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ORIGINAL RESEARCH

INTERVENTIONS

Exercise Improves Self-Reported Sexual Function Among Physically Active Adults

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ABSTRACT

Background: Sexual dysfunction is common among adults and takes a toll on quality of life for both men and women.

Aim: To determine whether higher levels of weekly cardiovascular exercise are protective against self-reported sexual dysfunction among men and women.

Methods: We conducted an international online, cross-sectional survey of physically active men and women between April and December 2016, assessing exercise activity categorized into sextiles of weekly metabolic equivalent-hours. Odds ratios (ORs) of sexual dysfunction for each activity sextile compared with the lowest sextile were calculated using multivariable logistic regression, controlling for age, body mass index, diabetes mellitus, tobacco/alcohol use, sport, and marital status.

Main Outcome Measures: Female sexual dysfunction was defined as a score ≤26.55 on the Female Sexual Function Inventory and erectile dysfunction (ED) was defined as a score ≤21 on the Sexual Health Inventory for Men.

Results: 3,906 men and 2,264 women (median age 41–45 and 31–35 years, respectively) met the inclusion criteria for the study. Men in sextiles 2–6 had reduced odds of ED compared with the reference sextile in adjusted analysis ($P_{trend} = .03$), with an OR of 0.77 (95% CI = 0.61–0.97) for sextile 4 and 0.78 (95% CI = 0.62–0.99) for sextile 6, both statistically significant. Women in higher sextiles had a reduced adjusted OR of female sexual dysfunction ($P_{trend} = .02$), which was significant in sextile 4 (OR = 0.70; 95% CI = 0.51–0.96). A similar pattern held true for orgasm dissatisfaction ($P_{trend} < .01$) and arousal difficulty ($P_{trend} < .01$) among women, with sextiles 4–6 reaching statistical significance in both.

Clinical Implications: Men and women at risk for sexual dysfunction regardless of physical activity level may benefit by exercising more rigorously.

Strengths & Limitations: Strengths include using a large international sample of participants with a wide range of physical activity levels. Limitations include the cross-sectional design, and results should be interpreted in context of the study population of physically active adults.

Conclusion: Higher cardiovascular exercise levels in physically active adults are inversely associated with ED by self-report in men and protective against female sexual dysfunction in women. **Fergus KB, Gaither TW, Baradaran N, et al. Exercise Improves Self-Reported Sexual Function Among Physically Active Adults. J Sex Med 2019;XX:XXX–XXX.**

Key Words: Erectile Dysfunction; Female Sexual Dysfunction; Metabolic Equivalents; Orgasm; Exercise; Arousal

INTRODUCTION

Sexual dysfunction is common among adults and takes a toll on quality of life for both men and women. The prevalence of at least 1 form of sexual dysfunction among women ranges as high as 40%–50%.[1,2] In men, the prevalence of erectile dysfunction (ED), one component of sexual dysfunction, increases with age, from 1%–10% for those age <40 years to ≥50% among those age >70 years.[1]

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Exercise is a low-cost, low-risk intervention that can be implemented before or in concert with pharmacologic and other treatment strategies and is known to have a protective effect against ED in men.[3,4] Exercise improves symptoms for patients already suffering from ED and protects against ED in the general population.[4−7] Exercise also reduces the risk of cardiometabolic diseases known to be associated with ED and female sexual dysfunction (FSD).[8,9] The evidence for improved sexual function in women who exercise is not as robust, however, with preliminary findings of improvement in self-reported sexual function among obese, perimenopausal, and postmenopausal women.[10−12] In addition, little is known about the type of exercise activity or amount of physical activity necessary to achieve a benefit in both men and women. As a result, clinical guidelines suggest the need for more evidence to determine whether exercise prevents ED[13,14] and omit any mention of exercise in the treatment of FSD.[15] Research is also lacking to determine the effect of higher energy expenditure levels on sexual function in men and women.

Our aim in the present study was to determine whether higher exposure levels to 3 cardiovascular exercise activities—swimming, biking, and running—is associated with decreased sexual dysfunction in men and women. Given the similarity of penile and clitoral anatomy and vascular supply, we hypothesize that female orgasm satisfaction and arousal will closely parallel erectile function in men. To date, few studies have investigated the impact of exercise on male and female sexual function outcomes in a large, multinational sample of physically active adults.

MATERIALS AND METHODS

Study Population

This is a secondary analysis of a multinational cross-sectional study of urinary and sexual wellness in a volunteer sample of physically active adults age >18 years. After obtaining institutional review board approval, our study team recruited cyclists, runners, and swimmers in the United States, Canada, Great Britain, Australia, and New Zealand who were willing to complete an anonymous online survey. Methods of recruitment have been discussed previously,[16] and in brief included outreach through Facebook advertisements and to sporting clubs directly via e-mail between April and December 2016. Our study population is thus composed of physically active adults, who engage in activities ranging from casual recreational activities to preparation for competitions.

Out of the 8,866 completed survey responses received, 707 participants were excluded for incomplete exercise activity data, such as daily distance, time, or days exercised per week. Other exclusion criteria included incomplete Sexual Health Inventory for Men (SHIM) scores (n = 326) or Female Sexual Function Inventory (FSFI) scores for women (n = 204). Women (n = 392) and men (n = 259) reporting no sexual activity were excluded, to avoid potential biases in the FSFI and SHIM.[17] Of the remaining 2,533 women and 4,445 men, participants were excluded (n = 808) for missing covariates in the final multivariable model. A priori chosen covariates included age, body mass index (BMI), marital status (single, partnered, married, divorced, separated, or widowed), exercise type (bicycling, running, swimming, or multiple), diabetes mellitus (yes or no), tobacco use (yes or no), and alcohol use (yes or no). Participants were then categorized into 4 groups: bicycling only, running only, swimming only, and multiple exercise types.

Exposure

We investigated weekly exercise energy expenditure as the primary exposure of interest. Our survey tool inquired about average time, distance, and speed exercised per day, as well as days exercised per week in recent months. We estimated metabolic equivalents (METs) using speed and a standardized classification known as the Compendium of Physical Activities,[18] similar to the methods used by Manson et al[19] in their study of coronary heart disease. Energy expenditure was measured in units of weekly MET-hours, calculated by multiplying METs and hours exercised per week. Finally, given the possibility for measurement error, we stratified men and women separately into sextiles of increasing levels of weekly MET-hours.

To evaluate the effect of energy expenditure on sexual function in each exercise activity group, we stratified according to exercise activity in a subanalysis: cycling only, running only, swimming only, and multiple activities. We chose a dichotomous exercise energy expenditure predictor with a cutoff of 30 weekly MET-hours, which accommodates the decrease in sample size after stratification. For reference, this would be equivalent to five 30-minute workouts of running at a pace of 4 minutes and 39 seconds per kilometer, similar to recommendations from the American Heart Association for a physically active population.[20] Men and women were again analyzed separately using the same covariates as in the primary analysis.

Sexual Function Ooutcomes

For men, the primary outcome of interest was ED, as ascertained from self-reported scores on the SHIM. We dichotomized SHIM scores according to an SHIM score $\leq$21, which we defined as ED, and an SHIM score >21, which we defined as no ED.[21] For women, the primary outcome of interest was FSD, as defined by an FSFI score $\leq$26.55.[22] Exploratory secondary outcomes of interest in women were orgasm dissatisfaction and arousal difficulty, as reported in the respective domains of the FSFI (questions 11-13 and 7-10, respectively). We dichotomized self-reported orgasm domain scores; a score of $\geq$4 on all 3 questions about orgasms in the FSFI (contributing $\geq$4.8 points to the FSFI total score) was categorized as "satisfied;" those below this threshold were categorized as "dissatisfied," similar to the exploratory model in the FSFI validation study.[22] Self-reported arousal domain scores were dichotomized similarly; a score $\geq$4 on all 4 questions about arousal in the FSFI (contributing $\geq$4.8

Table 1. Demographic and health characteristics by sex

Characteristic	Men (N = 3,906)	Women (N = 2,264)
Demographic characteristics		
Age, yr, n (%)		
18-30	787 (20.2)	930 (41.1)
31–40	723 (18.5)	531 (23.5)
41–50	1,070 (27.4)	440 (19.4)
≥51	1,326 (34.0)	363 (16.0)
Race/ethnicity, n (%)*		
White	3,197 (87.2)	1,814 (85.6)
Black/African American	41 (1.1)	24 (1.1)
Hispanic/Latino	165 (4.5)	101 (4.8)
Asian	115 (3.1)	91 (4.3)
Other†	149 (4.1)	89 (4.2)
Marital status, n (%)		
Single	872 (22.3)	821 (36.3)
Married	2,402 (61.5)	817 (36.1)
Partnered	304 (7.8)	439 (19.4)
Divorced/separated	312 (8.0)	170 (7.5)
Widowed	16 (0.4)	17 (0.8)
Health characteristics		
Body mass index, median (IQR)	25.0 (23.2–27.6)	23.2 (21.3–25.7)
Diabetes diagnosis, n (%)	89 (2.3)	16 (0.7)
Hypertension diagnosis, n (%)*	449 (11.5)	85 (3.8)
Ischemic heart disease, n (%)*	56 (1.4)	6 (0.3)
Current tobacco use, n (%)	135 (3.5)	61 (2.7)
Current alcohol use, n (%)	2,858 (73.2)	1,625 (71.8)
Exercise characteristics		
Sport type, n (%)		
Multiple	1,562 (40.0)	1,028 (45.4)
Cycling	1,431 (36.6)	710 (31.4)
Running	625 (16.0)	320 (14.1)
Swimming	288 (7.4)	206 (9.1)
Weekly MET-hours, median (IQR)	57 (31.8–101.3)	48 (24.9–88.2)
Competition training, n (%)*	2,363 (60.5)	1,271 (56.1)

IQR = interquartile range; MET = metabolic equivalent.
*Numbers may be smaller than total for these variables because they were not required for study inclusion.
†Other includes American Indian/Alaska Native; Native Hawaiian/other Pacific Islander; more than one race; and other.

points) was categorized as "no difficulty," and those below this threshold were categorized as "arousal difficulty."

Statistical Analysis

Demographic, exercise, and health characteristics are reported by sex with descriptive statistics. In our primary analysis, we stratified by sex and used univariate and multivariate logistic regression to assess the associations between weekly MET-hours and our dichotomous outcome variables: ED for men and FSD, orgasm dissatisfaction, and arousal difficulty for women. In the multivariate models, we controlled for the a priori chosen covariates described above. We then conducted a test for linear trend in our multivariate models across exercise intensity sextiles.[23] We also performed a likelihood ratio test for interaction between exercise sextile and type of exercise. In our subanalysis, we stratified by sex and exercise type and then used multivariate logistic regression to evaluate the association between our dichotomous predictor (≥30 MET-hours per week) and ED and FSD. Finally, a second subanalysis used linear regression models to investigate continuous associations between weekly MET-hours (units of 10) and the FSFI for women and the SHIM for men. All statistical analyses were performed using Stata version 15 (StataCorp, College Station, TX, USA). Statistical significance was set at $P < .05$ for a 2-sided test.

RESULTS

Demographic and Health Characteristics

A total of 3,906 men met the study inclusion criteria (Table 1). The majority of men (61%) were age >40 years. Most

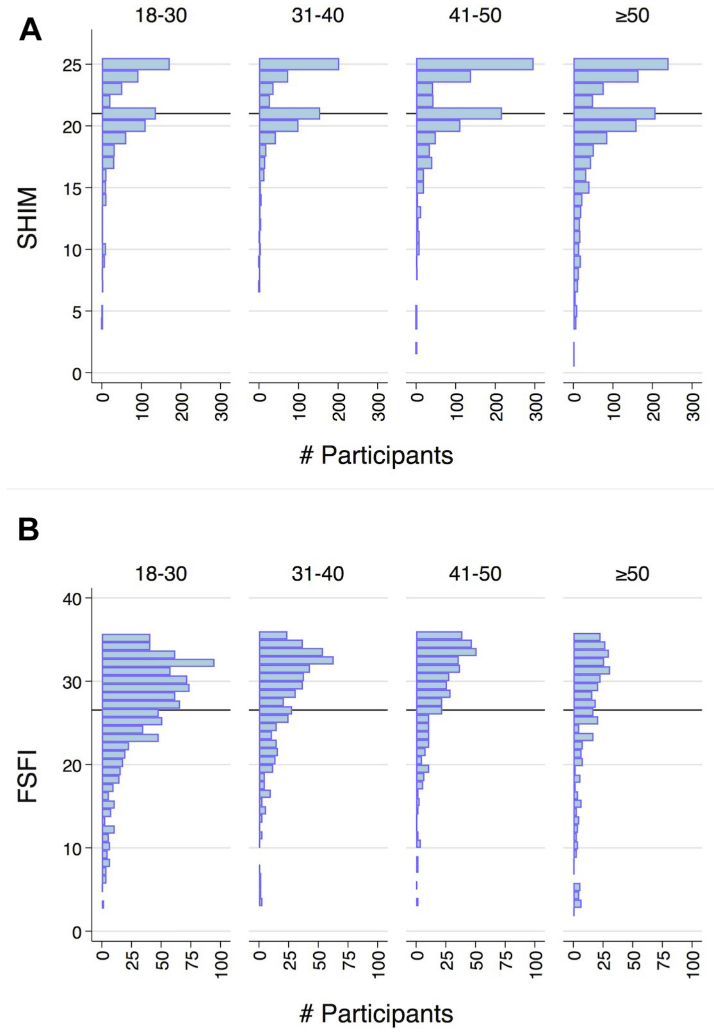

Figure 1. Distribution of Sexual Health Inventory for Men (SHIM) and Female Sexual Function Index (FSFI) scores according to age group. A, Distribution of SHIM scores according to age category in our sample. The cutoff for erectile dysfunction (ED) is a score of 21, indicated by the horizontal line. Men age ≥50 represented the majority of those with ED, and most men had mild ED symptoms if any. B, Distribution of FSFI scores according to age category in our sample. The cutoff for female sexual dysfunction (FSD) was 26.55, indicated by the horizontal line. Before age 50, the proportion of women reporting FSD decreased with age. Figure 1 is available in color online at www.jsm.jsexmed.org.

participated in multiple exercise activities, with bicycling-, running-, and swimming-only categories composing progressively smaller percentages. The median weekly MET-hours was 57 (interquartile range [IQR] = 31.8−101.3), and a large proportion (61%) reported training for a sporting competition. Hypertension was the most commonly reported medical comorbidity (12%), 2,858 patients (73%) reported current alcohol use, and the median BMI was 25.0 (IQR = 23.2−27.6).

Among the 2,264 women, 65% were age <40 years. Women had a similar distribution of exercise activities as the men, with multiple activities (45%) representing the majority and swimming (9%) the minority. The median weekly MET-hours was 48.0 (IQR = 24.9−88.2), with many respondents reporting training for a sporting competition (56%). Female participants reported few medical comorbidities, 1,625 (72%) indicated current alcohol use, and the median BMI was 23.2 (IQR = 21.3−25.7).

Exercise and ED

The distribution of SHIM scores by age group in our sample of men is shown in Figure 1. Of those reporting ED, 62% were age >40 years ($P < .001$), and the vast majority had mild symptoms. The proportion of men with ED, as well as the odds of ED for each of the sextiles of weekly MET-hours, are shown in Table 2. In both adjusted and unadjusted models, we see reduced odds of ED for each sextile compared with the referent first sextile, with an attenuated effect after adjustment. In the adjusted model, only sextiles 4 (OR = 0.77; 95% CI = 0.61−0.97) and 6 (OR = 0.78; 95% CI = 0.62−0.99) reached statistical significance. This model was tested for linear trend and found to be statistically significant

Table 2. Erectile dysfunction by sextile of weekly MET-hours (N = 3,906)

Sextile	Exercise, MET-hours/week*	% Dysfunction, n (%)	Unadjusted OR (95% CI)	*P* value	Adjusted OR† (95% CI)	*P* value
1	≤23.3	374 (60)	Reference		Reference	
2	23.4–41.2	381 (57)	0.86 (0.69–1.07)	.19	0.88 (0.70–1.11)	.29
3	41.3–56.2	362 (56)	0.83 (0.66–1.03)	.09	0.89 (0.70–1.12)	.31
4	56.3–92.0	354 (53)	**0.74 (0.59–0.92)**	**<.01**	**0.77 (0.61–0.97)**	**.03**
5	92.1–117.9	354 (54)	**0.77 (0.62–0.97)**	**.02**	0.81 (0.64–1.03)	.08
6	>118	344 (53)	**0.75 (0.60–0.94)**	**.01**	**0.78 (0.62–0.99)**	**.04**

Significant ORs and *P* values (<.05) are in bold type. Test for trend in males, ***P* = .03**; likelihood ratio test for interaction between sport and energy level, *P* = .81.
MET = metabolic equivalent; OR = odds ratio.
*Weekly MET-hours measured using exercise speed indexed in Compendium of Physical Activities, multiplied by hours/week.
†Adjusted for age, marital status, body mass index, diabetes mellitus, tobacco use, alcohol use, and exercise type (bike, swim, run, multiple).

(P = .03), and the likelihood ratio test for interaction between exercise sextile and exercise type was nonsignificant (P = .81). Furthermore, the number of weekly MET-hours was correlated with SHIM score (Supplementary Table A). Figure 2 presents the results of the subanalysis stratifying men by exercise activity type, comparing those exercising for ≥30 weekly MET-hours and those exercising less.

Exercise and Sexual Function in Women

FSFI score distributions according to age category are shown in Figure 1. The primary analysis of FSD and results for orgasm dissatisfaction and arousal difficulty according to sextiles of weekly MET-hours is presented in Table 3. In the adjusted logistic regression analysis, sextiles 2–6 had reduced odds of FSD, orgasm dissatisfaction, and arousal difficulty compared with the lowest energy sextile. This finding was statistically significant for FSD in sextile 4 (OR = 0.70; 95% CI = 0.51–0.96). For orgasm dissatisfaction, the finding was significant in sextiles 4 (OR = 0.62; 95% CI = 0.46–0.84), 5 (OR = 0.71; 95% CI = 0.52–0.96), and 6 (OR = 0.64; 95% CI = 0.46–0.88). Similar results for arousal difficulty are shown in Table 3. All 3 models were tested for linear trend and found to be statistically significant (FSD, P = .02; orgasm dissatisfaction and arousal difficulty, $P < .01$). The likelihood ratio test for interaction was nonsignificant for each model, including FSD (P = .95), orgasm dissatisfaction (P = .85), and arousal difficulty (P = .99). A correlation between weekly MET-hours and FSFI score was also observed (Supplementary Table A). The results of the subanalysis stratifying women by exercise activity type are presented in Figure 3.

DISCUSSION

This large, multinational cross-sectional study of sexual function in physically active adults has several key findings. First, in our sample of men, an inverse association trend between exposure and outcome is observed; men who exercise more have lower odds of self-reported ED. Men exercising over a threshold of 118 MET-hours per week—approximately 8,260 kcal/week for a 70-kg man—had 22% lower odds of ED compared with our reference of ≤23.3 MET-hours per week. More practically, men cycling approximately 10 hours per week at 26 km/hour had 22% lower odds compared with men cycling for ≤2 hours per week. In fact, we observed a statistically significant linear association between weekly MET-hours and SHIM score. This result corroborates the presumed beneficial effect of exercise on erectile function.[24] Our findings mirror those of Cheng et al,[4] who previously reported a 58% reduction in ED with activity, but likely had a more substantial effect owing to less physically active reference groups. Given our sextile 4 threshold of 56.3 weekly MET-hours (3,941 kcal/week for a 70-kg man), it is clear that increasing exercise beyond the 4,000 kcal/week level investigated by Kratzik et al[25] yields additional benefits. This novel finding at higher energy expenditures underscores the dose–response relationship suggested in previous studies,[4,5] and broadens the generalizability of this intervention to include men who are already physically active.

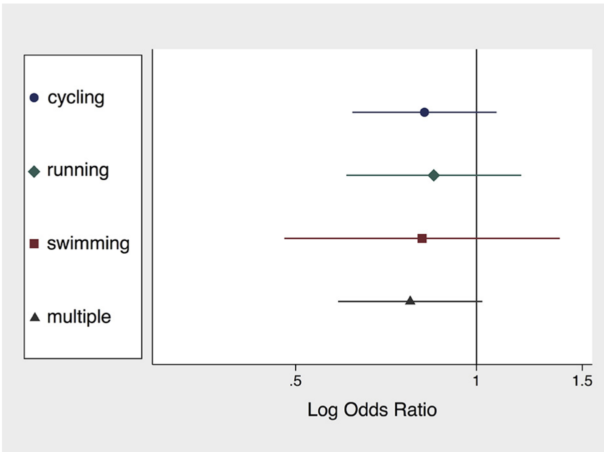

Figure 2. Adjusted log odds of erectile dysfunction for ≥ 30 weekly MET-hours stratified by exercise activity. *P < .05. Cycling, n = 1,431 (P = .16); running, n = 625 (P = .34); swimming, n = 287 (P = .44); multiple, n = 1,562 (P = .07). Figure 2 is available in color online at www.jsm.jsexmed.org.

Table 3. Female sexual dysfunction, orgasm dissatisfaction, and arousal difficulty by sextile of weekly MET-hours (N = 2,264)

Sextile	Exercise, MET-hours/week*	% Dysfunction, n (%)	Unadjusted OR (95% CI)†	P value	Adjusted OR (95% CI)†	P value
Female sexual dysfunction						
1	≤9.2	141 (38)	Reference		Reference	
2	19.3–33.0	138 (37)	0.94 (0.70–1.27)	.69	0.95 (0.70–1.29)	.74
3	33.1–47.3	125 (34)	0.83 (0.61–1.11)	.21	0.82 (0.60–1.13)	.22
4	47.4–73.2	124 (31)	**0.71 (0.53–0.96)**	**.03**	**0.70 (0.51–0.96)**	**.03**
5	73.3–102.5	125 (32)	0.78 (0.58–1.05)	.10	0.74 (0.54–1.02)	.07
6	>102.6	123 (34)	0.84 (0.62–1.14)	.26	0.75 (0.54–1.04)	.08
Orgasm dissatisfaction						
1	≤19.2	181 (49)	Reference		Reference	
2	19.3–33.0	164 (44)	0.81 (0.60–1.08)	.15	0.86 (0.63–1.16)	.31
3	33.1–47.3	159 (43)	0.78 (0.59–1.05)	.10	0.79 (0.58–1.07)	.13
4	47.4–73.2	157 (39)	**0.66 (0.49–0.87)**	**<.01**	**0.62 (0.46–0.84)**	**<.01**
5	73.3–102.5	160 (42)	**0.74 (0.55–0.98)**	**.04**	**0.71 (0.52–0.96)**	**.03**
6	>102.6	157 (44)	0.80 (0.60–1.08)	.14	**0.64 (0.46–0.88)**	**<.01**
Arousal difficulty						
1	≤19.2	188 (51)	Reference		Reference	
2	19.3–33.0	172 (46)	0.82 (0.61–1.09)	.17	0.78 (0.58–1.06)	.11
3	33.1–47.3	167 (45)	0.79 (0.59–1.06)	.11	0.77 (0.57–1.04)	.09
4	47.4–73.2	180 (44)	0.77 (0.58–1.02)	.07	**0.70 (0.52–0.94)**	**.02**
5	73.3–02.5	168 (44)	**0.75 (0.56–0.99)**	**.045**	**0.70 (0.52–0.95)**	**.02**
6	>102.6	152 (42)	**0.70 (0.53–0.94)**	**.02**	**0.61 (0.45–0.84)**	**.002**

Significant ORs and *P* values (<.05) are in bold type. Female sexual dysfunction: test for linear trend, ***P* = .02**; likelihood ratio test for interaction between exercise type and energy sextile, *P* = .95. Female orgasm dissatisfaction: test for linear trend, ***P* < .01**; likelihood ratio test for interaction between exercise type and energy sextile, *P* = .85. Female arousal difficulty: test for linear trend, ***P* < .01**; likelihood ratio test for interaction between exercise type and energy sextile, *P* = .99.

MET = metabolic equivalent; OR = odds ratio.

*Weekly MET-hours measured using exercise speed indexed in Compendium of Physical Activities, multiplied by hours/week.

†Adjusted for age, marital status, body mass index, diabetes mellitus, tobacco use, alcohol use, and exercise type (bike, swim, run, multiple).

Second, our study found an association between higher levels of exercise and lower odds of FSD, orgasm dissatisfaction, and arousal difficulty in women with significant tests of trend. Interestingly, the prevalence of FSD in our sample of women ranged from 31% to 38% across sextiles, lower than the 40%–50% reported in other studies.[1] Future studies with a less active reference group are needed to identify any true difference between physically active women and the general population. In addition, many previous studies have dichotomized groups into exercise vs no exercise or designed randomized clinical trials with a preset exercise regimen.[10,26] To our knowledge, this is the first study to examine such varied and wide-ranging exercise activity levels in women. In light of our findings, increasing cumulative exercise activity from baseline appears beneficial, particularly for those exercising ≤47.4 weekly MET-hours at the outset. This expands the target population for exercise interventions to treat FSD beyond obese, perimenopausal, and postmenopausal women.[10–12]

Third, we can conclude from the test of interaction that no one exercise activity explains the relationship between energy expenditure and sexual function in both men and women. Our subanalysis supports this idea by demonstrating that exercising ≥30 MET-hours per week in any sport category had a protective effect in our sample, although these findings were not statistically significant. Future studies with larger swimming and running cohorts are warranted to identify any true difference in cardiovascular exercise activity. The relationship between cycling and sexual dysfunction is of particular interest, as some studies report

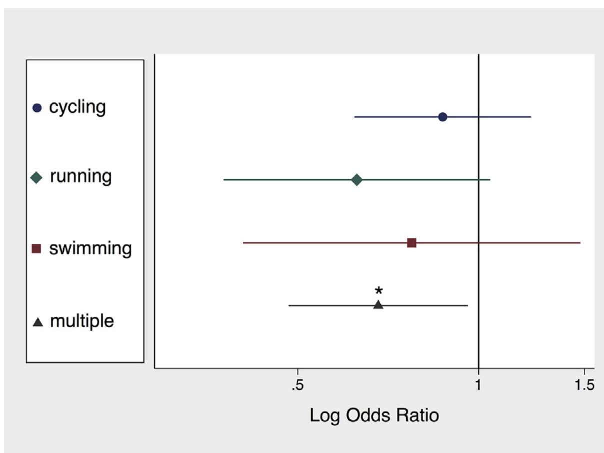

Figure 3. Adjusted log odds of female sexual dysfunction for ≥30 weekly MET-hours stratified by exercise activity. **P* < .05. Cycling, n = 710 (*P* = .42); running, n = 320 (*P* = .07); swimming, n = 201 (*P* = .44); multiple, n = 1,028 (*P* = .03). Figure 3 is available in color online at www.jsm.jsexmed.org.

evidence that cycling increases the risk of ED in men.[27,28] On the other hand, these findings were not replicable in subsequent studies,[16,29,30] and cycling may be more closely associated with genital numbness.[31] Future research should investigate the net effect of cardiovascular benefits for cyclists, who also experience prolonged perineal compression as they increase exercise duration.

The association between exercise and functional erections in men is hypothesized to be due to improved vascular supply of the penis.[6] It is well known that the penis and the clitoris share a common embryologic origin, and the 2 organs have the same 3 erectile tissues, regional skeletal muscles, and neurovasculature.[32–34]

Although female sexual organs do not typically progress from the flaccid state to complete rigidity,[34] both the clitoris and the labia minora engorge on arousal due to vasocongestion.[34,35] The anatomic reason why the clitoris does not typically reach the rigid phase is that it lacks the venous return network and thick, nonelastic fascia that a penis has; however, it does reach the tumescence phase, and case reports of priapism in women (and hence rigidity) exist.[32,35] This property of the clitoris is important because engorgement is a key feature of arousal in the female sexual response cycle: arousal/excitement, plateau, orgasm, and resolution.[36,37] Sufficient arousal is currently believed to be a critical threshold to achieving orgasm, and barriers to clitoral and labial engorgement are hypothesized to be a source of sexual dysfunction.[34,36,37] Because exercise sustains healthy vasculature and reduces the risk of comorbidities, it is conceivable that there is a physiological basis for the observed relationship between exercise and arousal, as well as orgasm satisfaction. In fact, Karatas et al[38] reported both increased clitoral blood flow as measured by Doppler ultrasound and better self-reported sexual function in a group of 25 elite female athletes compared with 25 sedentary women.

Physical activity is also associated with primary prevention of cardiovascular disease, diabetes, hypertension, dyslipidemia, obesity, depression, and even osteoporosis.[9,39] Numerous studies in men suggest that a correlation exists between good cardiometabolic health and better erectile function, with men with diabetes,[40] hypertension, and obesity having increased risk of ED.[41] Exercise may improve sexual function in men by simply reducing the influence of these medical comorbidities. In fact, because ED is considered a risk factor for forthcoming ischemic heart disease, exercise may treat these 2 conditions simultaneously.[42–44]

Although the evidence linking cardiometabolic health and sexual function is less robust for women, recent studies suggest that these same comorbidities have a milder yet still deleterious effect on women's sexual functioning.[8] This evidence in conjunction with the low prevalence of cardiometabolic disease in our study population increases the plausibility of this particular hypothesis.

Another potential mechanism for better sexual function in physically active women is superior pelvic floor muscle strength. Numerous studies suggest an association between stronger pelvic floor muscles and better sexual function.[45,46] There are also known psychological benefits of exercise, including better self-esteem and body image.[47] This raises the possibility of an alternative yet complementary mechanism of improved sexual function, because women with higher self-esteem and body image conceivably have better sexual function.[48] Future studies should measure these various benefits of exercise, as they may be on the causal pathway to improved sexual function.

This study is limited by the cross-sectional design, precluding an analysis of temporal relationships between exposure and outcome. As a secondary analysis, the study population was limited to physically active adults, and thus implications for the benefits of exercise in more sedentary populations are best gleaned from previous studies. The study team also designed predictor and outcome variables in the survey to detect differences in urinary and sexual function between bicyclists and nonbicyclists (as opposed to exercise exposure); therefore, the survey did not inquire about resistance exercise for strength building. Survey participation in our volunteer sample selects for respondents over nonrespondents. In this study, our population age distribution is older in men (age >40 years) and younger in women (age ≤40 years), and our results should be interpreted accordingly. Bicyclists and those participating in multiple activities are overrepresented in our sample, whereas swimmers are underrepresented; nonetheless, we believe that the likelihood of selection bias was low, because advertisements did not mention our specific outcomes of interest, which reducing the likelihood of selection on the basis of exposure and outcome status. In addition, all measurements are self-reported and thus subject to recall bias; however, any bias would likely be nondifferential misclassification of exposure status and thus would bias toward the null hypothesis.

We also observed a relatively high proportion of ED, ranging from 53% to 60%. It is important to note that the vast majority had mild symptoms, because we used the most sensitive SHIM cutoff for ED. Other potential explanations for this observation include the anonymous survey design, the high proportion of men age >40 years, or other unmeasured factors in our sample that could lead to nondifferential misclassification of the outcome. Given the multitude of studies showing reduced prevalence of ED among physically active men compared with sedentary men, it is unlikely that active men are at increased risk of ED. Finally, the final model included key potential confounding variables reported in the literature but did not ask about depression or mood, menopausal status, hormone replacement therapy, or other medication use, so residual confounding is possible. These variables have potential associations with sexual function and exercise, and would be an excellent avenue of investigation for future studies.

CONCLUSION

Increasing levels of cardiovascular exercise in men had a corresponding increase in protection from self-reported ED. This pattern continued beyond the weekly energy levels reported in previous studies. Thus, in addition to encouraging sedentary populations to begin exercising as previous studies suggest, it also might prove useful to encourage active patients to exercise more rigorously to improve their sexual functioning. Interestingly, women reported similar incremental benefits of increasing exercise activity in protecting against self-reported sexual dysfunction. Interventions aiming to improve sexual function or prevent sexual dysfunction through aerobic exercise should thus broaden the scope of patients eligible to benefit from increased exercise to include both men and women as well as anyone with baseline physical activity levels below 47—56 MET-hours per week. Future studies, especially in women, are warranted to assess differences in effect among exercise activity types.

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SUPPLEMENTARY DATA

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