

## The Effect of Physical Activity on Body Fat

Samaras K, Kelly PJ, Chiano MN, Spector TD, Campbell LV. Genetic and environmental influences on total-body and central abdominal fat: the effect of physical activity in female twins. *Ann Intern Med* 1999;130:873–82.

### Study Overview

**Objective.** To examine (1) the effect of physical activity on total-body and central abdominal fat, independent of genetic and other environmental factors; and (2) the effect of physical activity in persons genetically susceptible to generalized or central adiposity.

**Design.** Cross-sectional and case-control twin study.

**Setting and participants.** A London teaching hospital. 970 healthy white female twins, ranging in age from 39 to 70 years (mean age, 55.5 years) and ranging in body mass index (BMI) from 16.4 to 44.0 kg/m<sup>2</sup> (mean BMI, 24.4 kg/m<sup>2</sup>). There were 241 monozygotic pairs, 228 dizygotic pairs, and 32 women whose co-twin lacked complete data. Fifty-six percent of the participants were of normal weight, 30% were overweight, 7% were obese, and 7% were underweight.

**Main outcome measures.** Total-body and central abdominal fat were measured by dual-energy x-ray absorptiometry. Physical activity was assessed by 2 standardized quantitative and semi-quantitative questionnaires administered by trained research nurses. One instrument (a modified version of instruments developed by Spector et al and Paffenberger et al [1,2]) assessed overall current physical activity at home or work, in sport, and in walking. The second (a modified version of the Allied Dunbar National Fitness Survey [3]) assessed whether the subject engaged in leisure time physical activity and quantified the amount of time (in 15-minute units) spent engaging in weight-bearing and non-weight-bearing sports of varying intensity. Data on dietary intake, socioeconomic status, smoking status, and use of hormone replacement therapy (HRT) were also gathered.

**Main results.** Higher levels of home, sport, and sweating-associated activity were associated with lower total-body and central abdominal adiposity. Total-body and central abdominal fat were 5.6 kg and 0.44 kg lower, respectively, in participants who reported vigorous weight-bearing activity. Physical activity was the strongest independent predictor of total body fat ( $\beta = -0.6$  [95% confidence interval (CI),  $-1.06$  to  $-0.15$ ];  $P = 0.009$ ) and central abdominal fat ( $\beta = -0.07$  [95% CI,

$-0.1$  to  $-0.03$ ];  $P < 0.001$ ) in a regression model that included age, diet, smoking, HRT use, and socioeconomic status.

Monozygotic twin pairs concordant for smoking and HRT status but discordant for moderate-intensity sports activity showed greater within-pair differences in total body fat than those concordant for activity level. For example, 1 hour and 2 hours per week of moderate-intensity sports activity accounted for within-pair differences respectively of 1.0 kg ( $P = 0.05$ ) and 1.4 kg ( $P = 0.04$ ) of total body fat. In participants with a high genetic risk for obesity (those with an overweight twin), the differences in total body fat and central abdominal fat between high- and low-activity groups (3.96 kg and 0.53 kg) were greater than the differences between high- and low-activity groups in participants with a low genetic risk (2.05 kg and 0.20 kg).

### Conclusion

Physical activity seems to exert greater influence on total-body fat and central abdominal fat than any other measured environmental factors, including reported dietary carbohydrate and fat intake, smoking, socioeconomic class, and HRT use. Physical activity did not have a lesser effect on body fat values in those genetically predisposed to adiposity.

### Commentary

Obesity is a major risk factor for type 2 diabetes and cardiovascular disease [4,5]. Although genetic factors may influence obesity, the increasing prevalence of obesity and overweight in society cannot be explained by changes in society's genetic composition but rather may be related to environmental factors. This study of twins quantified the influence of various environmental factors on obesity, independent of genetic factors. Cross-sectional analyses confirmed the inverse relationship between physical activity and both total-body and central abdominal fat: the lowest fat values were found in physically active participants.

### Applications for Clinical Practice

This study's findings support physical activity as the strongest environmental determinant of total body and central abdominal fat in healthy, middle-aged women. Medical professionals who direct programs aimed at reducing obesity and its adverse clinical outcomes may use these findings in designing their programs and as motivation for the participants.

### References

1. Spector TD, Harris PA, Hart DJ, Cicuttini FM, Nandra D, Etherington J, et al. Risks of osteoporosis associated with long-term weight-bearing sports. A radiological survey of the hips and knees in female ex-athletes and population controls. *Arthritis Rheum* 1996;39:988-95.
2. Paffenbarger RS Jr, Hyde RT, Wing AL, Hsieh CC. Physical activity, all-cause mortality, and longevity of college alumni. *N Engl J Med* 1986;314:605-13.
3. Health Education Council and Sports Council. Allied Dunbar National Fitness Survey. London: Belmont Press; 1992.
4. Ohlson O, Larsson B, Svardsudd K, Welin L, Eriksson H, Wilhelmsen L, et al. The influence of body fat distribution on the incidence of diabetes mellitus. 13.5 years of follow-up of the participants in the study of men born in 1913. *Diabetes* 1985;34:1055-8.
5. Freedman DS, Wiliamson DF, Croft JB, Ballew C, Byers T. Relation of body fat distribution to ischemic heart disease. The National Health and Nutrition Examination Survey I (NHANES I) Epidemiologic Follow-up Study. *Am J Epidemiol* 1995;142:53-63.

Copyright 1999 by Turner White Communications Inc., Wayne, PA. All rights reserved.