Published in final edited form as:

Med Sci Sports Exerc. 2005 November ; 37(11): 1893.

Nonlinear Relationships between Weekly Walking Distance and Adiposity in 27,596 Women

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Abstract

Introduction—Data from vigorously active women (runners) suggested that declines in adiposity with weekly running distance were nonlinear and dependent on whether the women are relatively lean or fat. The purpose of the current study is to assess the cross-sectional relationship between the amount of moderate-intensity physical activity (walking distance) and indicators of adiposity.

Methods—Cross-sectional analyses (i.e., quadratic polynomial regression, regression for percentiles of adiposity) of body mass index (BMI), body circumferences, and bra cup sizes in 27,596 women.

Results—The estimated percent reductions between walking 40–50 km/wk and <10 km/wk were greatest for BMI, intermediate for waist circumference and cup size, and least for hip and chest circumferences. The relationships of walking distance to BMI and body circumferences were all nonlinear (convex). In addition, the inverse relationship between weekly walking distance and adiposity was greatest at the highest percentile of BMI, body circumferences, and cup size, and least at the lowest percentiles. Thus, the decline in adiposity per kilometer per week increment in walking distance was greatest in overweight mostly sedentary women and least in lean active women. The decline in BMI per kilometer per week of exercise was greater in the walkers than previously reported for runners. However, based on the relationships between walking distance and percentiles of the BMI distribution reported here, we show that the majority of this difference is attributable to the leanness of the runners and greater fatness of the walker.

Conclusion—These data suggest that in women the greatest benefit of walking may be among the most obese and that at higher weekly distances the declines in weight associated with walking diminish. Whether these relationships are causal remains to be determined.

Keywords

exercise; body mass index; regional adiposity; waist circumference

Walking is specifically recommended for achieving the minimum exercise goals set forth by the Centers for Disease Control and Prevention and other government and non-government organizations [19,27]. It is among the most common forms of exercise in women, with 47% of U.S. women reporting participation [24]. Cross-sectional studies have shown that women who maintain a higher level of physical activity are leaner than less active women [5,9,22, 25]. This is consistent with some experimental studies that show reductions in body weight or fat when women become more active [1,2].

Although some studies have described the relationship between adiposity and walking [5,9, 22,25], few have focused specifically on whether the relationship was linear or targeted women engaged in one specific activity. Most studies postulate a linear relationship explicitly or by their choice of statistics, that is, simple linear regression or Pearson correlation [5,25]. They

also usually postulate linearity when relationships between activity and health outcomes are statistically adjusted for adiposity.

In runners, Williams [29,30] recently showed that the relationship between adiposity and weekly distance run depended on the percentile of the BMI distribution, with the slope being greatest (most negative) at the highest body mass index (BMI) percentiles and least at lower percentiles. Per mile run per week, the calculated decrease in women's BMI was ninefold greater at the 95th than the 5th percentile [29]. Thus, the estimated effect of running on BMI (or the effect of self-selection) was greatest in women who were the most overweight and least in those who were relatively lean.

The present study extends previous findings to women walkers who participated in the baseline survey of the National Walkers' Health Study. Specifically, we wished to determine whether the cross-sectional relationships might suggest greater benefits to fatter or leaner women (which may indicate who might benefit most from walking) and whether the benefits with respect to weight loss accrue at both shorter and longer distances (suggesting an optimal weekly effort). This large cohort included a high proportion of women who walked substantial distances. The large cohort allowed testing for consistency across the age groups. Recently developed statistical procedures are applied to test whether the relationships between walking distance and five indicators of obesity (BMI; circumferences of the waist, hip, and chest; bra cup size) are linear or nonlinear, and whether they depend on the percentile of adiposity [29, 30].

Materials and Methods

A two-page mailed questionnaire, completed by 7% of subscribers of Walking Magazine (Boston, MA), solicited information on demographics (age, race, education), walking history (age when began walking at least 12 miles per week, current average weekly mileage, frequency, longest walk, usual walking speed), weight history (greatest and current weight; weight when started walking; least weight as a walker; body circumferences of the chest, waist, and hips; bra cup size), diet (vegetarianism and the current weekly intakes of alcohol, red meat, fish, fruit, vitamin C, vitamin E, and aspirin), current and past cigarette use, history of heart attacks and cancer, and medications for blood pressure, thyroid, cholesterol, or diabetes. Walking distances were reported in miles per week, body circumferences in inches, and body weights in pounds. These values were converted to kilometers per week, centimeters, and kilograms, respectively. The current paper focuses exclusively on the relations of walking distance to indicators of adiposity, deferring to later analyses of the additional effects of walking history, frequency, or intensity.

BMI was calculated as the weight in kilograms divided by height in meters squared. Self-reported body circumferences of the waist, hip, and chest were in response to the question "Please provide, to the best of your ability, your body circumferences in inches" without further instruction. The relationships between circumferences and walking distance are expected to be weakened by different locations of where waist, hip and chest circumferences were measured. However, unless the perceived location varied systematically in relation to walking distance, the subjectivity would be unlikely to produce the relationships reported in the tables and figures.

Waist circumference is reported because it has been shown to be a good indicator of intraabdominal fat [23]. Analyses are reported for chest circumference even though it has not been frequently used as a measure of adiposity. However, others have reported that endurance-oriented physical activity significantly decreases chest diameter [11]. Bra cup sizes were coded on a 5-point scale: 1 (A cup), 2 (B cup), 3 (C cup), 4 (D cup), and 5 (E cup or larger). The study

protocol was reviewed by the University of California Berkeley committee for the protection of human subjects, and all subjects provided a signed statement of informed consent.

Statistical analyses

Except where noted, statistics are reported as mean $\pm$ SE or slopes $\pm$ SE. The relationships of adiposity to walking distance were assessed graphically by determining the mean for each indicator of adiposity within each distance category, separately by age group. In addition, we used standard polynomial regression with adiposity as the dependent variable and walking distance (km/wk) and walking distance squared ((km/wk)²) as the independent variables (Fig. 1). We determined from these equations the tangent slope for selected walking distances (the mathematical change in adiposity corresponding to a 1-km/wk increment in walking distance), which were determined by the first derivative of the polynomial regression equation evaluated at distance X . These are presented because quadratic regression equations are themselves enigmatic, whereas the tangent slope at any particular point is readily interpreted as the estimated change in adiposity for a 1-km increment in weekly distance walked (Fig. 1). The tangent slopes will be the same for all walking distances if the relationship is linear and will become less negative with increasing walking distance if the relationship is convex.

An earlier approach [29,30] for estimating the slope for the k th percentile of Y (dependent variable) versus X (independent variable) involved partitioning the data by X and determining the percentiles of Y within each partition. Simple linear regression was then used to calculate the slope of the k th percentile of Y versus X . The present analyses use polynomial (quadratic) regression instead of simple linear regression because the relationships of walking distance to adiposity were found to be nonlinear. In addition, the present analyses used nearest neighbors instead of data partitions to determine the percentiles of the dependent variable corresponding to each X_i , $i=1, \dots, N$. Specifically, if X is walking distance and Y is BMI, then the bivariate observations (X_i, Y_i) were ordered from the smallest to largest walking distance to yield the ordered set of observations ($X_{[i]}, Y_{[i]}$). For each $X_{[i]}$, we chose the 100 observations that were closest to the walking distance of $X_{[i]}$. The BMI for these 100 observations were then sorted from smallest to largest, and the 5th, 6th, ..., 95th highest BMI were then used as the 5th, 6th, ..., 95th percentiles of BMI at walking distance $X_{[i]}$. Quadratic polynomial regression was then applied to k th percentile of BMI; waist, hip, or chest circumferences; or bra cup size.

RESULTS

Of the 33,598 women who provided complete information on age and weekly walking distance, we excluded 4164 for thyroid medication use, 708 for using medications for diabetes, 1619 for reporting that they smoked cigarettes currently, and 384 for following strict vegetarian diets. Of the remaining 28,342 women, 27,596 (97.4%) provided complete height and weight information so that BMI could be calculated, 22,562 (79.6%) reported their waist circumferences, 22,017 (77.7%) reported hip circumferences, 22,135 (78.1%) reported their chest circumferences, and 24,144 (85.2%) reported bra cup sizes. Table 1 presents the sample distribution and characteristics by self-reported walking distance. Table 2 presents distribution by age of average current walking distance (km/wk).

BMI versus walking distance

Figure 2 (top) displays the average BMI (Y axis) by weekly walking distance (X axis) stratified by age. The corresponding regression coefficients appear in Table 3. The graphs are mostly non-linear; therefore, we applied quadratic equations to quantify their relationships, that is, regression models that included coefficients for both kilometers walked per week (Table 3, column 1) and the square of kilometers walked per week (Table 3, column 2). The statistical significance of the coefficients for squared distances confirm the nonlinearity of the graphs.

The table also presents the tangent slopes at 5 km/wk (column 3), 25 km/wk (column 4), and 50 km/wk (column 5). The data suggest that the declines in the walkers' BMI are greatest at the shorter weekly distances and diminished in magnitude as distance increased (i.e., diminishing impact at higher weekly distances). The estimated effects on BMI of a 1-km increment in walking distance (i.e., the tangent slope) were on average 35% less at 20 km/wk, and 81% less at 40 km/wk, vis-a-vis 5 km/wk.

The bottom part of Figure 2 presents the graphs of the 10th, 50th (median), and 90th percentiles of the walkers' BMI distribution versus weekly walking distance. The graphs suggest that the convex relationship between BMI and weekly distance is most pronounced at the 90th percentile, somewhat diminished at the 50th percentile, and generally indiscernible at the 10th percentile. Figure 3 plots the tangent slopes as a function of the percentile of BMI. Because the relationships are nonlinear, the tangent slopes will differ depending on whether they are evaluated at 10, 20, 30, or 40 km/wk. For example, at 10 km/wk (solid curve), a 1-km increment in weekly distance walked (i.e., from 10 to 11 km/wk) was associated with a 0.038-kg/m² decrease in BMI at the 10th percentile, a 0.073 kg/m² decrease at the 25th percentile, a 0.137 kg/m² decrease at the 50th percentile, a 0.223 kg/m² decrease at the 75th percentile, and a 0.299 kg/m² decrease at the 90th percentile of the BMI distribution. However, the relationship of BMI to distance walked is nonlinear (specifically convex); therefore a 1-km/wk increment in walking distance was associated with a smaller decline in BMI at longer weekly distances (e.g., 40–41 km/wk) than shorter distances (e.g., 10–11 km/wk). Correspondingly, at 40 km/wk, there is a smaller difference in slopes between the higher and lower percentiles of the BMI distribution (the curves all being more horizontal) than at 10 km/wk. The convexity of the relationship between BMI and distance was also greater at the highest percentiles of BMI than at the lower percentiles (e.g., the difference in slope between 10 and 40 km/wk is over 16 times greater at the 90th percentile than at the 10th BMI percentile). Together, these data suggest that the decline in BMI associated with a 1-km/wk increment in walking distance was greatest in sedentary overweight walkers and least in physically active lean walkers.

Body circumferences and bra cup size

Figure 4 displays the graphs for waist, hip, and chest circumferences versus walking distance, and Table 3 presents the corresponding regression coefficients. The nonlinearity of the relationships between body circumferences and walking distances is supported by both the significance of the quadratic (squared) terms in the regression analyses of Table 3 (column 2), and the consistent curvature of the graphs across age groups in Figure 4. Compared to going from 5 to 6 km/wk, the decline in waist circumference averages about 33% less when going from 20 to 21 km/wk, and about 78% less when going from 40 to 41 km/wk. The corresponding values are approximately 30% less and 70% less for both hip and chest circumferences. Bra cup size also declined significantly and nonlinearly in association with walking distance for women 18–64 yr old (Fig. 4).

Figure 3 presents the tangent slopes for waist circumference versus walking distance for the 5th through the 95th percentiles of the walkers' waist distribution. As in the case of BMI, the calculated effect of a 1-km/wk increment in walking distance was greatest among the least active women with the broadest waists and least among the most active women with the narrowest waists. Specifically, an increment in walking distance from 10 to 11 km/wk was associated with a decline in waist circumference that was over fivefold greater at the 90th percentile than at the 10th percentile. In contrast, the difference in the tangent slopes between lean (10th percentile) and broad-waisted women (90th percentile) was only half as great (2.3-fold) at 40 km/wk. At the 90th percentile, there was a 3.7-fold difference in the tangent slope between 10 and 40 km/wk, whereas at the 10th percentile there was only a 1.6-fold difference in slopes). Incremental increases in walking distance were associated with declines in hip and

chest circumference that were least in long-distance walkers with narrow hips and small chests and greatest in more sedentary women with large hips and chests (graphs not displayed).

Figure 3 also shows the graph tangent slopes for bra cup sizes. Separate curves are presented for the tangent slopes evaluated at 10, 20, 25, 30, and 40 km/wk. The curves exhibit an oscillating pattern typical for noncontinuous (ordinal) data. The tangent slopes are most negative for the least active women (10 km/wk) and become less negative at longer weekly distances. The amplitude of the oscillation is also greater above than below the 40th percentile of bra cup size, again supporting the paradigm that incremental differences in walking distance were associated with decreases in adiposity (cup size) that are greatest among sedentary large-cupped women and the least among active women with the smallest cup sizes.

Comparisons across indicators of adiposity and between moderate (walking) and vigorous (running) activity

Figure 5 examines the percent difference in BMI; circumferences of the waist, hip and chest; and bra cup size in women walking 40–50 km/wk vis-à-vis 10 km/wk or less. Per kilometer per week walked, the greatest estimated percent reductions were for BMI, slightly less for waist circumference and bra cup size, and least in hip and chest circumferences. Figure 5 also shows that these results are generally in agreement with results previously reported for women runners [29]. Specifically, the women runners showed the greatest apparent reductions in bra cup size, followed by BMI, waist, hip and chest circumferences.

Figure 5 also suggests that the percent reductions in adiposity per kilometer of activity appear to be greater for walkers than runners for all measurements except bra cup size. This may be due in part to walkers being generally fatter than runners. Figure 6 plots the cumulative percentiles of the walkers' BMI distribution (Y axis) versus the cumulative percentiles of the runners' BMI distribution (X axis). The plotted values would lie along the diagonal if the distributions were the same for walkers and runners. However, runners have lower BMI than walkers at any given percentile, and therefore the curve lies below the diagonal. For example, among women who averaged between 5 and 15 km/wk of exercise, the 50th percentile of the walkers' BMI distribution (25.02 kg/m²) corresponds to the 85th percentile of the runners' distribution.

To test whether the differences in walkers' and runners' slopes are explained by the fact that, at any given percentile, walkers have a higher BMI than runners, we replotted the walkers' curves to correspond to the runners' cumulative percentiles. For example, we replotted the walkers' tangent slope for the 50th percentile of BMI (−0.137 kg/m² per km/wk) at the 85th percentile to assess whether the shift in the BMI distribution explained the differences between exercises. The re-plotted curves of Figure 7 (dashed lines) suggest that the greater leanness of the runners accounted for 78% of the difference between the walkers' and runners' slopes at 10 km/wk, 75% of the difference at 20 km/wk, and 77% of the difference at 30 km/wk (there is little difference between the runners' and walkers' slopes at 40 km/wk or more).

Discussion

The results of this study indicate that higher levels of moderate-intensity physical activity (walking) were related to lower levels of adiposity as measured by BMI, body circumferences, and bra cup size. The reductions in adiposity per kilometer per week increase in distance walked suggested by the tangent slopes were greatest at shorter weekly distances and diminished as distance increased. These data are observational and cross-sectional, so that it is not possible to distinguish the causal effects of exercise from effects due to self-selection. Our use of the terminology “increasing weekly distance” in reference to the independent variable and “decreasing adiposity” in reference to the dependent variables pertain only to their

mathematical functional relationship. Nevertheless, our analyses suggest nonlinear relationships between exercise and adiposity that warrant verification experimentally. The differences between sedentary and active walkers were greatest for BMI, substantial for waist circumference and bra cup size, and least for hip and chest circumference. The decreases in adiposity per kilometer per week walked appeared to be greatest among fatter larger women and least among leaner smaller women.

Others have also reported that physical activity may attenuate age-related weight gain [8,21, 30] and weight gain following smoking cessation [14]. One study of Americans showed that consistently inactive women were sevenfold more likely to gain over 10 kg during 10 yr of follow-up as active women [31]. A Finnish cohort found that women who rarely engaged in leisure-time physical activity were nearly twice as likely to gain 5 kg in 5 yr as were those who frequently engaged in such activity [21]. Women who increase their activity show smaller increases in BMI over time [18]. Kahn et al. [12] reported that walking ≥ 4 h/wk was associated with decreases in BMI during 10 yr of follow-up. Haapanen et al. [10] reported that light to moderately active women gained more weight than vigorously active women. Vigorous activity, but not total activity, was reported to be protective against weight gain in the Nurses' Health Study II [7]. Women who exercised vigorously for ≥ 5 h/wk gained about 0.5 kg less than inactive women, whereas every 10 h spent sitting was associated with an 0.11 kg weight gain during 6 yr of follow-up [7]. Others report a significant decrease in waist circumference but not total weight in premenopausal overweight women who take up walking for exercise [4,17].

Women are reported to be vulnerable to weight gain around menopause [15,26]; however, Figures 2 and 4 show little difference between older and younger women, which is consistent with the suggestion that physically active women exhibit smaller differences in adiposity with age than sedentary women [28]. In contrast to the report by DiPietro et al. [6], we found a significant association between higher weekly walking distance and lower adiposity in women under 40 (Figs. 2 and 4). Our analyses are also at variance with the assertion that the association between physical activity and adiposity is restricted to vigorous rather than moderate-intensity activities. For example, Bernstein et al. [3] reported that obesity was significantly less prevalent in the highest versus lowest tertile of high-intensity activity (more than four times the basal metabolic rate) but not less intense activity.

In addition to BMI, we showed an inverse relationship between walking activity and four indicators of regional adiposity, that is, waist, hip, and chest circumferences and bra cup sizes. Others have also shown that women's waist circumferences were associated with steps walked per day [5]. There has been little discussion of breast size in epidemiological studies of female adiposity. Breasts include approximately twelve percent of female sex-specific fat [13]. The metabolic characteristics of breast fat show similarities to both abdominal (low lipoprotein lipase activity and high lipolytic responsiveness and sensitivity [20]) and gluteofemoral fat depots (low mRNA and protein expression of resistin, a hormone that may play a role linking obesity with type 2 diabetes [16]), such that the health implications of larger breasts in women is not obvious.

Although the inverse relationship between walking and adiposity are well documented [9,22, 25], most studies postulate a linear relationship explicitly or by their choice of statistics. Some departures from perfect linearity are inevitable, and when small their clinical or statistical significance may not warrant concern. However, our data suggest a fivefold difference between the estimated effects at 5 and 40 km/wk. Statistical adjustment based on a simple linear relationship will underadjust BMI among the least active women and overadjust BMI among the most active, which may create misleading findings if health outcomes of the least and most active women contribute disproportionately to health benefits of physical activity. Our results

suggest that both linear and quadratic terms may warrant consideration when the effects of adiposity are adjusted for physical activity or, conversely, when the effects of physical activity are adjusted for adiposity.

A more problematic issue affecting statistical adjustment is our finding that the slopes relating walking distance to adiposity depend on whether BMI, body circumferences, or cup size are large or small relative their percentile distribution (Figs. 2, 3, and 7). Specifically, incrementing weekly distance walked from 10 to 11 km/wk was associated with a 15-fold greater decrease in BMI at the 95th than at the 5th percentile of the BMI distribution. The impact of walking on body weight or the effects of self-selection may be substantially greater in overweight than in lean women. In either case, these data demonstrate that traditional regression slope appears to accurately characterize the decline in BMI associated with walking distance for only a narrow central portion of the BMI distribution. This is also true for body circumferences and bra cup sizes.

To summarize, we have shown that the slopes relating adiposity to weekly distance walked were most negative in overweight sedentary women and least in lean active women. This dependence of the slope on whether the women were lean or fat appears to account for the majority of the difference in the estimated effect of 1 km of exercise in runners' (who were primarily lean) and walkers' (who were generally fatter) slopes. Whether these effects are due to the causal effects of walking on adiposity or are the consequence of self-selection remains to be determined.

Acknowledgments

This study was supported in part by grants HL-45652 and HL-72110 from the National Heart, Lung, and Blood Institute, and DK066738 from the Institute of Diabetes and Digestive and Kidney Diseases and was conducted at the Lawrence Berkeley Laboratory (Department of Energy DE-AC03-76SF00098 to the University of California).

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Figure 1. Quadratic regression curve (waist circumference vs. weekly distance walked) and tangent slopes at 5, 20, and 40 km/wk.

Figure 2.

Cross-sectional relationship of body mass index to weekly walking distance in 27,596 female walkers. The average (top) and the 10th, 50th (median), and 90th percentiles (bottom) are shown.

Figure 3.

Plot of the estimated change BMI, waist circumference, and bra cup size per 1-km/wk increase in walking mileage (i.e., tangent slope, vertical axis) by percentile of the dependent variable (horizontal axis) at 10, 20, 25, 30, and 40 km/wk.

Figure 4. Cross-sectional relationship of average waist (N=22,562), hip (N=22,017), and chest (N=22,135) circumference and bra cup size (N=24,144) to weekly walking distance in females by age group.

Figure 5. Percent difference in BMI, body circumferences, and bra cup sizes for women averaging 40–50 km/wk vis-à-vis <10 km/wk by walking (data from this report) or running (29).

Figure 6. Quantile–quantile plot showing the correspondence between the cumulative distribution of BMI in female walkers (e.g., 50th percentile) and runners (85th percentile) by reported weekly distance.

Figure 7.

Plot of the slope relating the theoretical change in BMI to a 1-km/wk change in weekly distance (tangent slope, vertical axis) by percentile of the dependent variable (horizontal axis) in female walkers and runners at 10, 20, 30, and 40 km/wk. The dashed line represents the walker's change in BMI per 1-km increase in BMI replotted at the cumulative percentage of the runners' BMI distribution (e.g., the slope for the 50th percentile in walkers is replotted at the 85th percentile of runners, see Figure 6).

Table 1

Characteristics of female walkers.

	Kilometers Walked per Week						
	<2	2-9.9	10-19.9	20-29.9	30-39.9	40-49.9	≥50
Percent of sample	5.38	23.90	28.85	19.56	11.65	7.38	3.27
Age yr	50.36 ±15.01	49.70 ±13.81	49.70 ±12.77	49.63 ±12.42	49.09 ±11.97	48.70 ±11.23	48.84 ±12.06
Education (yr)	14.56 ±2.59	14.99 ±2.56	15.19 ±2.53	15.08 ±2.52	14.98 ±2.53	14.79 ±2.47	14.56 ±2.52
Alcohol (mL/wk)	27.69 ±70.43	34.41 ±69.87	40.60 ±71.65	41.74 ±71.16	43.73 ±77.96	46.66 ±87.56	41.42 ±93.19
Meat (servings per week)	3.22 ±3.25	2.90 ±2.72	2.72 ±2.64	2.47 ±2.38	2.31 ±2.18	2.27 ±2.48	2.13 ±2.17
Fish (servings per week)	1.32 ±1.58	1.42 ±1.38	1.44 ±1.45	1.44 ±1.43	1.50 ±1.53	1.67 ±2.30	1.66 ±1.92
Fruit (servings per week)	8.15 ±7.04	9.68 ±7.12	11.06 ±7.69	11.46 ±7.52	11.62 ±7.80	12.73 ±8.57	12.71 ±8.95
Years walked	9.62 ±10.36	9.22 ±10.60	7.01 ±8.56	7.13 ±8.25	8.33 ±8.47	9.07 ±8.99	9.87 ±10.21
Body mass index (kg/m ²)	29.09 ±7.46	27.06 ±6.09	25.47 ±4.98	24.69 ±4.39	24.50 ±4.45	23.98 ±4.42	23.62 ±4.22
Waist circumference (cm)	85.96 ±15.65	81.90 ±13.30	78.36 ±11.49	76.69 ±10.47	75.99 ±10.41	74.31 ±10.20	74.04 ±10.66
Hip circumference (cm)	106.21 ±16.15	102.72 ±12.83	99.97 ±10.55	98.66 ±9.55	98.05 ±9.49	96.70 ±9.27	95.77 ±9.44
Chest circumference (cm)	98.53 ±11.01	95.83 ±9.83	93.85 ±8.41	92.86 ±7.75	92.60 ±7.52	91.74 ±7.27	91.26 ±7.01
Bra cup (A=1, B=2, ...)	2.87 ±0.97	2.73 ±0.94	2.60 ±0.93	2.53 ±0.92	2.55 ±0.92	2.47 ±0.93	2.39 ±0.93
Children (no.)	2.01 ±1.91	1.97 ±1.92	1.97 ±1.80	1.98 ±1.70	1.97 ±2.01	1.93 ±1.69	1.82 ±1.49
Menses (%)	45.89	47.17	49.03	49.25	50.17	51.81	49.46

Results are mean±SD for all variables except menses, which is given in percent.

Table 2

Distribution of average weekly walking distance by age group in women.

Age group, years	Percent of sample	Distance walked, km/wk (mean±SD)
18–34	12.82	18.84±14.26
35–44	25.85	20.91±14.52
45–54	31.15	21.04±14.30
55–64	17.63	20.73±14.05
65–74	9.51	18.99±13.18
≥75	3.49	15.25±13.16

Table 3

Regression analyses of adiposity vs. weekly walking distance in women.

Age Group	Regression coefficients		Tangent slope evaluated at		
	km/wk	(km/wk) ²	5 km/wk	20 km/wk	40 km/wk
BMI					
18–34	−0.1981±0.0190 ***	0.0023±0.0003 ***	−0.1751	−0.1061	−0.0141
35–44	−0.2074±0.0124 ***	0.0021±0.0002 ***	−0.1864	−0.1234	−0.0394
45–54	−0.2145±0.0106 ***	0.0022±0.0002 ***	−0.1925	−0.1265	−0.0385
55–64	−0.2189±0.0137 ***	0.0023±0.0002 ***	−0.1959	−0.1269	−0.0349
65–75	−0.1707±0.0177 ***	0.0016±0.0003 ***	−0.1547	−0.1067	−0.0427
Waist					
18–34	−0.4430±0.0455 ***	0.0055±0.0007 ***	−0.3880	−0.2230	−0.0030
35–44	−0.4261±0.0295 ***	0.0042±0.0005 ***	−0.3841	−0.2581	−0.0901
45–54	−0.4499±0.0271 ***	0.0044±0.0004 ***	−0.4059	−0.2739	−0.0979
55–64	−0.4406±0.0350 ***	0.0043±0.0006 ***	−0.3976	−0.2686	−0.0966
65–75	−0.3955±0.0494 ***	0.0032±0.0009 ***	−0.3635	−0.2675	−0.1395
Hip					
18–34	−0.3917±0.0484 ***	0.0048±0.0008 ***	−0.3437	−0.1997	−0.0077
35–44	−0.3114±0.0290 ***	0.0028±0.0005 ***	−0.2834	−0.1994	−0.0874
45–54	−0.3777±0.0245 ***	0.0035±0.0004 ***	−0.3427	−0.2377	−0.0977
55–64	−0.3087±0.0324 ***	0.0025±0.0005 ***	−0.2837	−0.2087	−0.1087
65–75	−0.2653±0.0456 ***	0.0019±0.0008 *	−0.2463	−0.1893	−0.1133
Chest					
18–34	−0.2232±0.0325 ***	0.0025±0.0005 ***	−0.2463	−0.1893	−0.1133
35–44	−0.2379±0.0213 ***	0.0023±0.0003 ***	−0.2149	−0.1459	−0.0539
45–54	−0.2813±0.0195 ***	0.0029±0.0003 ***	−0.2523	−0.1653	−0.0493
55–64	−0.2394±0.0268 ***	0.0023±0.0004 ***	−0.2164	−0.1474	−0.0554

Age Group	Regression coefficients		Tangent slope evaluated at			
	km/wk	(km/wk) ²	5 km/wk	20 km/wk	40 km/wk	
65–75	–0.2820±0.0381 ***	0.0024±0.0007 **	–0.2580	–0.1860	–0.0900	
Bra cup						
18–34	–0.0149±0.0032 ***	0.0002±0.0001 **	–0.0129	–0.0069	0.0011	
35–44	–0.0146±0.0023 ***	0.0001±0.0000 **	–0.0136	–0.0106	–0.0066	
45–54	–0.0175±0.0021 ***	0.0002±0.0000 ***	–0.0155	–0.0095	–0.0015	
55–64	–0.0159±0.0027 ***	0.0002±0.0000 **	–0.0139	–0.0079	0.0001	
65–75	–0.0073±0.0040	0.0000±0.0001	–0.0073	–0.0073	–0.0073	

Coefficients presented ±SE. Significance levels from standard polynomial regression:

- * P<0.05;
- ** P<0.001; and
- *** P< 0.0001.