

Exercise Predictors of Self-Reported Sexual Performance among Healthy Adults

Duston Morris¹, S. Alexandra Marshall² & Denise Demers³

Abstract

The purpose of the study was to determine if a set of exercise variables including exercise frequency, exercise intensity, exercise time, and exercise type could predict self-reported sexual performance among healthy adults. The sample consisted of 509 participants ranging in ages from 18-74 who completed a 30-item questionnaire on exercise frequency, intensity, time, and type and sexual performance indicators. Self-reported sexual performance was identified as frequency of sexual arousal, ability to be easily aroused, number of orgasms in a single sexual episode, ease of orgasm, frequency of sexual intercourse, and sexual arousal then loss of interest. Logistic regression analyses demonstrated that exercise intensity regression models were able to significantly predict frequency of sexual arousal, frequency of sexual desire, frequency of sexual intercourse, and number of orgasms in a single sexual episode. Exercise frequency regression models were only able to significantly predict frequency of sexual desire.

Keywords: exercise, physical activity, sexual performance, arousal, orgasm

1.0 Introduction

Exercise has many known benefits (Garber et al., 2011) and can lead to overall improved quality of living (Fernhall, 2013). Likewise sexuality, which includes sexual performance, is also a critical component related to overall quality of life and well-being (Pujols, Meston, & Seal, 2010; Raudsepp, Neissaar, & Kull, 2013) and can contribute to an individual's level of personal and interpersonal self-worth (Choi, Jang, Lee, & Kim, 2011). Despite the well documented literature on the benefits of exercise and healthy sexuality, much of that literature addresses improvements related to sexual dysfunction (Collins et al., 2012; Goh & Tong, 2011; Hsiao et al., 2012; Mishra et al., 2015), while leaving considerable gaps in how exercise may be related and contribute to sexuality among healthy adults. In addition, many of these previous studies do not address how exercise might be related to a specific set of sexual performance indicators among healthy adults.

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Exercise includes a number of positive physical and emotional outcomes (Agarwal, 2012; Hunter et al., 2012; Roumen, Blaak, Corpeleijn, 2009; Sherrington et al., 2008; Teychenne, Ball, & Salmon, 2008), and has also been related to improved sexual satisfaction (Haavio-Mannila & Kontula, 1997; Marshall, Morris, & Rainey, 2014; Waite & Joyner, 2001), sexual desirability (Penhollow & Young, 2004), and self-reported sexual performance (Morris, Marshall, & Demers, 2015; Penhollow & Young, 2004). Various facets of exercise have been linked to improved aspects of sexual performance (Morris, Marshall, & Demers, 2015; Meston, 2000), however, most of the previous literature examined these relationships among unhealthy adults who had been diagnosed with physical conditions such as COPD (Abd-El salam, Mahgoub, Ghoneim, & Abou-Abdu, 2015), diabetes (Lindau et al., 2010), heart failure (Mohammadi, Shahparian, Fahidy, & Fallah, 2012) and obesity (Kolotkin, 2006).

Typically when addressing sexual performance, it is done in the context of exploring sexual disability and dysfunction (Bacon, Mittleman, Kawachi, Glasser, & Rimm, 2006; Dabrowska, Drosdzol, Skrzypulec & Plinta, 2010). Researchers and clinicians also tend to examine and investigate sexuality at various points along the sexual response stage (Kaplan, 1979; Masters & Johnson, 1966). In addition to asking participants about desire, arousal and orgasm, the current study also included questions about aspects of sexual performance not typically included in previous studies such as the number of orgasms in a single sexual episode with a partner.

Building off of previous work which looks at the relationship among exercise and sexuality among healthy adults (Marshall et al., 2014; Morris et al., 2015; Penhollow & Young, 2004), the current study examines self-reported exercise and sexual performance data from a sample of generally healthy adults. This study contributes to the existing literature by examining whether or not a set of exercise regression models were able to predict self-reported sexual performance among healthy adults. Researchers were specifically interested in determining which exercise models (i.e. exercise frequency models, exercise intensity models, exercise type models, exercise time models) were better at predicting self-reported sexual performance among healthy adults.

More specifically the study attempted to answer the following research questions: 1) Can exercise behavior predict frequency of sexual arousal? 2) Can exercise behavior predict frequency of sexual desire? 3) Can exercise behavior predict frequency of sexual intercourse? 4) Can exercise behavior predict number of orgasms in a single sexual episode? Based on previous work related to exercise and sexuality (Marshall et al., 2014; Morris et al., 2015; Penhollow, Young & Denny, 2009; Penhollow & Denny, 2004; Pujols, Meston, & Seal, 2010), the hypothesis for this study was that exercise regression models comprised of exercise frequency, exercise intensity, exercise time, and exercise type would be able to significantly predict improved self-reported sexual performance among healthy adults.

2.0 Methods

2.1 Research Design

A non-experimental research design was utilized to collect quantitative data through the use of an online self-report survey that addressed self-reported sexual performance, exercise, and physical activity. The data collected were used to provide descriptive and logistic regression analyses regarding the interaction between self-reported exercise behavior and sexual performance. Researchers utilized an online survey in order to help achieve a higher level of confidentiality and anonymity regarding questions surrounding exercise behavior and sexuality, and to increase the sample size through using a self-selected sample and a self-report survey.

This type of research design provides greater ability to collect sensitive data on subjects' exercise and sexual behavior while maintaining subjects' protection of privacy, without compromising the reliability of the study design. Earlier work regarding the use of internet samples has been able to provide greater diversity among the study participants' gender, socioeconomic status, geographic region, and age (Ritter, Lorig, Laurent, & Matthews, 2004; Gosling, Vazire, Srivastava, & John, 2004). Furthermore, studies using online data collection procedures have greater generalizability across various presentation formats without compromising reliability of the study. In addition these types of data collection procedures, are less likely to be adversely affected by non-serious or repeat responders while maintaining similar consistency with findings from traditional methods (Basnov, Kongsved, Bech, & Hjollund, 2009; Kongsved, Basnov, Holm-Christensen, & Hjollund, 2007).

Based on support from previous studies, it was concluded that Internet data collection methods can significantly contribute towards many areas of behavioral studies while maintaining validity, reliability, and response rate integrity.

2.2 Subjects

Individuals for this study were recruited through four different social networking sites. These included Facebook, Twitter, IamTri, and Active.com. Two of the sites were general social media platforms (i.e. Facebook & Twitter) while two of the social media platforms were geared more towards exercise and health content.

Individuals were also recruited from an email listserv of triathlon clubs provided by the USA Triathlon Organization (USAT). USAT provided approval for an invitation letter that described the study to be sent out via email to all USAT club directors which could be forwarded to all of their respective club members. Participants for this study were adults between 18-74 years of age that became aware of the study by either viewing and responding to an ad containing an online invitation to the study via one of the social networking platforms or through receiving an invitation email through the USAT email listserv.

2.3 Procedures

This research was reviewed and approved by the university's Institutional Review Board. Participants were recruited for the study by viewing and then responding to study ads placed on Facebook and Twitter or by reading and then responding to emails that were sent to them through the USAT email listserv because they were active members of organized USAT clubs.

Email lists provided by USAT were used to contact all USAT club organizers in each state across the United States. The USAT club organizers were sent an email which described the study and included an invitation letter that could be forwarded to all of their respective club members. They were asked if they would forward this email to their respective club members asking for voluntary participation in the study. A link to the online survey was provided in the email. Individuals could click on this link, which would open the online survey supported by Qualtrix. Participants provided consent by reading the study description and clicking on the link which allowed them to view and complete the 30-item survey that asked various questions regarding self-reported exercise behavior and sexual performance.

In addition to the provided email invitation, an advertisement was placed on four social media sites. These included Facebook, Twitter, IamTri, and Active.com. Prior to placing the ad, researchers contacted administrators from each of the social media sites and were provided approval to advertise and recruit study participants. The ad described the overall study purpose and study design, and included an invitation to in the study. Individuals interested in participating were able to select the link provided in the invitation where they were redirected to the 30-item survey. Once directed to the study site, they could also review the study description and consent form, provide consent, and then complete the 30-item survey that asked questions regarding exercise behavior and sexual performance.

Data collected from the participants was anonymous and confidential. No personal identifiers were collected, only demographic data and data related to exercise behavior and sexual performance. All data that was collected were assigned arbitrary code numbers via the Qualtrics database system which allowed for de-identification of study participants' data. Only the researchers assigned to this study had access codes to Qualtrics which allowed them to view and analyze the data.

2.4 Testing Instrument

The instrument used for this study was a 30-item self-report survey which included demographic items, items related to exercise behavior, sexual satisfaction, and sexual performance. Four items were taken from the Sexual History Form (SHF) that addressed sexual performance indicators (Nowinski & LoPiccolo, 1979). One item addressed frequency of sexual intercourse by asking, "How frequently do you and your partner have sexual intercourse or activity?" One item addressed the number of orgasms in a single sexual episode by asking, "When thinking about your sexual activity, on average, how many orgasms do you have in a single sexual episode?" Two questions were specific to men. These two items included: 1) "How often do you wake from sleep with a firm erection?" and 2) "How often do you wake with a partial erection?" These two items had a Cronbach's alpha of 1.0, while previous research that utilized these items from the SHF found that the temporal stability ranged from .92 (Creti, Fichten, Libman, Amsel, & Brender, 1988) to .98 (Libman et al, 1989). The SHF was originally developed for clinical use but has frequently been used item-by-item to assess sexual behavior frequency and sexual functioning.

Eight items were used from the Changes in Sexual Functioning Questionnaire (CSFQ). Two of the items addressed sexual performance indicators specific to men. These included: 1) "How often do you have an erection related to sexual activity?" and 2) "Do you get an erection easily?"

One item addressed a sexual performance indicator specific to women which was, “How often do you have adequate vaginal lubrication for sexual activity?” Five items addressed sexual performance indicators for both men and women. These included: 1) “How often do you desire to engage in sexual activity?” 2) “How often do you become sexually aroused?” 3) “How often are you easily aroused?” 4) “How often do you become aroused and then lose interest?” and 5) “Are you able to have an orgasm when you want to?”

Total item correlations for the CSFQ ranged from .45-.60. Cronbach’s alpha coefficient of internal reliability ranged from .90 for females to .89 for males (Keller, McGarvey & Clayton, 2006). Internal consistency of the CSFQ demonstrated a Cronbach’s alpha from .84-.86 across three different studies while item total correlations ranged from $r=.41$ to .77. Reliability of the CSFQ was also addressed over a four-week test-retest period with $r=.82$ (McIntyre-Smith & Fisher, 2010).

The researchers also developed four additional items, two for women and two for men, to assess likelihood of orgasm and time between multiple orgasms (refractory period). The two questions specific to men included: 1) “During a single sexual episode in which you had an orgasm, how likely were you able to reach additional erections in order to re-engage in sexual activity?” and 2) “During a single sexual episode in which you had an orgasm, approximately how long after your first orgasm did it take to reach erection in order to re-engage in sexual activity?” For the two items unique to men, the Cronbach’s alpha was .97. The two questions specific to women included: 1) “During a single sexual episode, how likely are you to reach multiple orgasm?” and 2) “During a single sexual episode in which you had multiple orgasm, approximately how long after your first orgasm did it take you to reach your second orgasm?” For the two items unique to women, the Cronbach’s alpha was .89.

To measure exercise, four items from the Behavior Risk Factor Surveillance Survey (BRFSS) were used which addressed exercise frequency, exercise intensity, exercise time, exercise type during the past 30 days. Exercise frequency was categorized as low, moderate, and high frequency. Low frequency was defined as a range from “never to 2-3 times per month.” Moderate frequency was defined as a range from “once a week to 2-3 times per week.” High frequency was defined as “daily to more than once a day.” Exercise intensity was measured using the Borg CR10 Scale. This scale can be used to document the perceived level of exertion (Rate of Perceived Exertion or RPE) during exercise (Borg, 1970). The Borg CR10 scale is an adaptation of the original Borg RPE Scale which rated perceived level of exertion on a scale of 6-20. The adapted Borg scale ranges in number from 0-10, with 0 indicating no effort at all to normal breathing, while 10 identifies extreme intensity and breathlessness during exercise (Borg, 1998). Low intensity was defined as “did not participate to light and easy breathing (0-2).” Moderate intensity was defined as “moderate breathing to becoming uncomfortable to breathe (3-6).” High intensity was defined as “very hard to breathe to impossible to maintain (7-10).” Time spent in exercise (exercise duration) was also categorized as low, moderate, or high. Low duration was defined as “never or less than 30 minutes.” Moderate duration was defined as “approximately 30 minutes to 45-60 minutes,” and high duration was defined as “more than 60 minutes.” General level of activity as it related to exercise type was categorized as low, moderate, and high activity. Low activity was defined as “never or physically inactive or irregular activity.” Moderate activity was defined as “regular activity,” while high activity was defined as “regular and vigorous activity.” These four items demonstrated a high level of consistency with a Cronbach’s alpha of .997.

The final version of the survey used to collect data for this study consisted of 30 questions which also included items related to sexual satisfaction; however these items were not used for analysis in this study. Reliability of the data using Cronbach’s alpha for all of the scaled items used for this study was .927.

2.5 Data Analysis

Data were collected via Qualtrics utilizing an online survey. After participants complete the survey through the online link, non-identifying data for each participant were automatically stored in the Qualtrics database. All of the data were cleaned, removing missing cases from the data set. Some of the data collected on exercise using likert-type items were collapsed into in fewer categories. This procedure was utilized in order to have large enough sample cells to complete the required statistical analyses. In addition, all sexual satisfaction data were omitted from the analyses because they were not relevant for logistic regression models predicting exercise and sexual performance, and associations between exercise/PA data and self-reported sexual satisfaction data have been previously reported

(Marshall, Morris & Rainey, 2014). Data were then analyzed using SPSS to perform descriptive statistics to summarize data according to various demographic variables and determine measures of central tendencies regarding self-reported exercise behavior and sexual performance. Logistic regression analyses were used to determine if exercise behavior models could possibly predict sexual performance among healthy adults.

3.0 Results

The final sample consisted of 509 participants who completed the online survey (Table 1).

Participants' ages ranged from 18 to 74 years, with the highest percentage (23.6%) of the participants falling within the 18-24 age groups, while the majorities (55.6%) of participants were between 18 to 34 years old. Forty-five percent were males while 55% were females. Most of the participants were white (81%) and most (58%) had completed a college degree. Approximately 26% of the participants had an annual reported income at less than twenty thousand dollars. Another 24% of the participants reported an annual income between \$20,000-\$49,999, while half (50%) of the participants reported an annual income that exceeded \$50,000, with 20.8% of the participants reporting an annual income of \$100,000 or more.

Table 1. Self-Reported Demographic Characteristics of Participants (N = 509)

Variable	N	%	Cum%
Age			
18-23	120	23.6	23.6
24-29	91	17.9	41.5
30-34	72	14.1	55.6
35-39	60	11.8	67.4
40-49	97	19.1	86.5
50-59	52	10.2	96.7
60-69	15	2.9	99.6
70+	2	0.4	100.0
Gender			
Male	231	45.4	45.4
Female	278	54.6	100.0
Race/Ethnicity			
White	411	80.7	80.7
Black	52	10.2	90.9
Hispanic	15	2.9	93.8
Asian	14	2.8	96.6
Other	17	3.4	100.0
Education			
High school/GED	8	1.6	1.6
Some college	134	26.3	27.9
College degree	182	35.8	63.7
Graduate degree	115	22.6	86.2
Advanced degree	70	13.8	100.0
Income			
10,000-19,999	131	25.7	25.7
20,000-29,999	33	6.5	32.2
30,000-39,999	40	7.9	40.1
40,000-49,999	50	9.8	49.9
50,000-69,999	71	13.9	63.9
70,000-99,999	78	15.3	79.2
100,000+	106	20.8	100.0

Frequency distribution for exercise type indicated that the large majority of participants (76%) only participated in sports such as basketball, football, softball, tennis, or golf once per week or less. Results also determined that the large majority of participants (78%) reported only participating in recreation activities such as canoeing, hiking, fishing, hunting or leisurely walking once a week or less. For strength training activities such as basic calisthenics, weight-lifting, yoga, and Pilates, 41.7% of the participants indicated they participated once a week or less. In contrast, only 18.7% of the participants reported low levels (i.e. once per week or less) of participation in aerobic activities such as running, cycling, swimming, power walking and aerobics classes. (Table 2).

These findings suggest that participation in aerobic activity was the exercise type that was most regularly selected by study participants compared to other exercise types.

Table 2. Self-Reported Characteristics of Exercise Participation (N = 509)

Variable	N	%	Cum%
<u>Aerobics Participation</u>			
Never	31	6.1	6.1
< Once a month	12	2.4	8.4
Once per month	16	3.1	11.6
2-3 times per month	14	2.8	14.3
Once per week	22	4.3	18.7
2-3 times per week	129	25.3	44.0
Daily	143	28.1	72.1
> Once per day	79	15.5	86.7
Missing data	63	12.4	100.0
<u>ST Participation</u>			
Never	55	10.8	10.8
< Once a month	17	3.3	14.1
Once per month	20	3.9	18.1
2-3 times per month	48	9.4	27.5
Once per week	72	14.1	41.7
2-3 times per week	173	34.0	75.6
Daily	52	10.2	85.9
> Once per day	9	1.8	87.6
Missing data	63	12.4	100.0
<u>Sports Participation</u>			
Never	224	44.0	44.0
< Once per month	68	13.4	57.4
Once per month	33	6.5	63.9
2-3 times per month	24	4.7	68.6
Once per week	36	7.1	75.6
2-3 times per week	27	5.3	80.9
Daily	23	4.5	85.5
> Once per day	11	2.2	87.6
Missing data	63	12.4	100.0
<u>Recreation Participation</u>			
Never	66	13.0	13.0
< Once per month	42	8.3	21.2
Once per month	41	8.1	29.3
2-3 times per month	78	15.3	44.6
Once per week	88	17.3	61.9
2-3 times per week	81	15.9	77.8
Daily	38	7.5	85.3
> Once per day	12	2.4	87.6
Missing data	63	12.4	100.0

To determine whether exercise could predict improved sexual performance among healthy adults, logistic regression analyses were performed using a set of predictor exercise variables that included exercise frequency, exercise intensity, exercise time, and exercise type. The self-reported sexual performance dependent variables included the frequency of sexual arousal, frequency of sexual desire, frequency of sexual intercourse, and number of orgasms in a single sexual episode. After performing preliminary analyses to ensure that there were no violations of high multicollinearity among the predictor variables and presence of outliers or cases which were not well explained by the regression models, the logistics regression analyses confirmed a number of significant findings related to exercise behavior and self-reported sexual performance among healthy adults

Although not all of the exercise regression models were statistically significant ($p \leq .05$), results of the analyses did reveal that RPE exercise models could significantly explain frequency of sexual arousal, frequency of sexual desire, frequency of sexual intercourse, and orgasms in a single sexual episode, while the exercise frequency model was only able to significantly explain frequency of sexual desire.

3.1 RPE and Frequency of Sexual Arousal

Direct logistic regression was performed to assess a number of factors on the likelihood that study participants would report an increase in frequency of sexual arousal. The model contained four independent variables (RPE of sports, RPE of aerobics, RPE of strength training, and RPE of recreation). The full model containing all of the predictors was statically significant $X^2(4, N = 432) = 15.65, p < .05$, indicating that the model was able to distinguish between participants who reported and did not report a higher frequency of sexual arousal. The model as a whole explained between .04% (Cox and Snell R square) and 11% (Nagelkerke R squared) of the variance in frequency of sexual arousal, and correctly classified 95% of the cases.

As shown in Table 3, only one of the variables made a unique statistically significant contribution to the model (i.e. RPE of aerobics). The strongest predictor of frequency of sexual arousal was RPE of aerobics, recording an odds ratio of 3.15. This indicated that participants who reported higher RPE during aerobics were over three times more likely to report higher frequency of sexual arousal compared to those who reported lower RPE during aerobics, controlling for all other variables in the model.

Table 3: Logistic Regression Predicting Frequency of Sexual Arousal

	B	S.E.	Wald	df	p	Odds Ratio	95% C.I. Lower	95% C.I. Upper
RPEsport	-.747	.555	1.81	1	.179	.474	.160	1.41
RPEaerobic	1.15	.541	4.50	1	.034	3.15	1.20	9.10
RPErec	.180	.596	.091	1	.762	.762	.372	3.90
RPEstrength	.911	.515	3.13	1	.077	2.50	.907	6.82
Constant	1.61	.397	16.42		.000	5.00		

3.2 RPE and Frequency of Sexual Desire

Direct logistic regression was performed to assess a number of factors on the likelihood that study participants would report an increase in frequency of sexual desire. The model contained four independent variables (RPE of sports, RPE of aerobics, RPE of strength training, and RPE of recreation). The full model containing all of the predictors was statically significant $X^2(4, N = 432) = 15.90, p < .04$, indicating that the model was able to distinguish between participants who reported and did not report a higher frequency of sexual desire. The model as a whole explained between .04% (Cox and Snell R square) and 10% (Nagelkerke R squared) of the variance in frequency of sexual desire, and correctly classified 94% of the cases.

As shown in Table 4, two of the variables made a unique statistically significant contribution to the model (i.e. RPE of sport and RPE of strength training). The strongest predictor of frequency of sexual desire was RPE of strength training, recording an odds ratio of 3.25. This indicated that participants who reported higher RPE during strength training were over three times more likely to report higher frequency of sexual desire compared to those who reported lower RPE during strength training, controlling for all other variables in the model.

Table 4: Logistic Regression Predicting Frequency of Sexual Desire

	B	S.E.	Wald	df	p	Odds Ratio	95% C.I. Lower	95% C.I. Upper
RPEsport	-1.15	.494	5.41	1	.020	.317	.160	1.41
RPEaerobic	.839	.543	2.40	1	.123	2.31	1.20	9.10
RPErec	.157	.543	.090	1	.772	1.20	.372	3.90
RPEstrength	1.20	.482	6.00	1	.014	3.25	.907	6.82
Constant	1.80	.417	17.65		.000	5.80		

3.3 RPE and Frequency of Sexual Intercourse

Direct logistic regression was performed to assess a number of factors on the likelihood that study participants would report an increase in frequency of sexual intercourse. The model contained four independent variables (RPE of sports, RPE of aerobics, RPE of strength training, and RPE of recreation). The full model containing all of the predictors was statically significant $X^2(4, N = 328) = 16.26, p < .05$, indicating that the model was able to distinguish between participants who reported and did not report a higher frequency of sexual intercourse. The model as a whole explained between .05% (Cox and Snell R square) and .09% (Nagelkerke R squared) of the variance in frequency of sexual intercourse, and correctly classified 82% of the cases.

As shown in Table 5, three of the variables made a unique statistically significant contribution to the model (i.e. RPE of sports, RPE of aerobics, and RPE of recreation). The strongest predictor of frequency of sexual intercourse was RPE of aerobics, recording an odds ratio of 2.80. This indicated that participants who reported higher RPE during aerobics were almost three times more likely to report higher frequency of sexual intercourse compared to those who reported lower RPE during aerobics, controlling for all other variables in the model.

Table 5: Logistic Regression Predicting Frequency of Sexual Intercourse

	B	S.E.	Wald	df	p	Odds Ratio	95% C.I. Lower	95% C.I. Upper
RPEsport	-.774	.337	5.28	1	.022	.461	.238	.892
RPEaerobic	1.02	.444	5.31	1	.021	2.80	1.17	6.65
RPErec	-.790	.327	5.88	1	.016	.454	.239	.861
RPEstrength	.488	.349	1.95	1	.162	1.63	.822	3.23
Constant	.912	.376	5.88		.015	2.50		

3.4 RPE and Number of Orgasms in Single Sexual Episode

Direct logistic regression was performed to assess a number of factors on the likelihood that study participants would report higher frequency of orgasms in a single sexual episode. The model contained four independent variables (RPE of sports, RPE of aerobics, RPE of strength training, and RPE of recreation). The full model containing all of the predictors was statically significant $X^2(4, N = 432) = 22.57, p < .004$, indicating that the model was able to distinguish between participants who reported and did not report a higher frequency of orgasms in a single sexual episode. The model as a whole explained between .05% (Cox and Snell R square) and .08% (Nagelkerke R squared) of the variance in frequency of orgasms in a single sexual episode, and correctly classified 75% of the cases.

As shown in Table 6, only two of the variables made a unique statistically significant contribution to the model (i.e. RPE of aerobics and RPE of recreation). The strongest predictor of frequency of sexual arousal was RPE of aerobics, recording an odds ratio of .520. This indicated that participants who reported higher RPE during aerobics were about one half times more likely to report higher frequency of orgasms in a single sexual episode compared to those who reported lower RPE during aerobics, controlling for all other variables in the model.

Table 6: Logistic Regression Predicting Orgasms in a Single Sexual Episode

	B	S.E.	Wald	df	p	Odds Ratio	95% C.I. Lower	95% C.I. Upper
RPEsport	.241	.266	.820	1	.365	1.27	.756	2.14
RPEaerobic	-.655	.342	3.67	1	.055	.520	.266	1.02
RPErec	.474	.253	3.52	1	.061	1.61	.979	2.64
RPEstrength	-.042	.267	.025	1	.874	.959	.568	1.62
Constant	-.735	.295	6.22		.013	.480		

3.5 Exercise Frequency and Frequency of Sexual Desire

Direct logistic regression was performed to assess a number of factors on the likelihood that study participants would report an increase in frequency of sexual desire. The model contained four independent variables (sport frequency, aerobic frequency, strength training frequency, and recreation frequency). The full model containing

all of the predictors was statically significant $X^2(4, N = 446) = 23.81, p < .002$, indicating that the model was able to distinguish between participants who reported and did not report a higher frequency of sexual desire. The model as a whole explained between .05% (Cox and Snell R square) and 15% (Nagelkerke R squared) of the variance in frequency of sexual desire, and correctly classified 94% of the cases.

As shown in Table 7, two of the variables made a unique statistically significant contribution to the model (i.e. aerobic frequency and recreation frequency). The strongest predictor of frequency of sexual desire was recreation frequency, recording an odds ratio of 7.12. This indicated that participants who reported higher recreation frequency were over seven times more likely to report higher frequency of sexual desire compared to those who reported lower recreation frequency, controlling for all other variables in the model.

Table 7: Logistic Regression Predicting Frequency of Sexual Desire

	B	S.E.	Wald	df	p	Odds Ratio	95% C.I. Lower	95% C.I. Upper
Sportfreq	-.727	.615	1.40	1	.237	.483	.145	1.61
Aerobicfreq	1.72	.683	6.32	1	.012	5.60	1.50	21.26
Recfreq	1.97	.764	6.70	1	.010	7.20	1.61	32.10
Strengthfreq	-.289	.554	.273	1	.602	.749	.253	10.15
Constant	1.51	.350	18.62		.000	4.52		

4.0 Discussion

In this study, researchers collected data using various social networking platforms and an email listserv to determine if a set of exercise variables including exercise frequency, exercise intensity, exercise time, and exercise type could predict self-reported sexual performance among healthy adults. Exercise behavior and self-reported sexual performance variables were analyzed using descriptive statistics and logistic regression. Results of the study partially supported the proposed hypotheses, demonstrating that logistic regression models containing exercise RPE variables and exercise frequency variables were able to significantly predict self-reported sexual performance among healthy adults. Logistic regression models containing exercise time and exercise type variables were not able to significantly predict self-reported sexual performance among healthy adults. Sport RPE, aerobic RPE, recreation RPE, and strength training RPE exercise models were able to significantly predict frequency of sexual arousal, frequency of sexual desire, frequency of sexual intercourse and number of orgasms in a single sexual episode.

Aerobic RPE was the independent variable that made the most significant contribution within three of the logistic regression models. Sport and recreation RPE provided a significant contribution within two exercise models, while strength training RPE was only able to provide a significant contribution within one of the exercise models.

Findings of this study may be supported through the work of previous studies. For example, recent work has demonstrated that high intensity training is related to increased levels of testosterone (Khoo, et al, 2013; Tanner, Nielsen, & Allgrove, 2014). This increase in testosterone can improve sexual desire (Davis & Braunstein, 2012). Aerobic and strength training exercise helps stabilize and maintain healthy blood pressure (Cornelissen & Smart, 2013) and a number of studies (Dabrowska, Drosdzol, Skrzypulec & Plinta, 2010; Margus et al., 2011; Spatz, Canavan, Desai, Krumholz & Lindau, 2013) showed that hypertension is correlated to decreased sexual performance. These particular components of sexual performance are considered also aspects of libido, which typically improve with exercise (Friedenreich, et al, 2010). Previous work also demonstrated that strength training intensity can contribute to ease of orgasm (Bo, Talseth, & Vinsnes, 2000; Braekken, Majida, Engh, & Bo, 2015; Kegel, 1952; Zahariou, Karamouti, & Papaioannou, 2008).

Furthermore, the Martinez et al (2014) study demonstrated that strength training improves the core and pelvic platform muscles and that this is related to improved sexual performance. Kegel's original work (1948) and the work of Braekken and colleagues (2015) also demonstrated that strength training and increased pelvic floor strength can improve the ease of orgasm during sexual episodes. Thus, greater RPE may lead to stronger pelvic floor muscle and ease of orgasm which in turn can improve the number of orgasms in a single sexual episode.

Recreation RPE was the exercise variable that made the largest significant contribution to frequency of sexual desire and number of orgasms in a single sexual episode. As discussed earlier, recreation RPE and self-reported sexual performance may be related to improved body awareness (Copland, 1994) and healthier perceptions of self-image (Pfirman, 1988). Recreation activities, such as hiking, canoeing, and wilderness trips, may help individuals deepen their

sense of physical awareness by engaging in activities that includes elements of risk taking, team-building, and trusting. Participating in recreation activities that contain such elements may help individuals improve physical awareness, positive self-image, and an increase in over body awareness, all of which could contribute to the likelihood of multiple orgasms. This concept of body awareness and multiple orgasms has been supported by research (Sayin, 2012) showing that women who are more aware of their bodies are more likely to have stronger, more intense, prolonged, or expanded orgasms (Sayin, 2012).

The variables that comprised the logistic regression model for frequency of sexual desire included sport frequency, aerobic frequency, recreation frequency, and strength training frequency. Aerobic frequency and recreation frequency were the two predictor variables that significantly contributed to the overall logistic regression model. Frequency of aerobic exercise may improve the frequency of sexual desire. These findings are supported by Pujols et al., (2010) conclusions, demonstrating that frequent aerobic exercise and higher levels of aerobic duration increases the likelihood of healthy weight, healthy body image and healthy self-esteem. Penhollow and Young (2004) indicated that these factors are significantly related to an individual's sexual image and sexual desirability. Findings from the current study also support previous work (Li, Holm, Gulanick, Lanuza, & Penckofer, 1999) which demonstrated that levels of physical activity may decrease distressful sexual symptoms like vaginal dryness and improve sexual desire. Research in outdoor recreation experiences has also shown that women who participated in a three-day outdoor recreation experience reported more positive feelings towards their bodies (Pfirman, 1988), and more current findings revealed that body image issues can impact all domains of sexual functioning (Woertman & van dem Brink, 2012).

The overall findings from this study seem to demonstrate that certain exercise variables can play a significant role in sexual performance among healthy adults. Previous studies (Marshall, Morris, & Rainey 2014 ; Morris Marshall, & Demers, 2015; Penhollow & Young, 2008; Penhollow & Young, 2004; Simon et al., 2015) support these findings by demonstrating that adults who report higher fitness levels were more likely to report improved sexual performance. Research by Karatas and colleagues (2009) showed that female athletes had higher scores on the Female Sexual Function Index as compared to sedentary healthy females, indicating better clitoral blood flow and better overall sexual function. Findings from the current study and previous research (Marshall, Morris, and Rainey, 2014) seem to suggest that fitness and exercise are important factors related to improved sexual performance among healthy adults.

5.0 Limitations

Methodological considerations should be addressed when looking into the limitations of this study. The instrument used to collect data for the study was a self-report questionnaire. Self-report questionnaires can be influenced by the willingness of the study participants to provide honest responses and their ability to have good clarity and memory concerning questions being asked about exercise and sexual performance. The nature of the subject matter and time requirement for participants to complete the questionnaire may have negatively influenced the participants' responses. Furthermore, this study employed a cross-sectional research design where behavior correlates were addressed rather than antecedents of behavior. Although beneficial in numerous ways, this design does not allow for assumptions related to whether or not this same set of exercise variables could predict sexual performance among healthy adults over a period time, and it does not help determine cause and effect (Soleman, 2015).

Other limitations commonly attributed to self-reported data are the under-reporting or over-reporting of behavior (Engeler&Raghubir, 2016). Participants may over-report or under-report their behaviors and perceived levels of participation as it related to exercise frequency, exercise RPE, Exercise time, and exercise type. Furthermore, disclosing personal sexual behavior may be uncomfortable for some participants, which may have led to a greater likelihood to not accurately report sexual performance behaviors. Since participants' responses were anonymous and confidential, self-reported exercise and sexual performance could not be traced to participants who participated in general exercise behavior as compared to participants who participate in a multi-sport lifestyle. This prevented the researchers from categorizing participants by groups who engaged in general exercise types compared to exercise types specific to triathlon. Therefore, these results are unique to the study sample and should not be generalized among the general fitness population or individuals who participate in triathlon.

When categorizing exercise time, specific categories were not included which might be more specific to participants who might have been engaging in triathlon training. Many triathletes will train anywhere from five to

nine hours a week for entry level participation (Cleveland & Swarthout, 2017), while some more elite triathletes will train up to 30 hours per week (Mosely, 2013). In this study, additional categories for exercise time that exceeded “high duration - 60 minutes or more” were not included.

Not including these additional exercise time categories limits the findings to broad range relationship between exercise and self-reported sexual performance among healthy adults. Exercise time categories beyond 60 minutes would have provided the opportunity to determine if exercise time that exceeds the recommended gold standard of sixty minutes, six days per week (American College of Sports Medicine, 2014) would explain a greater percentage of the variation among exercise and self-reported sexual performance among healthy adults.

In addition, this study only explores the relationship between a set of exercise variables and the self-reported sexual performance related to frequency of sexual desire, sexual arousal, sexual intercourse, and number of orgasms in a single sexual episode. Previous research demonstrated that other sexual performance factors, such as relationship status and relationship satisfaction can contribute to an individual’s perceived sexual performance. This same study also pointed to psychological and emotional factors being related to perceived sexual performance. (Janssen, McBride, Yarber, Hill, & Butler, 2008). To provide a more comprehensive understanding as to what variables or sets of variables have the most significant relationship with sexual performance indicators, these factors should also be considered in the context of future work related to exercise and sexual performance.

Future studies may want to consider including additional predictor variables (i.e. psychological and emotional) within the regression models to determine if these additional variables contribute more towards improved sexual performance than does exercise. In addition, it might be beneficial to consider comparing differences in exercise and sexual performance among multi-sport lifestyle participants and general exercise participants.

Additionally, future studies may want to investigate the relationship of exercise behavior time that falls well beyond recommended standards for exercise frequency, exercise intensity, exercise time, and exercise type. Participants who report exceedingly high levels of exercise behavior may or may not demonstrate improved sexual performance compared to those who reported exercise behavior that falls within normal limits.

6.0 Conclusions

Exercise and sexuality are important lifestyle factors that contribute to quality of life (Chodzko-Zajko, 2014; Skorupska, Szeligowska, & Mamcarz, 2013). Previous research consistently demonstrates that exercise and fitness is related to improved cardiovascular function (Gibala, Little, MacDonald, & Hawley, 2012), body image (Mehnert et al., 2011; Penhollow & Young 2008), self-esteem (Barton, Griffin, & Pretty, 2013), and overall quality of life (Gibala, Little, MacDonald, & Hawley, 2012; Mehnert et al., 2011; Myers et al., 2013). Healthy sexuality improves overall quality of life (Gelfand, 2000; Robinson & Molzahn, 2007) and significantly contributes to healthy relationships (Penhollow, Young, & Denny, 2009).

The current study was able to show that a set of exercise variables were able to significantly explain frequency of sexual arousal, frequency of sexual desire, frequency of sexual intercourse, and number of orgasms in a single sexual episode. It is well known that exercise is related to improved cardiovascular function and circulation (Bangsbo, Hansen, Dvorak, & Krstrup, 2015; Kang, 2014; Lavie, Arena, & Franklin, 2016). Stimulation of the male and female genitalia requires healthy circulation and this plays an important role in healthy sexual function and orgasm (Karatas et al., 2009; Spatz, Canavan, Desai, Krumholz, & Lindau, 2013). Findings from the current study support earlier work (Cormie et al., 2013; Lara et al., 2015; Meston 2000) showing that exercise RPE and exercise frequency is related to improved sexual performance.

Moreover, exercise RPE and exercise frequency were the exercise variables that provided the most contribution to the regression models, helping to explain components of exercise that are most likely to contribute to a greater frequency of sexual arousal, sexual desire, sexual intercourse, and number of orgasms in a single sexual episode. Exercise RPE made the most significant contributions to improved sexual performance. This may suggest that individuals wanting to improve their sexual performance may want to consider higher intensity exercise. More specifically they may want to focus more on higher intensity aerobic exercise.

Furthermore, it is interesting that when exploring frequency, recreation frequency was the predictor variable that made the most contribution to frequency of sexual desire and number of orgasms in a single sexual episode.

Although this was a somewhat surprising finding, review of earlier studies (Copland, 1994; Pfirman, 1988) in recreation demonstrates that individuals are likely to develop improved self-awareness, trust, and positive feelings of self-image through recreation participation. These personal traits have been related to improved sexuality (Sayin, 2012). Therefore, activity types that primarily focus on participation in traditional exercise activities (e.g. weight lifting, aerobics classes, group exercise, etc.) in order to stimulate weight loss, muscular strength, muscular endurance, and general fitness may not improve sexual performance as well as recreation activity such as canoeing, camping, hiking, and adventure activities. These activities seem to do a better job at promoting self-awareness, body awareness, and positive self-image.

This type of study adds to the current body of literature by attempting to use a set of exercise variables (i.e. frequency, intensity, time, and type) to explain sexual performance among healthy adults. Most studies that address exercise and sexuality do so in order to demonstrate that exercise can improve sexual function for individuals that have physical disabilities which limit sexual function. This study tries to explain that exercise can be used to enhance sexuality for individual who are relatively healthy and want to improve their sexuality and overall quality of life. In addition, this study's sample was uniquely collected from the general public that utilizes various social network platforms such as Facebook, IamTri, Twitter, and Active.com. It also included participants who were recruited from an email listserv of people who maintain a multi-sport lifestyle and are members of formal triathlon clubs (Marshall, Morris & Rainey, 2014).

Future research should focus on individuals who report excessive frequency, intensity, and time among different exercise types to determine if exercise prescription that greatly exceeds the recommended gold standard enhances or reduces self-reported sexual performance among healthy adults. Researchers could also consider including other known contributing variables related to improved sexuality within regression models in order to determine if there are other factors that are able to contribute more to improved sexuality as compared to exercise. Finally future studies should consider including randomized control trials to compare the effects of using prescribed exercise and activity participation to better assess the relationship between exercise and sexual performance among healthy adults.

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