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Injuries in Sedentary Individuals Enrolled in a 12-Month, Randomized, Controlled, Exercise Trial

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Abstract

Background—The risk of musculoskeletal injury with the introduction of moderate-to-vigorous exercise in sedentary adults is not well established. The purpose of this report is to examine the effect of a 12-month exercise intervention on musculoskeletal injury and bodily pain in predominately overweight, sedentary, men (n=102) and women (n=100), aged 40–75 years.

Methods—Participants were randomized to a moderate-to-vigorous aerobic exercise intervention (EX) (6 d/wk, 60 min/d, 60–85% max. heart rate) or usual lifestyle control (CON). Participants completed a self-report of musculoskeletal injury and body pain at baseline and 12-months.

Results—The number of individuals reporting an injury (CON; 27% vs. EX; 28%, $p = .95$) did not differ by group. The most commonly injured site was lower leg/ankle/foot. The most common causes of injury were sports/physical activity, home maintenance or “other”. In the control group, bodily pain increased over the 12 months compared to the exercise group (CON -7.9 , EX -1.4 , $p = .05$). Baseline demographics and volume of exercise were not associated with injury risk.

Conclusions—Previously sedentary men and women randomized to a 12-month aerobic exercise intervention with a goal of 360 min/wk reported the same number of injuries as those in the control group and less bodily pain.

Keywords

musculoskeletal; physical activity; bodily pain; overweight

Introduction

The benefits of regular physical activity are well documented, including maintenance of a healthy body weight, reduced risk of chronic diseases, enhanced quality of life and psychosocial well-being and prevention of premature death^{1–3}. However, less than half of the US population is meeting the current physical activity guidelines (i.e., 150 min/wk of moderate physical activity)^{4,5} and the majority of the adult US population is overweight or obese⁶. Therefore, there is a need to promote the adoption of a physically active lifestyle.

However, questions remain regarding the risk of injury in previously sedentary individuals who adopt a physically active lifestyle and what factors may contribute to injury. Similarly, enrolling previously sedentary individuals into physical activity intervention trials raises the question of possible negative implications for participants, in terms of sustaining an injury, and study validity, in terms of potential drop-outs due to injury and reduced ability to assess the intervention outcome of interest. To date, the risk of injury among previously sedentary, predominantly overweight individuals who are randomly assigned to a moderate-vigorous physical activity intervention has not been well established¹.

Studies of injuries related to physical activity have mainly focused more on competitive athletes and formal sports activities (i.e. basketball or football) or military recruits¹. Also, the larger surveys of injury risk related to physical activity have defined injury as those requiring medical attention, which fails to capture less serious injuries^{7–9}. Furthermore, there are limited data on the factors that may protect against or increase susceptibility to injury, such as dose of activity and demographic factors (i.e. age, gender, body mass index (BMI) and initial aerobic fitness).

The purpose of this study was to examine musculoskeletal injury and bodily pain in previously sedentary, predominately overweight adults who were enrolled in a 12-month randomized controlled trial of moderate-to-vigorous physical activity intervention examining the role of physical activity on biomarkers of colon cancer risk.

Methods

As part of the 12-month randomized controlled clinical trial of moderate-intensity exercise intervention versus a usual lifestyle control, we performed a secondary analysis to examine the pattern of self-reported musculoskeletal injury and bodily pain. A detailed description of the clinical trial methods has been reported previously^{10,11}. Participants were recruited through gastroenterology practices, media placements and referrals (2001–2004)^{11–13} (see Figure 1). Participants were 102 men and 100 women; aged 40–75 years; sedentary (i.e., < 90 min/wk of moderate-to-vigorous exercise in the past 3 months); had a normal exercise tolerance test; and no serious medical conditions. The study was approved by the Fred Hutchinson Cancer Research Center Institutional Review Board. All participants signed an informed consent form.

Injury and Bodily Pain Outcomes Assessment

At baseline and end of study (12-months), participants completed standardized self-report questionnaires assessing musculoskeletal injury and body pain. Participants were asked “In the past 12 months, have you had an injury that prevented you from doing your usual daily activities (including strains, sprains, bursitis, fractures, and other injuries to muscle, tendon, bone, joint or ligament)?” (Y/N), the number of injuries (enter a number 0–99), the body part injured (from a check list of possible body parts) and cause of the injury (from a check list of possible causes, namely 1) occupation related, 2) leisure/hobby, 3) home maintenance/repair, 4) sports/physical activity, 5) transportation or 6) other). If participants

selected “other” for body part or cause of injury and provided a written description, two independent coders re-coded the response to fit within the provided categories and inter-rater reliability was determined. Disagreements were settled by consensus. Severity, duration and timing of injury were not captured in the questionnaire. Bodily pain was determined from the bodily pain sub-scale of the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36), scored 0–100 where higher scores indicate less bodily pain ¹⁴.

Demographics, anthropometrics and fitness—At baseline and 12-months, participants were evaluated for: demographics; medical history; weight (kg); height (m); body composition, measured by DEXA whole-body scanner (GE Lunar, Madison, WI); and cardiopulmonary fitness (VO₂max), measured by oxygen uptake during a maximal-graded treadmill test (Medgraphics, MN).

Intervention

Exercisers—The intervention was a 12-month moderate-to-vigorous intensity aerobic exercise program. The goal was 60 min/d, 6d/wk at 60–85% of the maximal heart rate achieved on the baseline VO₂max test. The intervention included both facility (3d/wk; primarily treadmills, stationary bikes, rowing machines and elliptical machines) and home-based programs (3d/wk; primarily outdoor walking, jogging, or biking). The prescribed program was progressive in frequency and duration and aimed for the full prescription to be achieved by week 9, with the intensity range constant throughout the trial (Table 1). Heart rate was measured with Polar heart rate monitors (Polar Electro Inc., Lake Success, NY). Approximately 5–10 min of warm-up, cool-down, and stretching exercise were performed in addition to the 60 min exercise sessions.

Specific injury prevention strategies were included in the design of the exercise intervention. The exercise prescription was gradually progressive to allow participants to adapt to increased amounts of physical activity; home exercise began only after participants had 4 weeks of supervision working with the exercise trainer and each participant was given a \$50 subsidy towards purchasing athletic shoes.

A variety of strategies was used to achieve and maintain adherence, including regular monitoring and feedback, newsletters, incentives (e.g. water bottles), and group social events. Good adherence was defined as meeting at least 80% of the overall minutes per week goal of moderate-to-vigorous exercise. Exercisers maintained daily logs of all sports and recreational activity performed during the yearlong intervention period, including the activity type, duration, and peak heart rate of each exercise session. Facility logs were verified by the exercise specialist, and home logs were submitted weekly for review by the exercise specialist. If participants adherence dropped below 50% of prescribed minutes for greater than two weeks, participants were contacted to determine the reason for the drop in adherence.

Controls—Controls were asked not to change their exercise or diet habits during the trial and no overall change was observed by questionnaire.

Randomization: Participants were randomized in equal numbers to the exercise (EX) or control group (CON), matched on sex and, among women, on menopausal status (pre- or peri- vs. postmenopausal) and current use (yes/no) of postmenopausal hormones.

Statistical Analyses: Differences between groups at baseline and 12-months were compared using Chi square analysis and independent samples t-tests. Logistic regression, using a multivariable model, was used to investigate the influence of gender (male=0, female=1),

intervention group (control=0, exerciser=1), injury reported in the 12-months prior to enrolment (no=0, yes=1), baseline age (yrs), body weight (kg), BMI (kg/m^2), aerobic fitness (VO_2max), body fat (%), lean body mass (%) and self-reported minutes of moderate to vigorous physical activity (30 min/wk increments). All confidence intervals (CI) are at the 95% level and two-sided *P* values are used. Statistical analyses were carried out using SPSS (v. 14, Chicago, IL).

Results

The baseline demographic characteristics of participants are shown in Table 2. Within each gender, exercisers and controls were similar with respect to baseline demographic and physiologic characteristics. The majority of participants were overweight or obese, non-Hispanic white, with college degrees. Overall, participants exercised 5.7 ± 2.0 days per week (2.1 ± 0.7 at the facility and 3.6 ± 1.6 days per week at home). Seventy-one percent of exercisers adhered to at least 80% of the goal (or 288 min/week) of the exercise prescription on average over the 12 months, and 89% of exercisers met national physical activity guidelines (150 min/week). A total of 2 of 51 males and 5 of 49 female exercisers stopped the intervention, citing personal reasons (i.e., work demands, family illness or medical illness unrelated to the intervention) and none reported discontinuing the intervention due to “musculoskeletal problems associated with the intervention”. End of study data injury and bodily pain data was not available for these participants. Therefore, data on injuries and bodily pain were available for all participants at baseline and for 96% of male and 90% of female exercisers, respectively and 98% of male and 94% of female controls at 12-months. As previously reported, the male and female exercisers lost a mean 1.8 and 1.4 kg, respectively compared to a loss of 0.1 kg and gain of 0.7 kg in the male and female controls, respectively¹¹. Also VO_2max increased a mean $2.5 \text{ ml}\cdot\text{kg}\cdot\text{min}^{-1}$ (10.5%) in female exercisers and $3.3 \text{ ml}\cdot\text{kg}\cdot\text{min}^{-1}$ (11%) in male exercisers and decreased in controls ($p < 0.001$ comparing exercisers with controls)¹¹.

There was no difference in percentage of individuals reporting an injury (CON 28% vs. EX 28%, $p = .96$) or change in injury status (i.e., those with no injury at baseline but reported an injury at 12-months) ($p = .56$ (Table 3)). The total number of injuries reported, which accounted for some individuals reporting more than one injury per time period, also did not differ between groups at baseline or end of study (data not shown). The most commonly injured sites over the time of the intervention were lower leg/ankle/foot (CON 27%, EX 43%, $p = .36$), back (CON 21%, EX 14%, $p = .44$) and knee (CON 12%, EX 18%, $p = .64$) (Table 4). The most common reported causes of injury were: sports/physical activity (CON 30%, EX 55%, $p = .07$), home maintenance (CON 19%, EX 11%, $p = .56$) or “other” (CON 22%, EX 19%, $p = .88$). There was no association overall between baseline characteristics and injury risk (Table 5). In sub-group analysis by intervention group, controls who had a prior injury were more likely to report an injury during the trial (OR = 2.90, 95% CI 1.02–8.21, $p = 0.04$).

There was no statistically significant difference in SF-36 bodily pain between groups at baseline or end of the study (Table 3). However, when examined as change across the course of the intervention, body pain worsened in the controls compared to the exercisers (CON -7.9 , EX -1.4 , $p = .05$).

Discussion

Previously sedentary, predominately overweight men and women randomized to a gradually-paced 12-month aerobic exercise intervention with a goal of 360 min/wk did not report more injuries or bodily pain at 12 months than the control group. Those in the

exercise group reported more injuries due to sports or physical activity than did the control group but fewer non-sports injuries (differences not statistically significant). Our findings are consistent with those of Carlson et al.⁸ who reported no overall association between leisure-time physical activity and overall injury rate, but “active” respondents reported a greater incidence of injury due to sports and leisure-time activities than “non-active” respondents, while the “non-active” respondents reported a greater incidence of injury due to non-sports or non-leisure-time activities. While physical activity may cause some injuries, it may prevent injuries from other causes, by promoting better function, strength and agility^{1, 15}. Alternative explanations are that individuals in the exercise intervention may have changed their risk due to altered exposure (i.e., altered how they choose to spend their time, such as replacing time usually spent on home maintenance projects with physical activity), or may have been more likely to categorize an activity as physical activity. Future studies should obtain more detailed information on other common injury causes, such as home maintenance.

The site of injury did not differ between the groups, with the most common site of injury for both groups in the lower leg, ankle or foot category. While not statistically significant, the exercise group did have a greater proportion of lower leg, ankle or foot injuries. Future research should monitor this body area closely for injury. Our findings are consistent with Hootman et al.¹⁶, who found that the knee was the most common injury site for activity related and all-cause injury in a sample of active adults enrolled in the Aerobic Center Longitudinal study.

While personal characteristics, such as body composition, physical fitness and physical activity history, may play a role in injury susceptibility, the majority of injury surveys have not collected this information¹⁷. Objective measures of baseline aerobic fitness and body composition (i.e. BMI, body fat and lean body mass) were measured as part of our trial. Being overweight or obese could potentially put individuals at higher risk of musculoskeletal injury due to altered biomechanics and greater loading forces on joints and soft tissue¹⁸. However, in our trial baseline BMI, body weight, body fat and lean body mass were not predictors of injury risk. The literature on the association between body weight and injury risk has examined military recruits, runners, and other active people, with some reporting that higher BMI is associated with injury risk^{19–22} and others reporting no association^{15, 16, 23}. These studies, especially the non-military samples, have focused primarily on normal weight individuals. In our sample 79% were overweight or obese, yet we found no difference in injury risk associated with baseline BMI. This offers reassurance to sedentary, overweight or obese individuals who are interested in beginning a physical activity program or working to meet the current physical activity guidelines, as well as for those who work to promote physical activity in this population.

The overall amount of activity and baseline aerobic fitness have been shown to directly impact risk of injury in studies of mainly self-selected activity (i.e. running)^{15, 16, 19, 20} and military basic training^{1, 24}. Less information is available from intervention studies, where individuals are assigned to increased levels of physical activity. Perri et al.²⁵ reported more exercise-related injuries in previously sedentary participants randomized to high (65–75% heart rate reserve) versus moderate (45–55% heart rate reserve) intensity exercise but no difference with higher (5–7 d/wk) versus moderate (3–4 d/wk) frequency, however, no injury data for the control group is reported. In our trial we saw no impact of baseline aerobic fitness or amount of physical activity in the intervention group on risk of injury.

Prior musculoskeletal injury is commonly reported in many studies to be a risk factor for future injury^{1, 16, 19, 20}. We reported that this factor was predictive in those randomized to control but not to exercise. Re-injury of original injury that has not healed adequately,

inadequate rehabilitation, or persistence of the primary risk factor (i.e. structural or training defect) are proposed explanations for a risk for future injury^{1, 19, 20}.

In the literature to date appropriate measures of exposure have been limited, thus preventing a true denominator for injury risk. Only one prospective population based study has examined this question. Individuals were asked to record both participation in physical activity and all acute and overuse injuries over the course of a year²⁶. Overall injury risk per exposure time was lowest for commuting (i.e. 0.19 to 0.48 injuries per 1000 hours of participation for walking or cycling to work, respectively) and non-contact sports, such as swimming, walking or cycling (1.0, 1.2 and 2.0 injuries per 1000 hours of participation, respectively) compared to higher impact or contact sports, such as squash, Judo, downhill skiing (18.3, 16.3 and 4.1 injuries per 1000 hours of participation, respectively). However, the highest absolute numbers of injuries occurred in the low-risk activities, because these activities were the most widely practiced at a population level. This suggests that clinicians and exercise specialists should still be vigilant in exercise prescriptions of these low-risk activities for previously sedentary individuals.

Our intervention trial incorporated several specific injury prevention strategies which may have reduced the risk of injury in the study. First, we excluded individuals with recent or significant injuries that in clinical judgement were likely to lead to increased risk of injury. Second, the exercise prescription was individualized based on a baseline aerobic fitness test to determine appropriate heart rate ranges for each participant and the prescription progressed over the first 9 weeks. This gradual progression may be crucial in reducing musculoskeletal injury risk in previously sedentary individuals as Ready et al.²⁷ reported half of all injuries in their 24-week walking program in older women occurred in the first 4 weeks. Third, the exercise sessions were supervised prior to the introduction of home-based sessions, allowing the exercise specialists to address issues of proper form, use of machines, and adapt the exercise prescription as appropriate. Finally, each participant was given a \$50 subsidy toward purchasing athletic shoes and advised to go to a footwear store that specialised in walking or running shoes, as proper footwear is thought to reduce the risk of injury, especially of the lower extremity¹.

While intuitively it may be expected that bodily pain would increase with more physical activity due to such things as muscle soreness, the literature suggests that those who are more physical active report lower levels of bodily pain compared to those who are inactive^{2, 28}. At 12 months, the control group in our study reported worsening pain scores whereas the exercise group experienced little change in pain scores. Our findings suggest that participation in a 12-month aerobic exercise intervention does not increase bodily pain and furthermore, the increased physical activity may prevent temporal increases in pain commonly seen with aging.

The strengths of this study include objective measures of personal characteristics that may predict risk of injury, such as aerobic fitness (VO₂max) and body composition (i.e. BMI, body fat and lean mass), that have not been available in population level injury surveys. Furthermore, the randomized controlled trial methodology minimizes bias around self-selection to engage in physical activity¹⁷ and represents a better picture of possible injury risk under the current efforts to encourage sedentary individuals to meet recommended physical activity levels.

A limitation of this study is that the injury information was not linked to exposure data. In the exercise group, we cannot determine whether the injury occurred during or outside of the intervention-specific activities. Also, we cannot distinguish between acute, traumatic injuries and overuse injuries, the etiology of which likely differs¹. Furthermore, the injury

information is self-report and susceptible to recall and misclassification biases. Other studies have found very high validation of self-reported serious injuries, such as fracture in mid-age to older women²⁹, but it is likely that recall is better for more severe injuries than for more minor injuries. In addition, the definition of injury is non-standardized across the literature, making it difficult to compare our results to those of others. We also did not ascertain history of remote injury (older than 12 months prior to baseline), so we could not evaluate the effect of older injuries on risk of injury during the study. Finally, examining risk of injury was a secondary outcome of the main study, so statistical power for this analysis is limited. Future studies should collect more detailed prospective information on injuries, particularly on severity, cause and resulting treatment.

In conclusion, enrolling predominantly overweight, previously sedentary men and women into a 12-month exercise trial, did not result in a higher number of injuries in those randomized to an intervention with a goal of 60 minutes of moderate-to-vigorous physical activity, 6 days per week versus controls and may reduce temporal progression of bodily pain. This suggests that the positive benefit of regular physical activity may outweigh the risk of injury in this group. However, undertaking prevention strategies may be an important consideration for physical activity intervention studies, especially in those with a recent history of musculoskeletal injury.

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Figure 1.
Flow of participant through the trial.

Table 1

Outline of exercise prescription

Week	Number of Facility Sessions (per week)	Number of Home-based Sessions (per week)	Total number of sessions (per week)	Duration of session (min)
1	3	0	3	15
2	3	0	3	20
3	3	0	3	25
4	3	0	3	30
5	3	1	4	35
6	3	1	4	40
7	3	2	5	45
8	3	2	5	50
9	3	3	6	55
10–52	3	3	6	60

Table 2

Baseline demographic factors for men and women by intervention group.

	<u>Women</u>		<u>Men</u>	
	Controls N=51 Mean (SD) or N (%)	Exercisers N=49 Mean (SD) or N (%)	Controls N=51 Mean (SD) or N (%)	Exercisers N=51 Mean (SD) or N (%)
Age, yrs	53.7 (5.7)	54.4 (7.1)	56.6 (7.6)	56.2 (6.7)
Height, cm	165.5 (6.4)	163.9 (6.9)	179.8 (8.0)	178.4 (6.3)
Weight, kg	77.9 (12.8)	78.1 (17.8)	97.4 (18.2)	94.8 (14.9)
BMI, kg/m ²	28.5 (4.8)	28.9 (5.5)	30.1 (4.8)	29.7 (3.7)
Body fat, %	43.0 (6.8)	43.3 (7.2)	29.7 (6.0)	31.5 (6.4)
VO ₂ max, ml/kg/min	24.8 (4.3)	23.8 (5.1)	30.3 (6.7)	30.1 (5.9)
Moderate-to-vigorous exercise in past 3 months (min/wk)	24 (55)	27 (48)	28 (60)	22 (58)
Race, Caucasian	47 (92)	42 (86)	48 (94)	48 (94)
Education, College degree or more	34 (67)	28 (57)	28 (55)	33 (65)
Menopausal status				
Pre-menopausal	18 (35)	16 (33)	NA	NA
Postmenopausal	33 (65)	32 (66)	NA	NA
Smoking				
Smoker	1 (2)	2 (4)	5 (10)	4 (8)
Non-smoker	50 (98)	46 (96)	46 (90)	47 (92)

Table 3

Injury outcomes in the past 12-months reported at baseline and end of study and bodily pain score in the past 3 months reported at baseline and end of study in exercisers and controls.

	Baseline			End of Study			Change		
	Controls N=102 N (%) or Mean (SD)	Exercisers N=100 N (%) or Mean (SD)	p	Controls N=99 N (%) or Mean (SD)	Exercisers N=93 N (%) or Mean (SD)	p	Controls N=99 N (%) or Mean (SD)	Exercisers N=93 N (%) or Mean (SD)	p
Number of individuals reporting an injury ^a	26 (25)	21 (21)	.45	28 (28)	26 (28)	.96	Injury Status ^b +1 16 (16)	20 (22)	
							69 (70)	59 (63)	
							13 (13)	14 (15)	.56
Bodily pain scale ^b	80.2 (16.8)	77.4 (17.8)	.25	72.7 (21.6)	76.4 (19.6)	.21	-7.9 (23.4)	-1.4 (23.4)	.05

^a Injury preventing usual activities in the past 12-months;

^b Injury status, +1 denotes those with no injury at baseline but reported an injury at 12-months, 0 denotes those who reported the same injury status at baseline and end of study (i.e. no injury at both time points, or one injury at both timepoints) and -1 denotes those who reported an injury at baseline but no injury at 12-months.

Table 4
Descriptive injury outcomes at baseline and end of study in the exercisers and controls

	Baseline		End of study		p
	Controls	Exercisers	Controls	Exercisers	
	N (%)	N (%)	N (%)	N (%)	
Body part injured ^a					
Lower leg/ankle/foot	9 (32)	5 (17)	9 (27)	12 (43)	.36
Knee	1 (4)	1 (3)	4 (12)	5 (18)	.64
Hip/upper leg/groin	4 (14)	3 (10)	3 (9)	3 (11)	.91
Back	8 (29)	2 (7)	7 (21)	4 (14)	.44
Shoulder/upper arm	1 (4)	6 (20)	2 (6)	2 (7)	.92
Elbow	1 (4)	0 (0)	1 (3)	1 (4)	.95
Lower arm/wrist/hand	1 (4)	5 (17)	5 (15)	1 (4)	.12
Head/neck	1 (4)	7 (23)	2 (6)	0 (0)	.18
Other	2 (7)	1 (3)	0 (0)	0 (0)	NA
Cause of injury ^b					
Occupation related	0 (0)	2 (10)	4 (15)	2 (7)	.48
Home maintenance	10 (37)	6 (30)	5 (19)	3 (11)	.56
Leisure	2 (7)	1 (5)	3 (11)	3 (11)	.73
Sport/physical activity	6 (22)	2 (10)	8 (30)	15 (55)	.07
Transportation	2 (7)	3 (15)	1 (4)	0 (0)	.34
Other	7 (26)	6 (30)	6 (22)	5 (19)	.88

^aDenominator is total body parts reported (i.e. some individuals reported more than one injured body part with one injury event), N=28, 30, 33, 28 per group respectively;

^bDenominator is total cause of injury reported (i.e. some individuals reported more than one cause of an injury such as physical activity and transportation such as walking to work), N=27, 20, 27, 27 per group respectively.

Table 5
Results of multivariate regression to baseline predictors of injury risk for all participants and by group

	All Participants (N=202) ^a						Group					
				Control only (N=102) ^b						Exercise only (N=100) ^c		
	Odds ratio (95% CI)	SE	P	Odds ratio (95% CI)	SE	P	Odds ratio (95% CI)	SE	P	Odds ratio (95% CI)	SE	P
Sex (female or male)	0.42 (0.08,2.08)	0.34	0.28	0.33 (0.02, 4.65)	0.45	0.41	0.24 (0.02, 2.48)	0.29	0.78			
Age (years)	1.00 (0.94,1.06)	0.03	0.99	0.98 (0.90,1.06)	0.04	0.56	1.02 (0.93, 1.11)	0.04	0.74			
Group (Exercise or Control)	1.02 (0.52,2.00)	0.35	0.95	NA		NA	NA		NA			
Baseline V _O 2max (mg/kg/min)	1.00 (0.91,1.10)	0.03	0.93	1.01 (0.89,1.14)	0.06	0.92	1.02 (0.86,1.20)	0.08	0.86			
Baseline self-reported moderate to vigorous exercise (30 min/wk) ^d	0.98 (0.86, 1.10)	0.06	0.72	1.08 (0.89,1.14)	0.10	0.43	0.84 (0.64,1.09)	0.11	0.19			
Prior injury (Y or N)	1.70 (0.80, 3.61)	0.65	0.16	2.90 (1.02,8.21)	1.53	0.04	0.82 (0.21,3.21)	0.57	0.52			
Baseline body fat (%)	1.81 (0.74,4.44)	0.84	0.19	1.86 (0.53,6.50)	1.19	0.33	1.79 (0.40,8.05)	1.38	0.45			
Baseline lean body mass (%)	1.74 (0.70,4.27)	0.80	0.23	1.76 (0.50,6.18)	0.13	0.38	1.67 (0.37,7.55)	1.28	0.50			
Baseline body weight (kg)	1.00 (0.96,1.06)	0.02	0.82	1.02 (0.95,1.09)	0.04	0.62	0.98 (0.91,1.06)	0.04	0.58			
Baseline BMI (kg/m ²)	0.94 (0.77,1.14)	0.09	0.50	0.93 (0.70,1.22)	0.13	0.58	0.92 (0.67,1.28)	0.15	0.64			

^a Hosmer and Lemeshow Goodness-of-Fit test, P=0.50;

^b Hosmer and Lemeshow Goodness-of-Fit test, P=0.98;

^c Hosmer and Lemeshow Goodness-of-Fit test, P=0.44;

^d OR for increments of 30 min/wk