Assessment of the Relationship between Regular Fitness Activity and Sexual Functioning in Women

Joanne Kolean-Burley
Western Michigan University

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ASSESSMENT OF THE RELATIONSHIP BETWEEN
REGULAR FITNESS ACTIVITY AND
SEXUAL FUNCTIONING IN WOMEN

by

Joanne Kolean-Burley

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
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ASSESSMENT OF THE RELATIONSHIP BETWEEN
REGULAR FITNESS ACTIVITY AND
SEXUAL FUNCTIONING IN WOMEN

Joanne Kolean-Burley, M.A.
Western Michigan University, 1992

This study assessed differences between female aero­bic exercisers and nonexercisers in sexual functioning and arousability. Fourteen exercisers and 6 nonexercisers between the ages of 19 and 52 participated in the study. All subjects were involved in an ongoing sexual relationship with a duration of at least 3 months. Sexual functioning, satisfaction, and arousability were assessed through two self-report measures, the Sexual Interaction Inventory (LoPiccolo & Steger, 1978) and the Sexual Arousability Inventory (Hoon, Hoon, & Wincze, 1976); sexual arousability also was assessed through two extragenital physiological measures during exposure to erotic stimuli under laboratory conditions.

The results indicated that there were no significant differences between exercising and nonexercising women on any of the measures of sexual functioning, satisfaction, or arousability.
ACKNOWLEDGEMENTS

I would like to express my appreciation to the members of my committee, Dr. C. Richard Tsegaye-Spates, Dr. Galen Alessi, and especially my advisor, Dr. M. Michele Burnette for their guidance and availability throughout the course of this study. I would also like to thank my friend, Betty Fisher, for her unending support and helpful advice. Finally, I want to thank my best friend and mentor, my husband Morris J. Burley, for his endless patience and understanding during the course of this study.

Joanne Kolean-Burley
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Assessment of the relationship between regular fitness activity and sexual functioning in women

Kolean-Burley, Joanne Louise, M.A.

Western Michigan University, 1992
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INTRODUCTION

Sexual desire and arousability are determined by a variety of factors. An early theory of sexual arousability in women stated that increased levels of estrogen in the bloodstream increase sexual desire and responsivity (Benedek & Rubenstein, 1939). However, subsequent studies did not support this theory. Waxenberg, Kinkbeiner, Drellich, and Sutherland (1960) found that sexual desire, activity and responsivity in female cancer patients was not related to estrogen levels. Another study showed no difference in estrogen levels between women who reported high versus low levels of sexual activity (Persky, O'Brien, & Khan, 1976). Persky et al. (1978) found that in young, premenopausal women, plasma estradiol levels were not related to sexual arousal, intercourse frequency, or sexual gratification.

While factors such as hormonal changes seem to be uncorrelated with sexual arousability and desire, several psychosocial factors do appear to play a role. Warner and Bancroft (1988) found a relationship between sexual interest and measures of well-being in women. They asked women to indicate on a questionnaire during which time of the month they experienced the greatest and the least feelings of energy and "well-being." They found that
reported feelings of positive well-being correlate highly with sexual interest in most women; conversely, negative well-being is usually associated with low sexual interest. Sexual interest or desire may also be impacted by the level of stress to which a woman is exposed. Arnett, Prosen, and Toews (1986) found that when excessive stress resulted in feelings of anxiety, anger, depression, and guilt, sexual desire was decreased. There is also evidence that career-related stress may impact negatively on sexual arousability and desire. In a study of working and nonworking wives, it was found that women who were pursuing careers were twice as likely to experience inhibited sexual desire as nonworking wives or women who were employed in jobs emphasizing the "immediate organization of activities rather than increasing levels of responsibility" (Avery-Clark, 1986, p. 98). Additionally, these career women were also more likely to suffer from vaginismus, the involuntary spasms of muscles around the outer third of the vagina which impede penetration. The higher incidence of inhibited sexual desire and other dysfunctions in career women may be a consequence of exposure to an increased number and/or different types of stressors.

It is plausible that the traditional response patterns of sexually active couples are altered when the
female partner pursues a career. In fact, it is reported that the majority of dual-earner couples who seek professional marital counseling manifest at least one sexual dysfunction (Johnson, Kaplan, & Tusel, 1979). Rust and Golombok (1990) also have found sexual dysfunction to be a common factor in marital discord. They suggest that stress reduction techniques should be an integral part of sex and marital therapy. The use of these techniques has been effective in restoring normal sexual functioning in men and women; however, there is some indication that a more global approach, including traditional therapeutic techniques, may have a greater impact on women. Depression also has been shown to impact on sexual desire, sexual satisfaction, and sexual functioning. In a study which questioned women who were presenting for treatment at a menopause clinic, Channon and Ballinger (1986) found that scores indicating greater levels of depression on the Hamilton Depression Scale were highly correlated with decreased sexual desire and enjoyment. This finding supports the inclusion of loss of sexual desire and satisfaction in the classical definition of depression (Kaplan, Freedman, & Saddock, 1980).

Exercise has been shown to impact on feelings of well-being, as well as other mood states. For example, many studies have shown exercise to be effective in
improving mood (Blumenthal, Williams, Needels, & Wallace, 1982; Jasnoski, Holmes, & Banks, 1988; Moses, Steptoe, Mathews, & Edwards, 1989; Steptoe & Cox, 1988), reducing subjective feelings of tension and anxiety (Roth, 1989; Steptoe, Edwards, Moses, & Mathews, 1989), improving self-concept (Hughes, 1984), and increasing frustration tolerance (Jasnoski, Holmes, Solomon, & Aguiar, 1981). The question of whether the exercise must be of an aerobic nature to be effective in inducing change in mood states and anxiety levels has yet to be answered definitively.

Research also has shown that exercise is effective in reducing stress. Many researchers have investigated the impact of regular aerobic exercise on psychosocial and physiological stress reactivity (Crews & Landers, 1987; Hollander & Seraganian, 1984; Holmes & Roth, 1988; Hull, Young, & Ziegler, 1984; Sinyor, Golden, Steinert, & Seraganian, 1986; Sinyor, Schwartz, Peronnet, Brisson, & Seraganian, 1983). Most have found that individuals who regularly participate in aerobic exercise demonstrate faster physiological recovery when exposed to a psychosocial stressor (i.e., mental calculations of math problems while being timed) than nonexercisers. Additionally, exercisers generally show lower resting heart rates, resulting in lower heart rates than nonexercisers after
exposure to a stressor. There is also evidence that regular exercise may act as a "buffer" for stress. Brown and Siegal (1988) have shown that negative life events have less of an impact on adolescents who exercise regularly. They compared nonexercising adolescents to those who exercised regularly on reactivity to negative events over the course of a year. They found that the exercisers reported that the negative events had less of an impact on them.

Regular exercise has also been shown to have a positive impact on depression. When compared to relaxation, meditation, and psychotherapy, exercise has been shown to be as effective or more effective in reducing the signs of clinical depression (Doyne, Chambless, & Beutler, 1983; Griest et al., 1979; Klein et al., 1985; Martinsen, 1987; McCann & Holmes, 1984).

Given that sexual arousability and desire are associated with feelings of well-being, stress is associated with decreases in sexual functioning, depression is associated with decreases in sexual satisfaction and enjoyment, and exercise is correlated with increases in well-being, decreases in stress, and decreases in depression, then it seems plausible that exercise may impact positively on sexual functioning.

Weismier, Forsythe, Sundstrom, Ullis, and Hertz
(1986) found that when compared to normal, college men who did not participate in college sports, college athletes had different perceptions about sex. An 80-item, self-report questionnaire about general and specific sexual concerns was administered to 582 college men. Forty-one percent of the nonathletes reported having "sexual concerns," whereas only 33% of the athletes reported sexual concerns. The authors speculated that this difference could be attributed to the "macho" attitude of the athletes and/or the social locker room pressures to maintain a particular sexual profile; however, it is possible that participation in exercise impacts upon sexual functioning.

Only one study has directly assessed the impact of exercise on sexual functioning. White, Case, McWhirter, and Mattison (1990) compared men who exercised aerobically an average of 3.5 days per week with men who walked an average of 4.1 days per week on a variety of factors, including sexuality. They found significantly greater enhancement in sexual responsiveness and function in the aerobic exercise group. Aerobic exercisers reported increases in frequency of intimate activities and percentage of satisfying orgasms. They also reported decreases in the percentage of times they experienced difficulty in achieving an erection, as well as decreases
in sexual dissatisfaction. Additionally, the degree of sexual enhancement was correlated with the degree of individual improvement in fitness level. The authors also indicated that several subjects spontaneously postulated that their increased sexual interest was due to changes in the way they viewed their bodies following completion of the exercise program.

Based on this study, there appears to be some evidence which suggests that aerobic exercise may in fact impact sexual functioning in men. However, White and his colleagues did not include women in their study, nor are there any studies to date which examine the effects of exercise on sexual arousal and desire in women. Additionally, all information concerning sexual functioning in the study by White and his colleagues was obtained from subject diaries rather than from standardized inventories of sexual functioning. Furthermore, they obtained no physiological measures of arousal to erotic stimuli to assess differences in arousability between subjects in the aerobic and nonaerobic conditions.

The purpose of the present study was to evaluate the effects of regular aerobic exercise on sexual arousal, sexual interest, and general sexual functioning in women. It was hypothesized that women who engage in regular, aerobic exercise would show greater arousability to
sexual stimuli and report higher levels of sexual satisfaction than nonexercising women.
METHOD

Subjects

Subjects were 20 nonmenopausal women between the ages of 19 and 52. All subjects were currently involved in an ongoing, intimate, sexual relationship with a duration of at least 3 months. Subjects were recruited through aerobic exercise classes at a local health club, advertisements in the local newspaper and on a University cable channel, and through fliers posted throughout the University campus. The newspaper advertisement requested that only nonexercising women interested in participating in a research study respond; the advertisement appearing on campus and on the University cable channel solicited exercising and nonexercising women for participation in a research study (see Appendix B).

Setting

Physiological measures of arousal were taken individually in a sound-attenuated, 8 X 10 private laboratory room with a copper shield to filter electrical noise. Subjective measures of sexual satisfaction, sexual arousal, depression, anxiety, and demographic information and health inventories were completed in the large laboratory.
room outside the private chamber or in a private therapy room in the Psychology Clinic within the Psychology Department. The private chamber was equipped with a comfortable, reclining chair, and an intercom system for communicating instructions. Fitness testing was completed either in the adjoining large laboratory room by the researcher or in the exercise physiology room by a master's level graduate student in the Exercise Physiology program.

Subjective Measures

Subjective measures of sexual satisfaction and functioning were assessed with the Sexual Interaction Inventory (SII) (LoPiccolo & Steger, 1978). The SII consists of a list of 17 heterosexual behaviors, with 6 questions pertaining to each behavior. When used to assess a couple's sexual functioning, responses from each member of the couple are summed across all 17 behaviors and the totals are used to create an 11-scale profile. For the purpose of this study, only scales 2, frequency of dissatisfaction, 4, self-acceptance, and 6, pleasure mean were used because the partners of the subjects were not included in this study. Scales 2, 4, and 6 have test-retest reliability correlations of .65, .71, and .89, respectively, and all three of these scales distinguish
between sexually dysfunctional individuals and sexually satisfied individuals.

Additionally, the Sexual Arousability Inventory (SAI) (Hoon, Hoon, & Wincze, 1976) was used to assess perceived arousability to a variety of sexual experiences. The SAI consists of 38 descriptions of sexual experiences which are rated in terms of how arousing the experience would be using a scale from -1 (adversely affects arousal) to 5 (always causes sexual arousal). This inventory has internal consistency with a split-half reliability correlation of .92. The SAI has a test-retest correlation of .69 and can distinguish between normal and sexually dysfunctional women.

Assessment for other conditions which may cause a decrease in sexual satisfaction, functioning, or arousal were also completed. Depression was assessed through the use of the Self-Rating Depression Scale (SDS) (Zung, 1965). The SDS contains 20 items which assess the presence and severity of three aspects of depression including pervasive affect, physiological concomitants, and psychological concomitants. Ten of these items were designed to read symptomatically positive with the other 10 reading symptomatically negative. Respondents rate each item on a sliding scale of how it applies to them at the time of testing. Although reliability data are not
available, the SDS distinguishes between depressed and nondepressed samples.

Anxiety was assessed through the State-Trait Anxiety Scale (STAI) (Spielberger, Gorsuch, & Lushene, 1970). The STAI consists of 2 separate self-report subscales, each consisting of 20 questions designed to measure state anxiety and trait anxiety. The instructions for the Trait scale ask for subjects to describe how they generally feel, while the State scale instructs subjects to describe how they feel at a particular moment in time. The test-retest reliability of the Trait scale ranges from .73 to .86, while the test-retest reliability for the State scale ranges from .16 to .54; the low coefficients for the State scale are expected since this scale is designed to reflect the influence of situational variables. The Trait scale has concurrent validity ranging from .52 to .80, while the State scale has construct validity ranging from .83 to .94.

Cardiovascular health was assessed through a questionnaire developed for use by the University Wellness Program (see Appendix C).

General demographic information regarding the length of the relationship, type of relationship (dating, cohabitating, married), number of children living with the subject, income, education level, and a general
assessment of body image was assessed by a questionnaire as well (see Appendix D).

A Likert-type scale ranging from 0 (not at all aroused) to 5 (orgasm) was used to assess subjective arousal to erotic stimuli. A similar scale ranging from 0 (not anxious) to 5 (extremely anxious) was used to assess anxiety during exposure to erotic stimuli. Both scales were printed on a 2" X 4" card, and one card was identified for each vignette and video. Subjects dropped completed cards into a 12" X 16" box with a slit cut in the top.

Report forms with spaces for recording exercise type, duration and date outside of experimental sessions were also provided for subjects (Appendix E).

Physiological Measures

Arousal during exposure to erotic stimuli was assessed through the use of two extragenital, physiological measures, heart rate and galvanic skin response. Bartlett (1956) reported marked fluctuations in heart rate in both men and women during foreplay, as well as consistent accelerations in heart rate following intromission. Wenger, Averill, and Smith (1968) measured electrodermal level in 10 men while they read erotic and neutral texts and found that this measure differentiated
between erotic and neutral conditions. Heart rate was monitored continuously through the attachment of an electrode to alcohol-cleansed skin on the distal phalanx of the index finger of the nondominant hand. Electrodermal activity was measured continuously through the placement of electrodes on the medial phalanxes of the middle two fingers of the nondominant hand. The measures were recorded using two Modality Modules from the J & J I-330 Physiological Monitoring System. Heart rate was recorded by the Plethysmograph Module P-401, and skin conductance was recorded by the Temperature/Electrodermograph T-601. The I-330 Interface receiving these signals was connected to a Zenith Data Systems Z-150 PC (IBM compatible). Measures were processed and stored by an application program developed in the Universal Sensing Environment (USE) Physiological Monitoring Language. The program computed average readings every 5 seconds and specified 1 trial to consist of 12 averages for both measures.

Fitness testing was accomplished through the use of a Monark 818E bicycle ergometer. During fitness testing in the laboratory, heart rate was monitored with the SD-700-A automated blood pressure and pulse rate monitor. For fitness testing done in the Exercise Physiology room, heart rate was monitored with the Exersentry Heart Rate
Monitor, Model 60100. Percent body fat was estimated with the use of the Lange Skinfold Caliper.

Apparatus

Three audiotaped vignettes averaging 7 minutes, 27 seconds in length and 3 sexually explicit videos averaging 4 minutes, 28 seconds in length were used as erotic stimuli for both physiological measurement sessions. The vignettes were based on female fantasies from *To Turn You On* (Aphrodite, 1975). Each vignette described sexual encounters in explicit terms from a female perspective. The first vignette described foreplay and sexual intercourse between willing, adult partners. The second vignette consisted of a description of cunnilingus with a female partner. The third vignette described fellatio and sexual intercourse with more than one male partner. Masters and Johnson (1979) reported that for heterosexual females, replacement of an established partner ranks first among fantasy themes, with cross-preference encounters ranking fifth and idyllic encounters with unknown men ranking fourth. The sexually explicit videos included cunnilingus, fellatio, and sexual intercourse with several partners.
Procedure

Volunteers were solicited from the aerobics classes at a local health club. The primary researcher arrived just before scheduled aerobic classes and described the study to the classes as "an effort to document the positive physical and psychological effects of aerobic exercise." Eligible and interested candidates were asked to provide their name and phone number on a sign-up sheet so the researcher could call them to describe the study in more detail. Volunteers were also solicited through a newspaper advertisement, through advertising on the University cable channel, and through fliers posted on campus. Those candidates who, after receiving details about the study by phone, expressed an interest in participating in the study were asked to schedule an appointment to come in for a meeting during which more specific information regarding the study was provided (see Appendix F for telephone script). They were told that the researcher was examining the relationship between participation in exercise and sexual satisfaction and functioning. Subjects were given consent forms to sign and forms on which to record exercise activity. Finally, an appointment for the first session was scheduled.

The first session consisted of the subject coming to
the large laboratory room to complete the five inventories, including the following: general information form, the Health Risk Rating Form, the Self-Rating Depression Scale, the Sexual Arousability Inventory, the State-Trait Anxiety Inventory, and the Sexual Interaction Inventory. Subjects were given instructions for completing the inventories and either remained in the large laboratory room alone for the remainder of the session or were shown to a private therapy room in the Psychology Clinic. In order to insure confidentiality, subjects were given a subject code number and asked to write this on each inventory rather than their names. Completion of all forms took approximately 30 to 40 minutes for all subjects. Finally, an appointment for the next session was scheduled.

The second session began with the subject being asked to sit in the recliner in the private laboratory room. The researcher attached the electrode to measure heart rate on the index finger of the nondominant hand and electrodes were attached to the middle two fingers of the nondominant hand to measure Galvanic Skin Response. Headphones were placed over the subject's ears and the rating forms for each vignette and video and a pen were given to the subject. The subject was given the following instructions:
This session will last approximately one hour. For the first 15 minutes, I would like you to just sit here and relax while I take baseline measures. At the end of 15 minutes, I will instruct you over this intercom that Story 1 will now begin. After you have listened to the first story, I will instruct you to complete this rating form and drop it in the box. I will give you approximately one minute to complete the form and then I will announce that Story 2 will begin. Again, after the story is finished, I will ask you to complete the rating form for Story 2. After the third story has finished playing, I will start the video. The first thing you will see on the television screen is instructions telling you to complete the rating form for Story 3. From this point on, all of your instructions will appear on the screen instead of me telling you what to do. When these instructions disappear from the screen, Video 1 will begin. This first video lasts about five minutes and when it is finished, you will again see your instructions printed on the screen. The second video lasts about three minutes and the third video lasts about five minutes. When the third video has finished and you have completed the rating form for Video 3, you may remove these three electrodes by pulling the Velcro tapes apart. When you are ready, you may then leave the room. It is important for you to remember to keep your body and especially your fingers with the measuring devices on them very still while you are listening to the stories and watching the videos. If you need to move your fingers or your arm, I would like you to wait until you are in between stories or videos and are completing the rating form. I will not be taking measures while you are writing, so this is a good time to move and readjust yourself in the chair if you need to. If at any time you have a question, you may ask your question out loud and I will hear you over the intercom. Do you have any questions now?

If the subject had no questions, the door to the private chamber was closed tightly and the session began.

Following a 10-minute adaptation period, a 5-minute
baseline measure was taken. At the end of this baseline, the audiotape containing Vignette 1 was started and heart rate and skin conductance were recorded. The vignettes were recorded on the audiotape in such a way that the end of the vignette coincided with the end of the tape and the machine shut off automatically. At this point, recording of physiological measures was stopped and instructions to complete the rating form were given over the intercom. After a one minute interval, the researcher announced over the intercom that the next story would now begin. At this point, the second tape was placed in the tape player and started, and recording of physiological measures was begun once again. At the end of the third vignette, the researcher announced over the intercom that the video would begin. An additional monitor outside of the private chamber next to the computer allowed the researcher to view what the subject was viewing and to start and stop recording the physiological measures at the correct time. At the conclusion of the third video, the subject was prompted to complete the rating form for Video 3, remove the measuring devices, and leave the room when she was ready. Finally, an appointment for the next session was scheduled for the following week when possible.

The third session proceeded in the same fashion as
the second using the same vignettes and video, in order to obtain reliability. Again, following this session, an appointment was made for the final session which consisted of fitness testing. The subject was instructed to bring or wear shorts, a t-shirt, socks, and tennis shoes, and to bring her record of exercise activity to the last session.

The fourth session in most cases lasted approximately 30 minutes. First, an estimate of percent body fat was made using skin calipers. Measurements were taken at three body sites, including the right tricep, the right suprailliac, and the front of the right thigh. At each site, three measures were taken and averaged. The three averaged measures were summed, and percent body fat was estimated according to the Jackson-Pollock Formula (Jackson & Pollock, 1978). Following the estimate of percent body fat, each subject was instructed to adjust the bicycle ergometer seat according to her height. The researcher attached the automatic blood pressure cuff to the left arm and the finger gauge to monitor heart rate to the left index finger. The starting resistance on the bicycle ergometer was set at .5 kilopons for all subjects regardless of fitness level. Subjects were instructed to pedal at a constant speed, maintaining a rate of 50 revolutions per minute according to the built-in monitor.
on the ergometer. Heart rate was monitored at this resistance for 3 minutes and was recorded at the end of this 3 minutes. Following the Y's Way to Physical Fitness (Golding, Myers, & Sinning, 1989) fitness testing protocol, the tension for the second workload was determined by the heart rate at the end of the first workload and adjusted accordingly, while the subject continued pedaling. The subject continued pedaling for 3 minutes at the second workload. Again, at the end of 3 minutes, heart rate was recorded and used to determine the workload for the final 3 minutes. After the tension was readjusted for the third workload, blood pressure was taken to ensure that it remained within normal limits during exercising. At the conclusion of the third workload, the subject was instructed to slow down and stop. At all times during fitness testing, the subject was monitored visually for signs of fatigue and/or difficulty in breathing. Following fitness testing, each subject was given her results, including her raw scores and her fitness rating according to the Astrand and Ryhming formula (Astrand & Ryhming, 1954).

Dependent Variables

Scores on the Sexual Interaction Inventory, the Sexual Arousability Inventory, subjective ratings of
arousal during exposure to erotic stimuli, and percentage change in heart rate and galvanic skin response during arousal were used to assess the effects of regular exercise on sexual satisfaction and arousability.
RESULTS

Statistical Analysis

Exercisers and nonexercisers were compared on a number of measures using Dunn’s test (Bonferroni $t$). Dunn’s test is performed by using the standard $t$-test procedure but referring to a modified critical value of $t$ that is more conservative, in order to compensate for the family-wise error rate (Howell, 1987).

Subject Characteristics

Fourteen subjects were classified as active exercisers, either participating in an ongoing weightlifting program or aerobic exercise program, of at least 2 months duration. Those subjects classified as exercisers exercised on the average 4.5 hours per week total, with an average of 3.1 hours of aerobic exercise and 1.5 hours of nonaerobic exercise. The range for aerobic exercise was 1.1 hours per week to 9.2 hours per week, while the range for nonaerobic exercise was 0 hours per week to 7.4 hours per week. The nonexercisers exercised an average of 1 hour per week overall, with .3 hours per week spent in aerobic exercise and 0.7 hours per week in nonaerobic exercise. The range for aerobic exercise was 0 hours per
week to 0.8 hours per week, while the range for non-aerobic exercise was 0 to 3.3 hours per week.

Estimates of aerobic capacity for exercisers and nonexercisers were compared using Dunn's test. There was no significant difference between exercisers and nonexercisers on cardiovascular fitness using estimates of VO2 max.

Exercisers and nonexercisers did not differ significantly with respect to marital status, income, age, or the length of the sexual relationship. Exercisers ranged in age from 19 to 50, with modes of 20, 21, and 22; nonexercisers ranged in age from 19 to 52 with a mode of 20. Of the exercisers, 4 were employed full-time, 9 employed part-time, and 1 was unemployed. Of the nonexercisers, 4 were employed part-time and 2 were unemployed. Seven exercisers had completed some college, 3 were college graduates, 2 had completed some graduate school, and 2 had completed master's degrees. Of the nonexercisers, 1 was a high-school graduate, 3 had completed some college, 1 had completed some graduate school, and 1 had completed a master's degree.

Self-Report Measures of Sexual Functioning

Table 1 summarizes the group means on the self-report measures of sexual satisfaction and arousability.
Scores obtained for exercisers and nonexercisers on the SII, SAI, and the self-reports of maximum arousal during exposure to erotic stimuli were compared using Dunn's test.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Exercisers</th>
<th>Nonexercisers</th>
<th>p</th>
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<tbody>
<tr>
<td><strong>SII</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of Dissatisfaction</td>
<td>9.71</td>
<td>10.17</td>
<td>n.s.</td>
</tr>
<tr>
<td>Self-acceptance</td>
<td>7.86</td>
<td>7.50</td>
<td>n.s.</td>
</tr>
<tr>
<td>Pleasure Mean</td>
<td>5.30</td>
<td>4.70</td>
<td>n.s.</td>
</tr>
<tr>
<td><strong>SAI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arousability</td>
<td>87.71</td>
<td>69.33</td>
<td>n.s.</td>
</tr>
<tr>
<td>Sexual Anxiety</td>
<td>10.29</td>
<td>8.67</td>
<td>n.s.</td>
</tr>
<tr>
<td>Maximum Arousal in Laboratory</td>
<td>3.5</td>
<td>4.0</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

Scores on the Frequency of Dissatisfaction subscale of the SII were obtained by summing the difference between the values associated with answers to questions 1 and 2 ("Currently occurs" and "I would like it to occur") across descriptions of 17 sexual behaviors. This scale provides information concerning the individual's level of dissatisfaction with respect to the range and frequency of sexual activity. Higher scores are indicative of greater levels of dissatisfaction with the range or frequency of sexual behaviors and activities. Scores on the Self-Acceptance subscale of the SII were obtained by
summing the difference between the values associated with answers to questions 3 and 5 across descriptions of 17 sexual behaviors ("I find this activity" and "I would like to find this activity"), thus providing an indication of the discrepancy between "real self - ideal self." Higher scores indicate that the individual would like to experience much more pleasure from engaging in sexual activities. Scores on the Pleasure Mean subscale of the SII were obtained by calculating the mean for the values associated with answers to question 3 ("I find this activity") across 17 items, which provides a global measure of how much pleasure the individual is obtaining from sexual activity. Higher scores are indicative of an overall greater level of pleasure being obtained from sexual activity.

Scores on both the SAI subscales, Sexual Arousability and Sexual Anxiety, were obtained by summing the values associated with each item. Higher scores on the Arousability subscale are associated with greater levels of arousability; likewise, higher scores on the Anxiety subscale are associated with greater levels of sexual anxiety with respect to the items appearing in the inventory.

Scores on the self-report of maximum arousal during exposure to erotic stimuli were obtained by reviewing all
the arousal report forms for each subject and selecting the highest number recorded from the Likert scale that was accompanied by an anxiety score of less than 3. Higher values on the arousal scales indicate more arousal, while higher levels on the anxiety scale indicate more anxiety.

There were no significant differences between scores for the two groups on either the SII or the SAI. The maximum self-report rating of arousal during exposure to erotic stimuli in the experimental setting did not differ significantly between the two groups.

Other Self-Report Measures

Scores obtained for exercisers and nonexercisers on the Health Risk Rating Form, Self-Rating Depression Scale, and State-Trait Anxiety Scale were also compared using Dunn's test.

Scores on the Health Risk Rating Form were obtained by summing the values obtained on each item, with higher scores indicating a greater risk to cardiovascular health. Exercisers scored significantly lower on the Health Risk Rating Form than nonexercisers ($t = -3.82, p < .05$).

Scores on the Self-Rating Depression Scale were calculated by summing the values obtained on each item,
with higher values indicating the presence of a higher degree of depression. There was no significant difference between scores of exercisers and nonexercisers on this inventory.

Scores on the State-Trait Anxiety Scale were calculated by summing the values obtained on each item for the State and the Trait scales; higher scores are associated with greater levels of anxiety. The scores of exercisers and nonexercisers on the State-Trait Anxiety Scale did not differ significantly on either of the sub-scales.

Physiological Measures

The percentage change from baseline for heart rate and skin conductance during exposure to erotic stimuli was compared for exercisers and nonexercisers using Dunn’s test. Percentage change from baseline was calculated on measures taken during one exposure to either a vignette or video trial for each subject. Trials selected were determined by each subject’s self-report of sexual arousal and anxiety; percentage change from baseline was calculated from the trial with the highest rating of sexual arousal and an anxiety rating of less than 3. Analyses showed no significant difference between the two groups for either measure. Table 2 contains the means of the two groups.

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Correlational Data

The researchers determined that the potential relationship between exercise and sexual functioning and arousability might be clarified via the use of correlational data. Individual Pearson's correlation coefficients were calculated between the frequency of exercise and each of the following seven variables in turn: scores on the three sub-scales of the SII, scores on the arousability subscale of the SAI, the self-report of maximum arousal during exposure to erotic stimuli, percentage change from baseline in heart rate and skin conductance during exposure to erotic stimuli. Because multiple Pearson r's were calculated using the same data, thus increasing the probability of committing a Type I error, the r values were compared to the more conservative Bonferroni critical values. Table 3 summarizes these correlation coefficients. No significant correlations were found to exist between any of the variables and the
frequency of exercise.

Table 3

<table>
<thead>
<tr>
<th></th>
<th>( r^* )</th>
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<tbody>
<tr>
<td>SII</td>
<td></td>
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<tr>
<td>Frequency of Dissatisfaction</td>
<td>.07</td>
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<tr>
<td>Self-Acceptance</td>
<td>-.09</td>
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<tr>
<td>Pleasure Mean</td>
<td>.14</td>
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<tr>
<td>SAI</td>
<td></td>
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<tr>
<td>Arousability</td>
<td>.12</td>
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<tr>
<td>Self-Report of Maximum Arousal</td>
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<tr>
<td>Percentage Change in Heart Rate</td>
<td>.13</td>
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<tr>
<td>Percentage Change in Skin Conductance</td>
<td>.09</td>
</tr>
</tbody>
</table>

* Correlation coefficients are not significant at \( p < .05 \).

In order to determine if a relationship between cardiovascular fitness level and sexual functioning and arousability exists, individual Pearson's correlation coefficients also were calculated between estimates of \( \text{VO}_2 \text{max} \) and each of the following seven variables in turn: scores on the three sub-scales of the SII, scores on the arousability sub-scale of the SAI, the self-report of maximum arousal during exposure to erotic stimuli, percentage change from baseline in heart rate and skin conductance during exposure to erotic stimuli. These correlation coefficients also were compared to the more conservative Bonferroni critical values. Table 4 summarizes these correlation coefficients. No significant
correlations were found to exist between any of the variables and estimates of VO2 max.

Table 4
Correlation Coefficients for VO2 Max

<table>
<thead>
<tr>
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<th>r*</th>
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<tbody>
<tr>
<td>SII</td>
<td></td>
</tr>
<tr>
<td>Frequency of Dissatisfaction</td>
<td>.13</td>
</tr>
<tr>
<td>Self-Acceptance</td>
<td>.07</td>
</tr>
<tr>
<td>Pleasure Mean</td>
<td>-.21</td>
</tr>
<tr>
<td>SAI</td>
<td></td>
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<tr>
<td>Arousability</td>
<td>-.26</td>
</tr>
<tr>
<td>Self-Report of Maximum Arousal</td>
<td>-.20</td>
</tr>
<tr>
<td>Percentage Change in Heart Rate</td>
<td>-.09</td>
</tr>
<tr>
<td>Percentage Change in Skin Conductance</td>
<td>-.13</td>
</tr>
</tbody>
</table>

* Correlation coefficients are not significant at p< .05.
DISCUSSION

This study assessed differences between female aero­bic exercisers and nonexercisers on two self-report measures of sexual satisfaction, functioning, and arous­ability, and on sexual arousability assessed using phys­iological measures during exposure to erotic stimuli. The results of the study do not support the prediction that exercising women would report a greater level of sexual arousability and satisfaction than nonexercising women; however, differences between the groups on these measures were in the expected direction. The results also failed to support the prediction that exercising women would evidence greater change in physiological measures from baseline during exposure to erotic stimuli than nonexercising women.

Several factors may account for the lack of significa­nt findings in this study. First, although the groups did differ significantly on the Health Risk Rating Form, they did not differ with respect to VO2 max scores, a measure of the cardiovascular benefits of exercise. In some respects, then, one might argue that the two groups did not represent two distinct groups. Correlations were also conducted to assess the relationship between both exercise and VO2 max scores and the sexual measures.
Since the participant scores in the two groups combined, however, were not dramatically different on the primary measures, these analyses may have suffered from restriction of range. It would be interesting to replicate this study using a broader sample of nonexercisers and exercisers. Perhaps the "amateur" athlete does not benefit sexually from exercise; it remains to be seen if comparisons between nonexercisers and "true athletes" would reveal differences on sexual measures.

A related question arising from this line of research is whether cardiovascular effects of exercise are critical in effecting changes in sexual functioning and arousability, if indeed such a relationship exists. Since sexual arousal and orgasm are physical responses involving vasocongestion (via blood flow), it is possible that changes in sexual functioning could result from improvement in the cardiovascular system through aerobic conditioning. Future research should be directed toward determining the necessity of the aerobic component of exercise by comparing cardiovascularly fit to "unfit" participants. If the aerobic component, responsible for cardiovascular improvement, is not a necessary factor for producing positive changes in sexual functioning, one may assume that other factors relating to exercise are operating. As previously noted, research suggests that
exercise can result in increased well-being (e.g., Steptoe & Cox, 1988), decreases in depression (e.g., Martinsen, 1987) and stress reactivity (e.g., Crews & Landers, 1987). It is possible that any relationship demonstrated between exercise and sexual functioning could be the indirect impact of these factors.

If we assume that cardiovascular fitness is a critical factor, one must consider the possibility that age would mediate a relationship between exercise and sexual functioning. While the age range in this study was broad, the majority of participants were in their twenties. Perhaps the virtues of exercise are only realized for those who exercise into their middle-age years and beyond, where the effects of "unhealthy living" typically become apparent. Thus, a stronger test of the hypothesized relationship may be one which utilizes a subject population which spans the lifetime and incorporates age as a factor.

Another factor which may warrant assessment as a mediating variable is body image. White and his colleagues (1990) reported that many of the subjects who participated in their study, which found a positive relationship between aerobic exercise and sexual functioning in men, spontaneously suggested during debriefing that the positive change in their sexual functioning was due to
improved perceptions of their physical appearance. Another study that examined the relationship between body-image attitudes and sexual functioning showed that a quasi-clinical group of females who reported a high frequency of sexual difficulties rated their physical appearance less positively and reported greater self-consciousness about their appearance than did a control group with a low frequency of sexual difficulties (Hangen & Cash, 1991). Thus, body image might be a critical factor to incorporate in future research on the relationship between exercise and sexual functioning.

Several potential methodological issues deserve mention. Problems of accuracy, and reactivity in particular, associated with self-report measures need not be detailed here but are assumed to be potential methodological confounds in this study. Even more significant are concerns associated with the objective, physiological measures employed to assess arousal in this study. Although the available literature would support the use of heart rate (Bartlett, 1956) and skin conductance (Wenger, Averill, & Smith, 1968) as measures of sexual arousal, this relationship has not been thoroughly tested. It is possible, therefore, that the objective measures of sexual arousal were inadequate. Furthermore, the degree of heart rate change during exercise and in
the presence of stressful stimuli are known to be mediated by cardiovascular fitness (Clausen, 1977); therefore, it is possible that the more cardiovascularly fit participants would show less "arousal" owing to their fitness level. This potential confound could have worked in direct opposition to the hypothesis. No relationship between cardiovascular fitness and skin conductance is known. Future research could employ the use of the vaginal photoplethysmograph, which allows for a more direct assessment of sexual arousal in women by measuring the amount of reflected light in the vaginal tissue through a photoelectric transducer; the amount of light varies with the level of tissue transparency due to blood engorgement in the vaginal tissue (Sintchak & Geer, 1975).

While every effort was made to include as many participants in this study as possible, the group numbers are admittedly quite small. The group comparisons were likely negatively impacted by the small sample size as were the correlational analyses. Replications should include a larger representation of the population under study.

Alternatively, future research might approach this problem using a single subject design; such an approach may be warranted given the numerous imaginable individual
variables which may mediate the relationship between exercise and sexual functioning. Furthermore, this design may make a causal, versus correlational analysis more accessible. Implementing an exercise program is time intense and requires that the experimenter maintain close contact with participants over a long period of time; a well-implemented, single case design (perhaps multiple baseline) might prove more fruitful than a large group design. Thus, a small number of nonexercisers might be asked to start an exercise program, and multiple sexual assessments could be conducted across phases. One must inevitably weigh the strengths of a single-case design against the limitations of such a design (e.g., limits to generalizability).

Yet another methodological concern related to assessment concerns the sexually explicit materials used. Although several subjects spontaneously reported that they found the material very arousing, it is possible that some subjects did not find the material arousing or even found it objectionable. Many of the subjects reported that they had never viewed a sexually explicit film before; it is possible that this mode of presentation was not appropriate for some participants. Future research could incorporate some individualized assessments such as participant-selected films or written
vignettes or fantasies generated by the participant.

While this first study of the relationship between exercise and sexual functioning in women failed to reveal a significant relationship, it brought to light many methodological and other concerns that can be addressed in subsequent research on this topic. Sexuality and physical fitness are both factors that play a role in the overall mental health and quality of life in the individual. The direction of the current findings, albeit not significant, would indicate that subsequent research on this topic could reveal significant relationships between these variables.
Appendix A

Informed Consent for Participation
INFORMED CONSENT FOR PARTICIPATION IN AN INVESTIGATION

Investigators: Joanne Kolean-Burley, and M. Michele Burnette, Ph.D.

I understand that I am being invited to participate in a research study which will examine the relationship between regular aerobic exercise and sexual satisfaction and arousability in women.

Participation in this study involves daily recording of exercise type and duration. In addition, the study will include four sessions. The first will involve completing six written questionnaires. The second and third sessions will involve listening to erotic stories and viewing a sexually explicit video while the researcher measures heart rate and galvanic skin response by attaching electrodes to the skin using velcro fasteners. No pain is involved in this procedure. The final session will consist of fitness testing.

I understand that my participation in this study is voluntary. There is no cost to me for participation. The primary benefits to me for participation are free fitness testing and a better understanding of what exercise can do for me. All information obtained during the course of this study will be held in strict confidence. A code number will be assigned to me and used to identify all information used for the analysis in this research. Name and number codings will be destroyed after analysis of the data. I may withdraw from the study at any time without penalty.

I understand that any questions or complaints that I have now or may have in the future can be answered by contacting Joanne Kolean-Burley at 387-4489 or Michele Burnette, Ph.D. at 387-4472.

My signature below indicates that I have read and understood the above information and have decided to participate in the study.

Signature of Subject ____________________ Date ______
Signature of Investigator__________________ Date ______
Appendix B

Advertisement for Subjects
Nonexercising women wanted for research in Western Michigan University Psychology Department. Free fitness testing. Call 387-4489.
Appendix C

Health Risk Rating Form
PERSONAL HEALTH HISTORY PROFILE

1. Have you ever been told by a physician that you had an abnormal EKG? ___ __

2. Have you ever been hospitalized for symptoms or problems related to your cardiovascular system (heart or blood vessels)? ___ __

3. Have you ever had a stroke, heart attack or heart surgery? ___ __

4. Do you have chest discomfort with exertion or at any other time? ___ __

5. Do you have any orthopedic or muscular/skeletal problems such as:
   ___Tendonitis ___Hip Problems ___Knee Problems ___Chronic back pain ___Ankle Problems ___Other

6. Have you had or do you now have:
   ___Arthritis/gout ___Epilepsy ___Hypoglycemia
   ___Heart palpitations ___Diabetes ___Unusual shortness of breath
   ___Lung disease, including asthma, emphysema or chronic bronchitis
   ___Any other major illnesses: ________________________________

7. Please list any recent illnesses, hospitalizations or surgical procedures (within past year): ________________________________

8. Describe any physical limitations that may affect your exercise program. ________________________________

9. Please list medications you are currently taking:
   Medications                         Purpose
   1. _________________________ 1. _________________________
   2. _________________________ 2. _________________________

10. Do you presently engage in exercise or physical activity? ___ YES ___ NO
    If yes: What kind? ________________________________
    How often? ________________________________
    Length of time of exercise period ________________________________
PLEASE COMPLETE THIS RISK FACTOR FORM AS FOLLOWS:

For each risk factor, circle the risk level that best describes you.

1. SMOKING: Cigarette smoking is a major cardiovascular risk factor. A two-pack-a-day smoker has more than twice the risk of dying from heart disease than does a nonsmoker. Determine your risk level by identifying your smoking behavior.

   a) Never smoked 0
   b) Quit smoking cigarettes more than 1 year ago or smoke cigar or pipe now 1
   c) Quit smoking less than 1 year ago or now smoke 10 or less cigarettes per day 2
   d) Smoke 20 cigarettes per day 3
   e) Smoke 40 or more cigarettes per day 4

2. BEHAVIOR CHARACTERISTICS: Studies indicate that certain personality traits may influence development of premature coronary disease. Persons who are highly competitive, hard-driving, impatient, aggressive, and live with a continual sense of time urgency may have a higher risk of heart attack than persons who are generally easygoing and relaxed. Assess your level of time urgency.

   a) Always easygoing and calm 1
   b) Easygoing and calm most of the time 2
   c) Frequently impatient and clock watching 3
   d) Hard driving; never can relax 4

3. AGE: Age is a risk factor over which you have no control. Advancing years increase your susceptibility to heart attack. At any age, however, modifying your lifestyle risk factors can enhance your quality of life and reduce your risk of heart disease. Please categorize your age.

   a) 10 - 20 years 0
   b) 21 - 30 years 1
   c) 31 - 40 years 2
   d) 41 - 50 years 3
   e) 51 - 60 years 4
   f) 61 years and up 5

4. GENDER: Although women are rapidly closing the statistical gap, men are currently more susceptible to heart attacks at a younger age. Certain male body builds are also associated with higher risk. Identify your gender risk.

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5. FAMILY HISTORY: Heredity can influence your risk of developing heart disease. If one or more close relatives have suffered a heart attack or stroke before age 50, a genetic tendency for heart disease may run in your family. Assess your family history. (Count parents, grandparents, brothers, sisters, aunts, and uncles).

   a) No known history of heart disease 0
   b) One relative with heart disease over age 50 1
   c) Two relatives with heart disease over age 50 2
   d) One relative with heart disease under age 50 3
   e) Two relatives with heart disease under age 50 4
   f) Three relatives with heart disease under age 50 6

6. WEIGHT: Being over-fat has been suggested to increase your risk of heart disease since other risk factors occur more frequently in overweight individuals. Compare your present weight to the standard weight table below for your profile determination.

   Standard Weight by Height and Sex

<table>
<thead>
<tr>
<th>Height Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>4'10''</td>
<td>4'11''</td>
</tr>
<tr>
<td>108-120 lbs.</td>
<td>110-123 lbs.</td>
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<tr>
<td>5'7''</td>
<td>5'8''</td>
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<tr>
<td>133-147 lbs.</td>
<td>136-150 lbs.</td>
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<tr>
<td>4'11''</td>
<td>4'12''</td>
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<tr>
<td>112-126 lbs.</td>
<td>115-129 lbs.</td>
</tr>
<tr>
<td>5'9''</td>
<td>5'10''</td>
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<tr>
<td>139-153 lbs.</td>
<td>142-156 lbs.</td>
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<tr>
<td>5'2''</td>
<td>5'3''</td>
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<tr>
<td>118-132 lbs.</td>
<td>121-135 lbs.</td>
</tr>
<tr>
<td>5'11''</td>
<td>5'12''</td>
</tr>
<tr>
<td>145-159 lbs.</td>
<td>148-162 lbs.</td>
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<tr>
<td>5'6''</td>
<td>5'7''</td>
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<tr>
<td>130-144 lbs.</td>
<td>137-149 lbs.</td>
</tr>
<tr>
<td>5'7''</td>
<td>5'8''</td>
</tr>
<tr>
<td>145-159 lbs.</td>
<td>148-162 lbs.</td>
</tr>
</tbody>
</table>

   (Weights shown are for people wearing clothing and shoes with 1'' heels.)

   a) 5 lbs. or more below standard weight or 0
      at standard weight for height
   b) 5 lbs. over standard weight 1
   c) 6-20 lbs. over standard weight 2
   d) 21-35 lbs. over standard weight 3
   e) 36-50 lbs. over standard weight 5
   f) 51 lbs. or more over standard weight 7

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7. EXERCISE: Physical activity stimulates circulation, tones muscles, helps avoid obesity, and promotes an overall sense of well being. Some scientific studies suggest that people who lead sedentary lives run a higher risk of heart attack than those who exercise regularly. Rate your current level of combined occupational and physical activity.

a) Strenuous occupational activity with aerobic exercise 4-5 times per week 0
b) Moderate occupational activity with aerobic exercise 3 times per week 1
c) Sedentary work and aerobic exercise 4-5 times per week 2
d) Sedentary work and aerobic exercise 3 times per week 3
e) Sedentary work and no regular exercise 4

8. DIABETES: For reasons not fully understood, individuals with diabetes are more susceptible to heart attack and stroke than are nondiabetics. Since most diabetes is hereditary, it is important to consider the presence of this condition in your family. (Count parents, grandparents, brothers and sisters only).

a) No known family history of diabetes 0
b) 1 relative with diabetes 1
c) 2 relatives with diabetes 2
d) Diabetes in yourself beginning after age 60 3
e) Diabetes in yourself beginning between 20 & 60 4
f) Diabetes in yourself before age 20 6
Appendix D

General Information Form
DATE _____________________________

SUBJECT CODE ______________________

AGE _____________________________

LENGTH OF CURRENT SEXUAL RELATIONSHIP _____________________________

CHECK THE CATEGORY WHICH APPLIES TO YOUR CURRENT SEXUAL
RELATIONSHIP: ___ MARRIED   ___ COHABITATING   ___ DATING

NUMBER OF CHILDREN CURRENTLY LIVING WITH YOU _________________________

AGES OF CHILDREN __________________________________________

CHECK THE CATEGORY WHICH CURRENTLY APPLIES TO YOU:

___ EMPLOYED FULL TIME       ___ EMPLOYED PART TIME

___ UNEMPLOYED                ___ DISABLED

CATEGORY WHICH DESCRIBES YOUR HOUSEHOLD INCOME:

___ $0-14,999                  ___ $15,000-24,999

___ $25,000-34,999             ___ $35,000-44,999

___ $45,000-54,999             ___ OVER $55,000

CHECK THE CATEGORY WHICH BEST DESCRIBES YOUR LEVEL OF EDUCATION:

___ SOME HIGH-SCHOOL           ___ HIGH-SCHOOL GRADUATE

___ SOME COLLEGE               ___ COLLEGE GRADUATE

___ SOME GRADUATE SCHOOL       ___ MASTER’S DEGREE

___ Ph.D.                     ___ POST DOCTORATE TRAINING

CHECK THE STATEMENT WHICH BEST DESCRIBES YOU:

___ I AM COMPLETELY SATISFIED WITH THE WAY MY BODY LOOKS

___ I AM SOMEWHAT SATISFIED WITH THE WAY MY BODY LOOKS

___ I AM SOMEWHAT DISSATISFIED WITH THE WAY MY BODY LOOKS

___ I AM COMPLETELY DISSATISFIED WITH THE WAY MY BODY LOOKS
Appendix E

Exercise Report Form
<table>
<thead>
<tr>
<th>Date</th>
<th>Type of Exercise</th>
<th>Duration of Exercise</th>
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Appendix F

Telephone Script
This study is intending to document the positive effects of aerobic exercise on sexual satisfaction and functioning. To be involved in the study you must be between the ages of 20 and 50, be involved in a sexual relationship which has been ongoing for at least 3 months, and be a nonexerciser (exerciser). Participation in this study would involve between 3 to 6 hours of time over a 2 month period. In return for your participation you would receive free fitness testing. Do you think you would be interested in participating?
Appendix G

Human Subjects Institutional Review Board
Date: February 25, 1991
To: Joanne Kolean-Burley
From: Mary Anne Bunda, Chair
Re: HSIRB Project Number 91-01-29

This letter will serve as confirmation that your research protocol, "Assessment of the Relationship Between Regular Fitness Activity and Sexual Functioning in Women," has been approved after full review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any change in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

xc: M. Michele Burnette, Psychology

Approval Termination: February 25, 1992
BIBLIOGRAPHY


and Exercise, 19(5), 114-120.


