Consequences of change in waist circumference on cardio-metabolic risk-factors over 9-years. The D.E.S.I.R. Study

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Abbreviations: D.E.S.I.R.,Data from an Epidemiological Study on the Insulin Resistance Syndrome•NCEP,National Cholesterol Education Program

Obesity and abdominal adiposity have been shown to be risk factors for cardiovascular disease and particularly for diabetes in prospective studies (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 characterise men and women who gained and lost abdominal adiposity over nine years and describe the incidence and the improvement in cardio-metabolic risk factors according to changes in waist circumference.

RESEARCH DESIGN AND METHODS—From the D.E.S.I.R. cohort (9,14,15), 1868 men, 1939 women, 30-64 years at baseline, were followed over nine years; the 73% of the cohort studied were older, less frequently abdominally obese, hypertriglyceridemic, hyperinsulinemic, smokers and fewer had the metabolic syndrome. Cardio-metabolic abnormalities and the metabolic syndrome were defined according to the NCEP criteria (16), except high blood pressure included anti-hypertensive treatment (Table); hyperinsulinemia was defined by upper quartiles of fasting insulin ≥57.3, 52.8pmol/l (men, women). The incidence and improvement of cardio-metabolic risk factors were studied by age-adjusted logistic regression, according to waist change: (≤-3.0cm);(-2.9 to +2.9cm);(+3.0 to +6.9cm);(≥+7.0cm). Statistical significance was defined as $P<0.05$.

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

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

The incidence of abdominal obesity was 10% in men, 15% in women (Table). Of all risk factors, high blood pressure had the highest incidence, (48% and 30% respectively) and. the incidences of the metabolic syndrome were 8% and 7%. The metabolic syndrome and all cardio-metabolic factors showed significant trends to worsen 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 more than 7cm, compared to a stable waist. Results were not changed after adjusting for baseline waist 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). High blood pressure was the abnormality which 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 was associated beneficially with the syndrome, triglycerides and insulin in both men and women, and blood pressure in women. Further adjustment for baseline waist 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).

CONCLUSION—A changing waist affected cardio-metabolic 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 3cm or more only had a significant beneficial effect on the metabolic syndrome in women, and increasing waist by more than 7cm 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 towards 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 change on 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 only found in the women.

While not all individuals were able to be followed-up, there were no differences in baseline waist nor in changes in waist over 3 and 6 years, with those studied.

An increasing abdominal adiposity was associated with individual cardio-metabolic 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 ageing 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.

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Table—*Age-adjusted odds ratios of the incidence of cardio-metabolic parameters according to change in waist circumference group; p-values for trend, adjusted for age. The D.E.S.I.R. Study*

Men

	incidence	**≤ -3 cm** n=250	**-2.9 to +2.9 cm** n=542	**3 to 6.9cm** n=488	**≥ 7 cm** n=659	P-value trend
INCIDENCE				**Odds ratios**		
Waist > 102 cm	*177/1716=10%*	no cases	1	**5.00 (4.29-10.0)**	**21.25 (10.9-41.2)**	**<.0001**
Glucose ≥ 6.1 mmol/l	*121/1583=8%*	0.79 (0.40-1.57)	1	1.18 (0.72-1.94)	**1.68 (1.03-2.72)**	**.01**
Blood pressures ≥ 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)	**.008**
Triglycerides ≥ 1.7 mmol/l	*181/1498=12%*	0.78 (0.42-1.44)	1	1.21 (0.78-1.86)	**2.29 (1.53-3.44)**	**<.0001**
HDL cholesterol < 1.03 mmol/l	*94/1738=5%*	0.64 (0.27-1.50)	1	1.39 (0.79-2.42)	**1.97 (1.14-3.41)**	**.001**
LDL cholesterol ≥4.13 mmol/l	*240/1280=19%*	0.85 (0.51-1.41)	1	1.23 (0.85-1.78)	1.39 (0.96-2.02)	**.02**
Insulin ≥ 57.3 pmol/l	*492/1401=35%*	0.67 (0.45-1.00)	1	**1.57 (1.18-2.09)**	**2.33 (1.73-3.14)**	**<.0001**
NCEP metabolic syndrome	*135/1693=8%*	0.57 (0.19-1.72)	1	**2.39 (1.28-4.44)**	**7.87 (4.46-13.88)**	**<.0001**
IMPROVEMENT				**Odds ratios**		
Waist ≤ 102 cm	29/152=19%	**32.1 (6.84-151)**	1	no cases	no cases	**<.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 pressures < 130 and 85 mmHg and not treated for hypertension	213/1289=17%	1.03 (0.66-1.63)	1	0.77 (0.52-1.14)	0.76 (0.50-1.14)	.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)**	**.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)	.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)	.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)**	**<.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)**	**.03**

Women

	incidence	≤ -3 cm n=250	-2 to +2.9 cm n=542	3 to 6.9cm n=488	≥ 7 cm n=659	P-value trend
INCIDENCE				**Odds ratios**		
Waist > 88 cm	*250/1679=15%*	no cases	1	**7.91 (3.52-17.8)**	**39.4 (18.2-85.1)**	**<.0001**
Glucose ≥ 6.1 mmol/l	*73/1845=4%*	0.28 (0.06-1.24)	1	0.83 (0.38-1.83)	**2.72 (1.49-4.96)**	**<.0001**
Blood pressures ≥ 130/85 mmHg or treated for hypertension	*306/1013=30%*	1.18 (0.72-1.94)	1	**1.53 (1.04-2.23)**	**1.52 (1.07-2.17)**	**.0370**
Triglycerides ≥ 1.7 mmol/l	*140/1784=8%*	1.11 (0.57-2.17)	1	1.14 (0.66-1.96)	**2.23 (1.40-3.54)**	**.0006**
HDL cholesterol < 1.29 mmol/l	*193/1759=11%*	0.70 (0.38-1.31)	1	1.09 (0.70-1.69)	**1.88 (1.29-2.75)**	**<.0001**
LDL cholesterol ≥4.13 mmol/l	*294/1552=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	*479/1455=33%*	0.71 (0.47-1.09)	1	1.21 (0.89-1.65)	**2.55 (1.92-3.38)**	**<.0001**
NCEP metabolic syndrome	*131/1815=7%*	0.48 (0.16-1.45)	1	1.28 (0.67-2.45)	**4.69 (2.77-7.93)**	**<.0001**
IMPROVEMENT				**Odds ratios**		
Waist ≤ 88 cm	29/260=10%	**54.9 (7.09-426)**	1	no cases	no cases	**<.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 pressures < 130 and 5 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)**	**<.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)	**.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)	**.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)	**.003**