (0.36–1.32)	0.5
Blood pressure <130/85 mmHg and not treated for hypertension	213/1,289 (17)	1.03 (0.66–1.63)	1	0.77 (0.52–1.14)	0.76 (0.50–1.14)	0.09
Triglycerides <1.7 mmol/l	187/370 (51)	0.95 (0.50–1.81)	1	0.81 (0.48–1.38)	0.45 (0.25–0.81)	0.01
HDL cholesterol ≥1.03 mmol/l	71/130 (55)	1.25 (0.37–4.20)	1	0.55 (0.21–1.46)	0.74 (0.30–1.84)	0.3
LDL cholesterol <4.13 mmol/l	288/588 (49)	1.35 (0.82–2.22)	1	0.91 (0.59–1.40)	1.09 (0.69–1.72)	0.5
Insulin <57.3 pmol/l	101/467 (22)	1.45 (0.78–2.70)	1	0.93 (0.54–1.62)	0.27 (0.13–0.57)	<0.0001
No NCEP metabolic syndrome	83/175 (47)	0.93 (0.41–2.12)	1	0.59 (0.27–1.32)	0.38 (0.16–0.91)	0.03
Women						
n		250	542	488	659	
Incidence						
Waist >88 cm	250/1,679 (15)	No cases	1	7.91 (3.52–17.8)	39.4 (18.2–85.1)	<0.0001
Glucose ≥6.1 mmol/l	73/1,845 (4)	0.28 (0.06–1.24)	1	0.83 (0.38–1.83)	2.72 (1.49–4.96)	<0.0001
Blood pressure ≥130/85 mmHg or treated for hypertension	306/1,013 (30)	1.18 (0.72–1.94)	1	1.53 (1.04–2.23)	1.52 (1.07–2.17)	0.0370
Triglycerides ≥1.7 mmol/l	140/1,784 (8)	1.11 (0.57–2.17)	1	1.14 (0.66–1.96)	2.23 (1.40–3.54)	0.0006
HDL cholesterol <1.29 mmol/l	193/1,759 (11)	0.70 (0.38–1.31)	1	1.09 (0.70–1.69)	1.88 (1.29–2.75)	<0.0001
LDL cholesterol ≥4.13 mmol/l	294/1,552 (19)	0.82 (0.52–1.30)	1	0.80 (0.56–1.15)	1.13 (0.82–1.55)	0.2
Insulin ≥52.8 pmol/l	479/1,455 (33)	0.71 (0.47–1.09)	1	1.21 (0.89–1.65)	2.55 (1.92–3.38)	<0.0001
NCEP metabolic syndrome	131/1,815 (7)	0.48 (0.16–1.45)	1	1.28 (0.67–2.45)	4.69 (2.77–7.93)	<0.0001
Improvement						
Waist ≤88 cm	29/260 (10)	54.9 (7.09–426)	1	No cases	No cases	<0.0001
Glucose <6.1 mmol/l	35/94 (37)	0.29 (0.07–1.24)	1	0.23 (0.07–0.83)	0.44 (0.14–1.37)	0.7
Blood pressure <130/85 mmHg and not treated for hypertension	196/926 (21)	0.90 (0.54–1.49)	1	0.66 (0.42–1.03)	0.37 (0.23–0.57)	<0.0001
Triglycerides <1.7 mmol/l	93/155 (60)	1.78 (0.61–5.18)	1	0.64 (0.26–1.62)	0.45 (0.20–1.03)	0.008
HDL cholesterol ≥1.29 mmol/l	82/180 (46)	2.53 (0.94–6.82)	1	0.84 (0.33–2.15)	1.43 (0.63–3.23)	0.4
LDL cholesterol <4.13 mmol/l	217/387 (56)	1.00 (0.54–1.87)	1	0.92 (0.53–1.62)	0.81 (0.48–1.37)	0.4
Insulin <52.8 pmol/l	109/484 (23)	1.31 (0.69–2.50)	1	0.67 (0.36–1.22)	0.47 (0.27–0.81)	0.0005
No NCEP metabolic syndrome	47/124 (38)	3.78 (1.28–11.13)	1	0.45 (0.14–1.50)	0.68 (0.25–1.87)	0.003

Data are odds ratio (95% CI) or ratio (%). *P* values are adjusted for age.

CONCLUSIONS — A changing waist circumference affected cardiometabolic risk factors, and this was most clearly seen for the metabolic syndrome, which accumulates the effects of individual abnormalities. After accounting for changes in BMI, reducing waist by ≥3 cm only had a significant beneficial effect on the metabolic syndrome in women, and increasing waist by ≥7 cm had a detriment effect in both sexes.

Overall, those who reduced their waist were older and more abdominally obese, and fewer men smoked at baseline. Such men and women might be receptive toward targeted intervention. Further, an increase in physical activity had beneficial effects in our study. The only other report that we have found on the effects of waist circumference change on cardiometabolic risk factors is a 10-year study of Chinese adults (13). Both waist and BMI change, together, were related to change in systolic blood pressure and hypertension. In our European population, a comparable result was found only in women.

Though not all individuals were able to be followed-up, there were no differences in baseline waist circumference or changes in waist circumference over 3 and 6 years with those studied.

Increasing abdominal adiposity was associated with individual cardiometa-

bolic risk factors and their aggregation in the metabolic syndrome in both men and women. Unfortunately, a decreasing waistline did not always have a large effect on risk factors, as aging is also inherent when following populations. The metabolic syndrome was still associated with changing waist circumference after taking account of changing BMI, indicating the importance of this simple clinical measure.

APPENDIX

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