The Influence of Sexual Activity on Athletic Performance

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THESIS ABSTRACT

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The purpose of this study was to determine whether sexual activity the night before competition impairs athletic performance. No concrete answer has been established about the influence of sexual activity on athletic performance yet the majority of young male athletes nonetheless report practicing abstention before an event, believing that sexual activity can impair athletic performance. In a repeated measures design, participants underwent a battery of performance-predicting exercise tests under 3 conditions. On the night before each testing, they were either: 1) abstinent and inactive, 2) sexually active only and 3) did yoga, only. Vital signs, morning relaxation levels, saliva, urine and blood glucose samples were collected at the beginning and end of each testing session and in addition the following performance tests were completed and analyzed for significant differences between conditions and relationships between variables: Aerobic capacity, grip strength, leg power, reaction time, hamstring flexibility, muscular endurance, testosterone, cortisol, blood glucose concentrations and blood pressure. No significant difference was found between performance test results between the 3 conditions. A strong, negative correlation was found between systolic blood pressure on the morning following sexual activity and orgasm rating, notably with the emotional intimacy component. Our findings indicate that sexual activity does not create short term impairments to athletic performance, no less then a yoga session. Furthermore, our findings indicate a possible long term beneficial effect of sexual activity on athletic output and blood pressure.

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LIST OF ACRONYMS

RP = Refractory Period
T = Testosterone
NE = Norepinephrine
DA= Dopamine
HR = Heart Rate
ORS = Orgasm Rating Scale
Pr-SBP = Pre-testing systolic blood pressure
Pr-SBP-s = Pre-testing systolic blood pressure on the morning following sex

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INTRODUCTION

"Women weaken the legs, Rock!"
Mickey Goldmill, from the movie Rocky

The question of sex the night prior to an event is a popular subject amongst athletes. No genuine answer to date has been established about the influence of sexual activity on athletic performance. Yet the majority of young male athletes nonetheless report practicing abstention before an event, believing that sexual activity can impair sport performance (Fischer, 1997). In addition, the subject has gained notoriety because of many popular and successful athlete celebrities lending testimonial to their beliefs. Mohammed Ali and Wilt Chamberlain for example, two elite athletes in their sports, supported opposing views on this subject, respectfully crediting their abstinence and active sex-life for their professional success (National Geographic-The Observer Sport & Chamberlain). Mohammed Ali reported abstaining from sexual activity up 6 weeks before a match, claiming that abstaining from sexual activity increased his aggression.

Sex and sports are two of the most popular themes in western society. In sports culture, competition has always been a way for men to express their "masculinity". This is reminiscent of mating in the wild, when two males compete physically for the right to copulate with a female. The winner was thought to be the most physically fit. Today, many men still believe that consistent sexual expression is important in maintaining their masculinity (Youn, 2009). Sex furthermore, is a natural human behaviour that can serve a variety of social and physiological functions ranging from reward to reproduction (Pfaus, 1999), and as such, is major practice in the western world because of its beneficial and pleasure-full outcomes.

Many reasons exist for adhering to sexual abstinence before competition, such as increased fatigue during competition, decreased focus and aggression levels; however most arguments are anecdotal and testimonial in nature. Nevertheless, the

amount of tangible evidence on the influence of sexual activity on athletic performance is scarce. To date, only one study has attempted to answer the question: does sexual activity impair performance? Boone and Gilmore (1995) looked at the effects of sexual activity on the haemodynamic and metabolic response to treadmill exercise in 11 sedentary men that did and did not partake in sexual intercourse. They found that VO_2, O_2 pulse, double product, heart rate, systolic blood pressure and RER remained unaffected by coitus (Boone & Gilmore, 1995). Furthermore, Johnson (1966) found that sexual activity did not affect grip strength in healthy men. Aerobic capacity however, is not sufficient to determine the effect of sexual activity on athletic performance. Many other variables overlooked by the aforementioned study play an important role in predicting athletic execution.

Although we do not know much about the effect of sexual activity on athleticism, we do however know about the effects of exercise on sexual activity. In a study by Meston and Gorzalka (1996), 36 women underwent 2 viewing sessions of a neutral film followed by an erotic film. In one of the session, participants engaged in high intensity cycling before the viewings. When the women engaged in exercise, they experienced increased pubic and vaginal blood flow during the erotic film regardless of whether they were sexually active or were experiencing some form of sexual desire impairment. Their findings suggested that sympathetic activation plays a significant role in the physiology of the female sexual arousal by mediating pubic vasodilation (Meston & Gorzalka, 1996)

Other studies have reported an increase in sexual activity and pleasure following exercise regimens, some of which have been used explicitly in the treatment of hypoactive sexual arousal and desire disorders (Fixx, 1977 in Fraumann, 1982). Furthermore, Fraumann (1982) found a positive correlation (. 57 and .32) between exercise time and sexual behaviour, desire and intercourse frequency in 2 participant pools totalling 222 men and women, who completed a questionnaire regarding their physical and sexual habits.

Given these findings, questions arise as to whether the influential relationship between sex and physical activity is uni-directional or bi-directional. Since exercise is reported to enhance sexual behaviour and since we can assume that sexual activity approximates the sympathetic nervous activation that takes place during exercise, would sexual activity then have an enhancing effect on physical activity rather than the supposed deleterious effects? And would the relationship itself be affected by the phenomena that take place during orgasm and the refractory period?

Although there is currently no empirical evidence that sexual activity generates physiological events that would thwart athletic performance in the long-term, there are many kinesiological variables overlooked by the aforementioned studies that may play important roles in athletic performance. In addition to cardiovascular function, these include reaction time, muscular endurance and strength, and changes in steroid hormone function. Any study that would attempt to give an informed answer to this popular question would have to take into account the essential variables of physical activity.

Athletic execution free of external influences can be seen as an amalgamation of skills and physiological variables. To study the relationship between sexual activity and performance in sports, we will look at the effects of sex on the specific skills and functions known to be determinant of on-field execution. To do so, we will choose a series of laboratory tests that evaluate the skills and functions necessary for optimum performance. The same tests have also been shown in many cases to be predictive of on-field performance. Furthermore, since physical exhaustion is thought to be the main by-product of sexual activity and cause of impairment, we will also compare the effects physical activity without sex on the same variables.

In order to better understand the roots of many of the popular misconceptions surrounding this subject and to determine whether sexual abstinence is a coach's fallacy**,** awareness of the physiological functions involved in sexual activity is

warranted. In the following pages, the human sexual response, including an explanation of the orgasm, as well as an insight into how the human body responds to sexual arousal is provided as to understand the relationship between sexual activity and athletic performance.

"An intellectual is someone who has found something more interesting than sex."

Aldous Huxley /Edgar Wallace

THE HUMAN SEXUAL RESPONSE

More then 40 years have passed since Masters and Johnson published their landmark study of The Human Sexual Response (1966), the first empirically-derived model of physiological sexual response. The model described four sequential phases, excitement, plateau, orgasm, and resolution, that reflected a "core" set of physiological responses displayed by men and women during sexual intercourse.

Excitement Phase: The excitement phase encompassed both sexual arousal and desire, and is believed to prepare the body for sexual stimulation. This preparation could occur as a result of physical or mental erotic stimulation, be it through "foreplay", stimulation of erogenous zones or erotic mental imaging or fantasy. Many physiological changes occur in men and women when they are sexually aroused. The changes can be gender specific, notably in the geniteliae or extra-genital, in which case they are comparable in both men and women.

In men, the most obvious change is the erection of the penis and the ascent of the testes into the scrotum (Masters & Johnson, 1966). The erection is a synergistic interaction between the sympathetic nervous system and parasympathetic nervous system. The autonomous nervous system acts to inhibit vasodilatory preganglionic neurons, activate vasoconstrictor preganglionic neurons (SNS), and initiate contraction of somatic motoneurons to cause contraction of the penile muscles for rigidity (McKenna, 1999) and of the creamaster muscle to elevate the testes (Katchadourian, 1990).

The female sexual organs are the labia majora and labia minora of the vagina and the clitoris (Masters & Johnson, 1966). In the excitement phase, the labiae flatten, legthen and separate while the vaginal barrel expands, and the vaginal wall becomes lubricated in anticipation for intromission (Masters & Johnson, 1966). Lubrification is the key external indicator of sexual excitement in women. The clitoris, which is the organ responsible for sexual stimulation, becomes

increasingly tumescent in response to increasing sexual stimulation. Lastly, the uterus elevates from its tilted position in response to erotic stimulation (Masters & Johnson, 1966, Katchadourian, 1990).

Extra-genitally, many of the body's systems respond to erotic stimulation, resulting in a progressively intensifying sensation of sexual tension. Heart rate and blood pressure increase, widespread vasoconstriction of the peripheral vasculature leads to the erection of the nipples, pupils dilate and various glands throughout the body discharge and lead to the following stage: the plateau phase.

Plateau Phase: In essence, the plateau phase is a continuation of the excitement phase. The physiological changes that took place in the excitement phase have increased in magnitude. For example, heart rate rises to anywhere from 100 to 175 bpm, hyperventilation is more pronounced, the musculature of the extremities, face and abdominal wall voluntarily and involuntarily contract spastically and the rectal sphincter contracts inconsistently (Masters & Johnson, 1966, Katchadourian, 1990).

In men, the bulbourethral gland secretes pre-ejaculatory fluid to neutralize the otherwise acidic milieu of the urethra and vagina and to lubricate the penis for intromission (Chudnovsky & Niederberger, 2007). In women, the clitoris withdraws into the pubic mound and the lips of the vagina swell considerably in what is known as the orgasmic platform (Masters & Johnson, 1966). Furthermore, the uterus also elevates into the pelvis. For some women this is the sexual climax. For men and most women, the sexual climax occurs at the following phase, orgasm.

"Do you know what the human body goes through when you have sex? Pupils dilate, arteries constrict, core temperature rises, heart races, blood pressure skyrockets, respiration becomes rapid and shallow, the brain fires bursts of electrical impulses from nowhere to nowhere, and secretions spit out of every gland, and the muscles tense and spasm like you're lifting three times your body weight. It's violent. It's ugly. And it's messy. And if God hadn't made it unbelievably fun, the human race would have died out eons ago. Men are lucky they can only have one orgasm. You know that women can have an hour long orgasm?"

Character Allison Cameron from the show *House MD.*

Orgasm Phase: Orgasm has been defined as a discharge of neuromuscular tension (Katchadourian, 1980), in which a central release of opioids, serotonin, and endocannabinoids produce a widespread sensation of euphoria and pleasure (Pfaus, 2009)**.** This phenomenon has been given an evolutionary raison d'être, being the reward for copulation and reproduction. Heart rate, blood pressure and ventilation reach peak intensities whereas muscular control becomes mostly involuntary and spastic in the pelvic region. The most notable event that occurs during orgasm in men is ejaculation; muscular contractions in and around the penis that help expel semen. In women, vaginal platform contracts with decreasing frequencies and the uterus contracts until there is a 50% increase in size (Masters & Johnson, 1966).

Resolution Phase: Once orgasm occurs, the body goes into state of resolution, otherwise known as the refractory period (RP), where there is a return to baseline physiological state and a long-term sense of satiety and sedation attributed to the sustained actions of serotonin and endocannabinoids (Pfaus, 2009). The Resolution Phase can be divided into absolute and relative refractory periods (RPs), in which many animals sleep and sexual stimuli lose their incentive and arousing capacity. In male rats, for example, the absolute refractory period is accompanied by a dramatic decrease in extracellular concentrations of dopamine in mesolimbic terminals such as the nucleus accumbens, whereas the relative refractory period is a time when dopamine release in those regions begins to increase back to baseline.(Blackburn, Pfaus, & Phillips, 1992), During the absolute RP, male rats are behaviourally quiescent, and female solicitations are not responded to (Pfaus, Kippin, Coria-Avila, 2003). Unfortunately, very little is actually known regarding human refractory periods aside from anecdotal reports that dopaminergic drugs shorten, whereas selective serotonin reuptake inhibitors lengthen their duration (Levin, 2009).

Sex relieves tension - love causes it.
Woody Allen

It is possible that the long-term relaxation and fatigue in the aftermath of orgasm has led some to assume it extends forward in time to reduce athletic performance and especially the competitive edge. This would lead athletes to adhere to sexual abstinence before competition. We must first explain the basic mechanisms behind sexual arousal in order to understand how the inhibition that takes place after sex might affect athletic performance.

The response to sexual cues involves the sympathetic nervous system. Sexual excitation activates neurotransmitters such as noradrenaline (NE) and oxytocin (OT), which stimulate sexual arousal, and dopamine (DA) and melanocortins, which stimulate sexual awareness and desire, within regions of the hypothalamus and limbic system (Pfaus, 2009). The activation of those neurochemical systems diminish the influence of inhibitory mechanisms, such as endogenous opioids, which are released in the cortex, limbic system, hypothalamus, and midbrain during an orgasm or sexual reward; endocannabinoids, which mediate sedation; and serotonin, which is released in those regions to induce refractoriness and sexual satiety (Pfaus, 2009).

DA and NE are also catecholamine neurotransmitters that play important roles in physical activity. Previously we spoke about how sexual activity approximates the sympathetic activation that takes place during physical activity. NE is a neurotransmitter of the sympathetic nervous system and is responsible for fight-or-flight response to all forms stress, including exercise. This phenomenon is also known as the adrenergic response and is responsible for the cardiovascular changes that take places during sexual arousal and activity ie, increased heart rate, blood pressure, ventilation which will be discussed later on in detail. Together, DA and NE are also responsible for the coordination and execution of physical acts. DA plays a more “executive” role, controlling the flow of information in the brain and assisting in the coordination of decisions and movements (Lundy Ekman, 2005).

As mentioned above, once orgasm is reached, there is an immediate release of brain opioids and endocannabinoids that causes a general sensation of euphoria and results in the release of neuromuscular tension and subsequent sedation. At this state as well there is a significant increase in blood oxytocin and prolactin (Kruger et al., 2002) released from the posterior and anterior pituitary, respectively. These neuropeptide hormones act in part to release the spinal mechanisms involved in orgasm and ejaculation from inhibition.

Far less is understood about the sexual inhibition mechanism that defines the RP. In brief, the increase in the inhibitory neurochemicals of orgasm inhibits the actions of the excitatory agents responsible for sexual arousal. This *shift in power from the active to sedative chemicals* is what is believed to cause the satiety, decreased sexual drive and relaxation associated with the RP.

The duration of the RP is at the core of the debate between sexual abstinence before competition vs. indulgence in sexual activity. Our interest in the RP derives from its inhibitory effects on the actions of DA and NE. Prolonged decreases in these catecholamines can be deleterious to athletic performance by decreasing alertness, reaction time and even decision making abilities, but also the drive to compete. Interestingly, RPs lasting over 1 hour however has not been reported. Moreover, Aversa and colleagues conducted a double-blind study where they compared RP in men taking sildenafil vs. a group on placebo. The 20 young men were given 100mg of sildenafil or placebo and were asked to masturbate while watching an erotic film. Once they ejaculated, they were asked to continue stimulation while watching the erotic film and the time it took for their erections to return was recorded. The average RP of the sildenafil group lasted 2,6 mins vs. 10.6 mins for the placebo group (Aversa *et al.,* 2000). Similar studies comparing RP duration in men given sildenafil or a placebo, using similar protocols have also found RP durations ranging from 5 minutes to 19 minutes (Aversa et al., 2000; Mondaini et al., 2003; Ekmekçioglu et al., 2005; Levin, 2009).

HORMONAL RESPONSES DURING SEX

Testosterone: Testosterone (T) plays an important role in sexual behaviour and athletic performance, and as such we decided to study T fluctuations. T is an anabolic androgenic steroid produced primarily in the testes and small amounts are also secreted by the adrenal glands. T increases muscular mass and the force-production capabilities of skeletal muscle (McArdle et al., 2005) and is a marker of aggression (Cohen et al., 1996) and sexual arousal (Bancroft, 2005). Steroid hormones activate mechanisms of sexual excitation by directing the synthesis of enzymes and receptors for several interactive neurochemical systems. A popular misconception is that sex and ejaculation decrease free T concentrations and therefore decrease aggression in sports where power and force is essential. This has been shown many times to be false. Where studies find no alterations in T levels after sex (Kraemer, 1976), others have shown increases, (Dabbs & Mohammed, 1992) even in men with erectile dysfunction (Jannini *et al.,* 2003) and in women following mental sexual cues (Goldey & van Anders, 2010). Long term effects of sexual activity on T concentrations are unknown however if T levels were negatively affected by sexual activity, the results would be similar to those of decreased NE and DA: decreased concentration, weakness, "sluggishness" and decreased vigour. One study found that refraining from ejaculation for one week did not increase blood T levels (Jiang *et al.,* 2003). Nonetheless, physical activity, particularly resistance exercise, is known for increasing levels of T, though within normal levels (McArdle et al., 2005).

Cortisol: Cortisol and corticosterone are glucocorticoids known colloquially as "stress hormones" and are considered markers of distress if significantly elevated beyond normal resting values (Guyton & Hall, 2006). For example, significantly increased measures have been reported in individuals suffering from anxiety and frustration. Cortisol is produced in the adrenal gland and its role is to facilitate

energy metabolism in response to stress, such as exercise, in order to increase the availability of glucose. However, both are released by "good" stress, such as sexual activity (Hamilton *et al*. 2008)

We chose to study cortisol variations presuming that if we find abnormally increased levels in blood at the end of testing, notably on the morning following sexual activity, we can deduce that completing the performance tests was strenuous due to the fatigue. During sexual activity, cortisol is believed to increase, because the response to sexual stimulation is in itself a response to stress. After sexual activity, studies have found cortisol values to be either unaffected (Hamilton *et al*., 2008) or presumably decreased because of the relaxational properties of sex. One study compared cortisol variations in 79 women who were subjected to either imaginatory social situations or sexual situations. The women in the sexual situation had increased T in response to the mental sexual cues but cortisol concentrations in saliva were unaffected (Goldey & van Anders, 2010). A repeated measures study by Hamilton and Meston (2010) compared pre-to-post viewing cortisol changes in 19 healthy women who viewed erotic, neutral and humorous films on separate occasion. They found that cortisol was significantly decreased in the humorous and sexual conditions, and interestingly enough found a negative correlation between genital arousal cortisol and changes.. (Hamilton & Meston, 2010).

THE CARDIOVASCULAR SYSTEM DURING SEX

Heart Rate (HR) was first described as going into tachycardia during sexual activity, with peak beat frequencies ranging from 110 beats per minute (b.p.m.) to 180 b.p.m. in adults (Masters & Johnson, 1966). The mean HR during sexual activity in healthy adults, from arousal to resolution was found to be between 90 and 110 bpm (Masters & Johnson, 1966; Bohlen et al., 1984, Palmeri et al., 2007) While most studies agree on the possibility of achieving the upper limit of 180 b.p.m and have reported such an increase, the general consensus is that average maximum HR during sex is situated in the 100 - 130 b.p.m range (Masters & Johnson, 1966; Bohlen et al., 1984; Katchadourian, 1980). Palmeri and colleagues (2007) found peak HR during sex of 32 healthy middle-aged participants with a mean age of 53 years to be 113 bpm for men and 105 bpm for women. Interestingly enough, Masters and Johnson noted the highest cardiac rates in women occurred during masturbation rather then during coitus (Masters & Johnson, 1966).

Blood pressure also rises considerably with systolic values rising by as much as 30-80 mmHg to reported values of 170 mmHg systolic in one study (Masters & Johnson, 1966) and as high as 213 mmHg in another (Katchadourian, 1980). Diastolic values nonetheless have been found to increase by 20-40 mmHg (Masters & Johnson, 1966). Blood pressure, is a difficult and unreliable parameter to measure during sexual activity, especially during orgasm

The above effects are in response to the stress of sexual stimulation and are mediated by the adrenergic actions of the sympathetic nervous system.

THE ENERGETICS OF SEX

Many incomplete conceptions exist in the popular media about the energetic demands of sexual activity. Energy expenditure is dependant on many variables such as age, body composition, basal metabolic rate, as well as time and type of activity done and on the overall health of the person. Few studies to date have dealt with the energetic cost of sexual activity. As a result, despite popular misconceptions there is no widely agreed upon standard for the energetic cost of sexual activity.

To date, one study has estimated energy expenditure during sex. Bohlen *et al.,* (1984) used respirometry to monitor the haemodynamic and metabolic changes during 4 sexual acts. Although the purpose of his study was to discriminate between sexual arousal and sexual stimulation, Bohlen *et al.,* (1984) provided us with data on energy consumption during sex. Their results showed that when men assumed the missionary position, they reached an average oxygen consumption of 11.55 ml O_2. kg^{-1} $.min^{-1}$ or 3.3 kcal/kg/hr compared to 5.61 ml O_2. kg^{-1} $.min^{-1}$ or 1.7 kcal. kg^{-1} hr^{-1} when they were stimulated by their partners or themselves. This study was done on young males aged 25-30 years. Bohlen' data should only be used as an approximation for healthy individuals, since energy expenditure, as mentioned earlier, is dependant on many variables.

"Sex without love is merely healthy exercise."

Robert Heinlen

HYPOTHESIS

Given the lack of evidence that sexual activity creates long term impairments or enhancements in human physiology, we expect to see no significant relationship between sexual activity and athletic performance. We expect to find no significant difference between performance measures throughout the three conditions nor do we expect a difference in basal testosterone and cortisol concentrations across conditions. Also, we do not expect to see a difference in T and cortisol responses to exercise between conditions.

"Love is the answer, but while you are waiting for the answer, sex raises some pretty good questions". Woody Allen

Prelude to the article:

The results and discussion about our study are portrayed in the following journal article which also serves as a summary of the project. After the article, a more detailed and technical explanations of the tests and of the orgasm rating scale are given. The findings of this study are intended to be disseminated in the *Journal of Sexual Medicine*. The following article describes the study parameters and results, followed by an appendix to the article which contains additional background information and details about each test performed.

TENTATIVE JOURNAL ARTICLE

ABSTRACT

Introduction: The question of sex the night prior to athletic competition is a popular subject amongst athletes. To date, no concrete answer has been established about the influence of sexual activity on athletic performance yet the majority of young male athletes nonetheless report practicing abstention before an event, believing that sexual activity can impair athletic output.

Aim: To determine whether sexual activity the night before competition impairs athletic performance.

Methods: In a repeated measures design, 8 participants underwent a battery of performance predicting exercise tests on under 3 conditions; the night prior to each testing, they were either: 1) abstinent and physically inactive, 2) sexually active or 3) did yoga. Vital sings, morning relaxation levels, saliva, urine and blood glucose samples were collected. In addition the variation in hormone concentrations and performance measures was analyzed.

Main Outcome Measures: Aerobic capacity, grip strength, leg power, reaction time, hamstring flexibility, muscular endurance, testosterone, cortisol, blood glucose concentrations and blood pressure.

Results: No significant difference was found between performance results between the 3 conditions. Blood Glucose and testosterone concentrations were unaffected by the conditions and cortisol levels were significantly increased on the mornings following sex and yoga. A strong, indirect relationship was found

between systolic blood pressure on the morning following sexual activity and orgasm rating, notably with the emotional intimacy component.

Conclusion: Our findings indicate that sexual activity does not create short term impairments in athletic performance, no less then a yoga session. Our findings indicate a possible long term beneficial effect of sexual activity on athletic output and blood pressure, possibly contradicting the coach's fallacy of sexual activity being detrimental to athletic performance.

INTRODUCTION

The question of sex the night prior to athletic competition is a popular subject amongst athletes. To date, no concrete answer has been established about the influence of sexual activity on athletic performance yet the great majority of young male athletes nonetheless report practicing abstention before an event, believing that sexual activity can impair their athletic output (Fischer, 1997).

In essence, sexual activity is believed to impair athletic performance by physically and mentally exhausting athletes. To date only one published study has looked at the question: does sexual activity impair performance? Boone and Gilmore (1995) looked at the effects of sexual activity on the haemodynamic and metabolic response to treadmill exercise in 11 sedentary men that did and did not partake in sexual intercourse. They found that VO2, O2 pulse, double product, heart rate, systolic blood pressure and RER remained unaffected by coitus (Boone & Gilmore, 1995).

Aerobic capacity however, is not sufficient to determine the effect of sexual activity on athletic performance. Many other variables overlooked by the aforementioned study play an important role in predicting athletic execution. These include: muscular endurance and strength, reaction time, leg power, flexibility, relaxation, blood glucose levels, cortisol and testosterone availability, blood pressure and overall fitness.

The purpose of this study will therefore be to determine whether sexual activity bares any effect on all of the previously mentioned variables and by extension, on athletic performance. Furthermore, since physical exhaustion is thought to be the main by-product of sexual activity and cause of impairment, we will also examine the effects of only being physically active the night prior to competition on the same variables.

METHODS

Study Design

The present study followed a repeated measures design. Participants were evaluated on 3 separate occasions, while having fulfilled one of three conditions on the prior night. The first condition served as the control: subjects were evaluated after having been abstinent and physically inactive, while the second condition, the subjects were sexually active the night prior to the evaluation and for the third and final condition the subjects remained abstinent the prior night but completed a 15 minute yoga exercise intended to mimic the energetic cost of sexual activity. The order in which the last sexually active and yoga conditions were fulfilled was random.

Participants

Seven men (mean age: 26.8 years, weight: 81 kg, height: 1.76 m) and one woman (36 years of age, 72 kg, 1.8 m) volunteered for this project. Five participants were classified as physically active and three as sedentary. Physically active participants engaged in physical activity of at least moderate intensity at least 4 times per week. All subjects were screened for contraindicating health problems or medication usage and had to first be at least 18 years of age and sexually active at the time of the data collection.

Conditions

Sexual Activity

Participants engaged in sexual activity in private, unmonitored settings. Participants were instructed to follow their normal sexual habits. We did not impose controls on sexual activity in order not to interfere with the validity of what is supposed to be a natural activity (Anshel, 1981).

During sex, each subject sported a HR monitor (Polar RS-200), which took note of the duration of sexual activity as well as each participant's mean and peak HR and an estimate of caloric expenditure. These were taken as subjective measures of sexual activity. The Mah & Binik orgasm rating scale was also used by participants to rate and provide a subjective evaluation of orgasm intensity. The ratings were then added and yielded total scores for sensory, affective and evaluative dimensions of orgasm..

Exercise-Yoga

The purpose of the third condition was to mimic only the exertive part of sexual activity. Bohlen *et al.,* (1984) found metabolic equivalency of sex in men to range from 1,7 METs to 3.3 METs, depending on the position assumed by the participants during sexual activity. For this project, we took the mean of Bohlen *et* al.,'s findings and consider 2.5 METs as the average energetic cost of sexual activity. Keeping in mind our conjecture, participants completed a 15 minute yoga work-out. Hatha-Yoga has an average metabolic equivalency of 2.5 METs as per Ainsworth *et al.,* (2000)'s *Compendium of Physical Activities and MET Intensities.* Participants were given a DVD with a series of yoga exercises and were instructed to complete the session on their own to the best of their abilities and were then asked to rate their sensations on the orgasm rating scale.

Measures

Sleep and Relaxation

Participants were asked to declare the number of hours they slept the night before testing on every occasion, as well as to rate their relaxation levels on the morning of each testing session by drawing a vertical line on a horizontal continuum. The extremities of the scale were denoted as "very tired" and "very relaxed" and the distance from the neutral point in the center, was then taken as an indicator of the quality of sleep. This was done to evaluate the effect of relaxation and sleep on athletic performance.

Vitals, Questionnaires, Anthropometric Measures and Fluid Collection

Saliva (*approx*. 1ml), urine samples (up to 30ml) and finger tip blood glucose concentrations were collected from the participants before and after performance testing on each occasion. The following Vital signs and anthropometric measures were also recorded: age, weight, initial blood pressure and heart rate. Once this was done, participants then completed their condition-appropriate questionnaires.

Special Considerations

Several measures were adopted to preserve internal consistency and to prevent a carry-over effect. These included: withholding results until the end of the last testing session to prevent participants from trying to surpass their alternate-testing results and establish misleading beliefs which can affect execution; have the testing and fluid collection take place at the same time of day on each occasion in order to avoid circadian-related changes in stress and exercise related hormones;

and impose a restriction on exercise, food and liquids consumption for at least 4 hours before each evaluation.

Analysis and Statistics

All statistical analyses were done with SPSS. A 3-level repeated-measures ANOVA model was used to:

a) Compare and analyze performance test results on the mornings following each of the three conditions for
b) Compare and analyze blood glucose, testosterone and cortisol concentrations on the mornings following each condition, before testing.
c) Compare and analyze BG, T and cortisol concentration-fluctuations in response to exercise
d) Compare and analyze BG, T and cortisol concentrations in response to exercise, between conditions.

Standard error was used to assess reliability of all measures across trials.

Person's correlation was then used to correlate orgasm rating scores for both the sexual activity and yoga experiences with each of the performance results on their respective following mornings, vital signs and BG, T and cortisol concentrations. The same was analysis done comparing mean and maximal heart rate of sexual activity with the above-mentioned variables.

PERFORMANCE MEASURES, BLOOD GLUCOSE & HORMONE CONCENTRATIONS

1) PWC_{170}-Aerobic Power

The Physical Work Capacity 170 (PWC_{170}) is a reliable, easily administered, ergometric, sub-maximal, graded-exercise test used to measure aerobic power (Motl *et al.,* 2001, Petzl *et al.,* 1988, Goodwin and Cumming, 1966), or the ability to produce energy and do work.

2) Vertical Jump-Leg Power

The vertical jump is a reliable test widely used to assess leg power (Maulder & Cronin, 2005) and has been found to correlate well with peak power and mean power produced during a Wingate test (Hoffman et al., 2000).

3) Hand Grip Dynamometry- Upper Body and Overall Strength

Hand grip dynamometry has been used by many researchers as a general indicator of overall strength (McArdle *et al.,* 2005).

4) Push-up Test - Muscular Endurance and Strength

The push-up test is a widely used, objective and reliable indicator of upper body strength and muscular endurance (Baumgartner *et al.,* 2002). The test consists of completing as many full push-ups as possible in 1 minute.

5) Ruler Test-Reaction Time

A traditional ruler drop was done to assess reaction time. The ruler test is a practical, easy to administer test that has been used to assess not only reaction time but mental acuity and concentration, particularly in alcoholic an elderly populations (Eby *et al.,* 2007; Streff *et al.,* 1990).

6) Sit and Reach-Hamstring Flexibility

The sit and reach test is a common measure of flexibility, and specifically measures the flexibility of the lower back and hamstring muscles. This test was first described by Wells and Dillon (1952) and is now widely used as a general test of flexibility (http://www.topendsports.com/testing/tests/sit-and-reach.htm).

Blood Glucose

Finger tip glucometry was performed using a *Contour* blood-glucometer. More details are provided in the appendix section.

ELISA-Hormones

Enzyme Linked Immuno-Sorbent Assays (ELISA) were used to monitor the concentration of cortisol and testosterone in saliva and urine. ELISA is an immunological and photometric tool used to measure the concentration of various biological agents. *For a detailed step-by step explanation of how ELISAs are performed, and more information see the appendix section.*

RESULTS

Performance Measures

All tests were completed with no significant statistical difference in performance values between conditions ($p > 0.05$) albeit a p value of 0.092 denotes the emergence of a trend in increased grip strength when the sexual activity and yoga conditions were performed the night before. The raw data as well as the statistical values are tabulated in tables 1& 2 respectively and the results between conditions per test were graphed in figures 1 to 6.

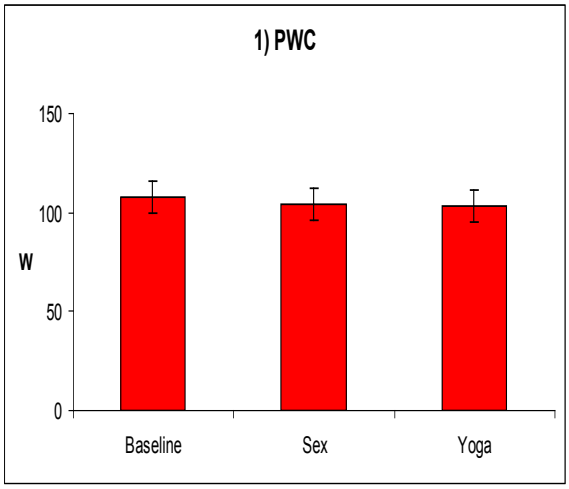
Table 1. Mean scores with the standard error for performance variables per condition.

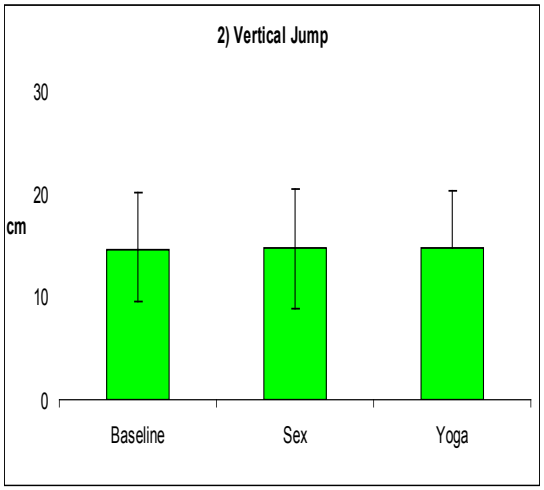
Variable/Condition	Abstinence and Ina (Baseline)	Sexual Activity	Exercise
PWC 170 (W)	108 (± 7.8)	104 (± 8.2)	103 (± 22)
Vertical Jump (cm)	14.5 (± 5.6)	14.8(± 5.6)	14.7 (± 5.6)
Grip Strength (psi)	19.3 (± 1.2)	20.1 (± 1.2)	20.2 (± 1.2)
Reaction Time (s)	0.171 (± 0.005)	0.168 (± 0.006)	0.172 (± 0.006)
Push-Ups (#/min)	30 (± 5.6)	32 (± 5.6)	30 (± 5.6)
Stretch Distance (cm)	44.5 (± 2.4)	47 (± 2.5)	48 (± 2.4)

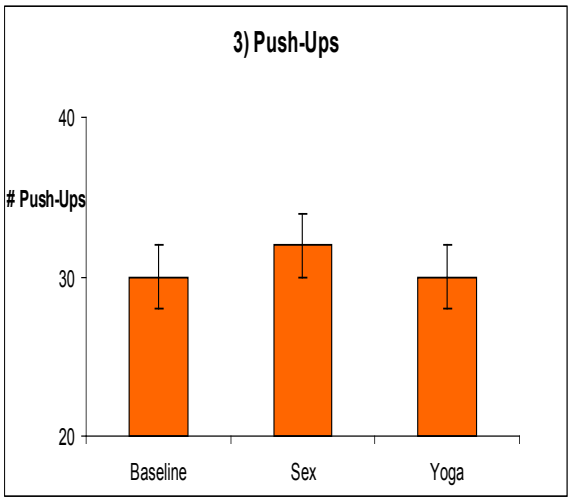
Table 2. Statistical comparison of performance variables in the 3 conditions using repeated-measures ANOVA:

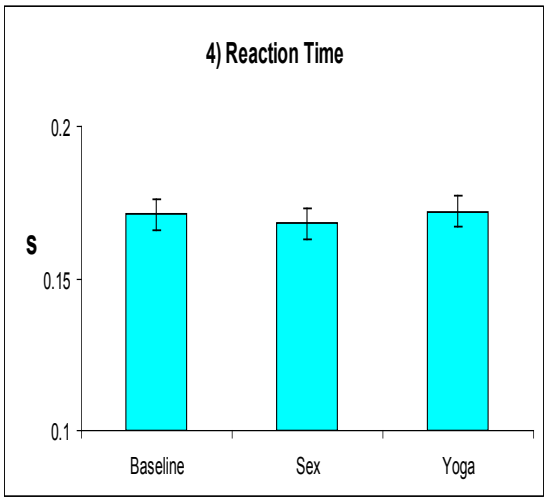
Variable	F value	p (α= .05)	Conclusion
PWC 170	1.387	.277	No effect.
Vertical Jump	1.038	.342	No effect.
Grip Strength	3.798	.092	No significant effect, Trend
Reaction Time	.120	.740	No effect.
Push-Ups	.076	.791	No effect.
Stretch Distance	.296	.603	No effect.
Blood Glucose	.019	.894	No effect.

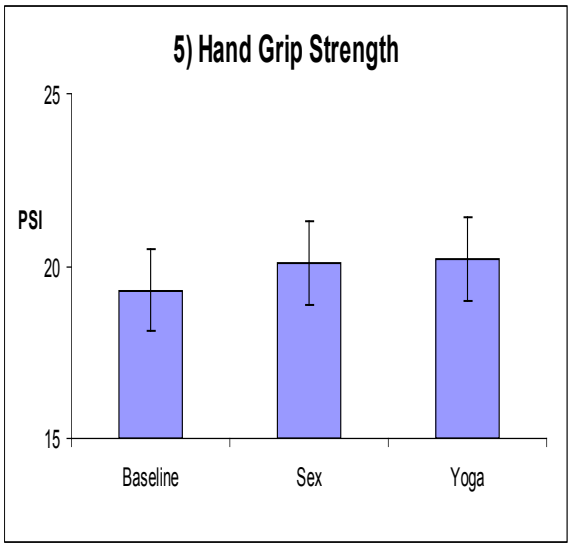
Figures 1-6. Comparison of performance tests

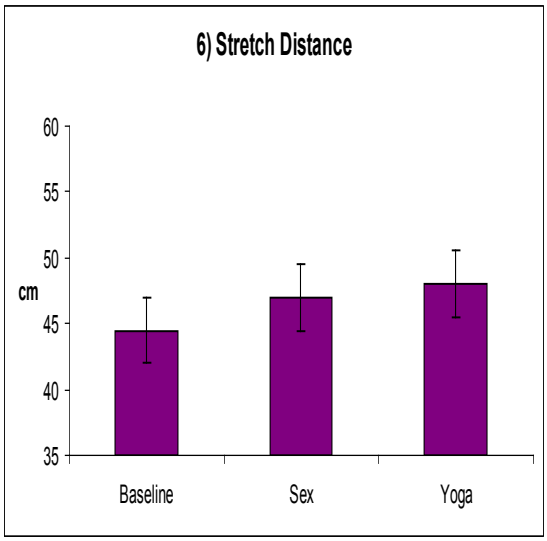












Sleep Data and Morning Relaxation Ratings

Participants reported sleeping an average of 7.5 hours after the baseline and sexually active conditions and 6.5 hours after yoga. These findings were statistically insignificant. ($F = 1.003$, $p = 0.783$). The following mornings, participants rated their relaxation on the very tired-very relaxed continuum and the results were as follows: On the morning following the sexually and physically inactive night, participants noted their relaxation levels to be 52mm to the right of the neutral mid way point, 71mm on the morning following sexually activity night and 56 mm following yoga. No statistical difference was found ($F = .698$, $p = .810$)

Sexual Activity

All eight participants reported achieving orgasm though intercourse. Mean heart rate during sexual activity was recorded as 98 beats per minute (bpm) with an average estimated energy expenditure of 130 kCal with an average maximal heart rate of 154 bpm. On average, sexual activity lasted 13 minutes as per monitor recordings.

Orgasm Ratings- Sex, Partner's perception and Yoga

Table 3. Orgasm rating cores per dimension and component for sexual activity, believed partner's perception and yoga.

Dimensic	Component	Sex	Yoga
Sensory	Building Sensation	4.5	3.4
	Flooding Sensation	4.7	2.5
	Flushing Sensation	5.7	2,3
	Spurting Sensation	4.9	1,4
	Throbbing Sensation	5.7	2,4
	General Spasms	6.9	2,4
	TOTAL:	**32.4**	**14.4**
Affective	Emotional Intimacy	15.9	3
	Ecstasy	13.6	7
	TOTAL:	**29.5**	**10**
Evaluative	Pleasurable Satisfaction	12	14
	Relaxation	8.3	12
	TOTAL:	**20.3**	**26**

Hormones and Blood Glucose

No significant difference was found in pre-testing blood glucose concentrations (BG) between the 3 conditions (F= .603, p > 0.05- *see Figure 7*). The change in BG from the beginning to the end of testing regardless of condition was insignificant (F= 1.21, p > 0.05- *see Figure 10)*. The change in BG from the beginning to the end of testing was insignificant between conditions (F= 1.04, p > 0.05).

No significant difference was found between pre-testing testosterone concentrations of the 3 conditions (F= .750, p > 0.05- *see Figure 8*), however testosterone concentrations increased from the beginning to the end of testing

regardless of the condition (F(baseline)= 18.71, F(sex)= 11.20, F(yoga) = 17.26, p > 0.05- *see Figure 11*). The pre-to-post differences in testosterone concentrations between conditions were insignificantly different (p > 0.05).

Pre-testing cortisol concentrations were significantly increased on the mornings of the sex and yoga conditions (F= 27.13, p = 0.048- *see Figure 9*). The change in cortisol concentrations from the beginning to the end of testing increased regardless of the condition (F(baseline)= 20.27, F(sex)= 16..08, F(yoga)= 20.27, p > 0.05- *see Figure 12*) and the change in cortisol from the beginning to the end of testing was insignificant between conditions (p > 0.05).

Figure 7. Initial (pre-testing) blood glucose concentrations on the morning following each conditions.

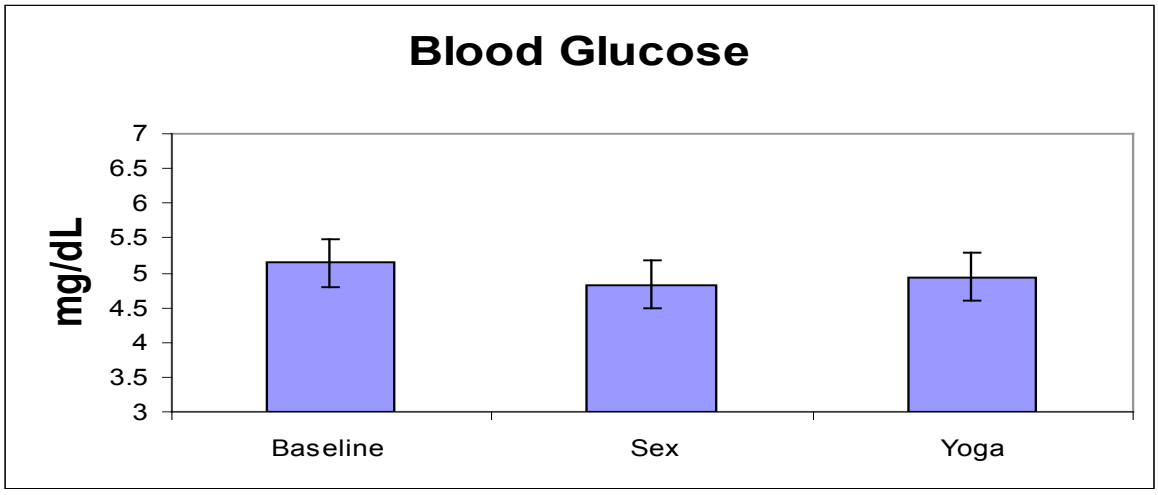


Figure 8. *Initial (pre-testing) Testosterone concentrations on the morning following each conditions.*

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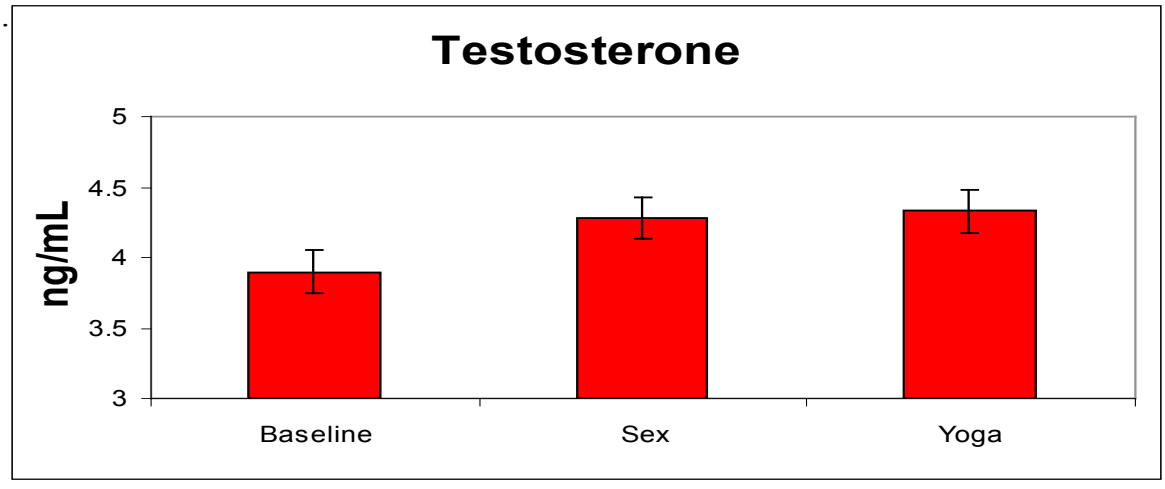


Figure 9. Initial (pre-testing) Testosterone concentrations on the morning following each conditions.

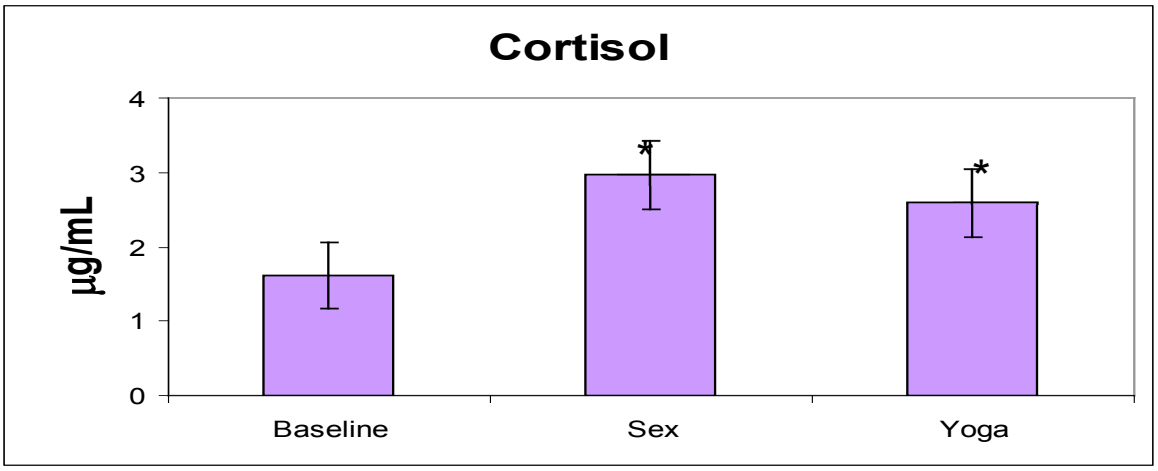


Figure 10. Fluctuations in blood glucose from the beginning to the end of each testing session.

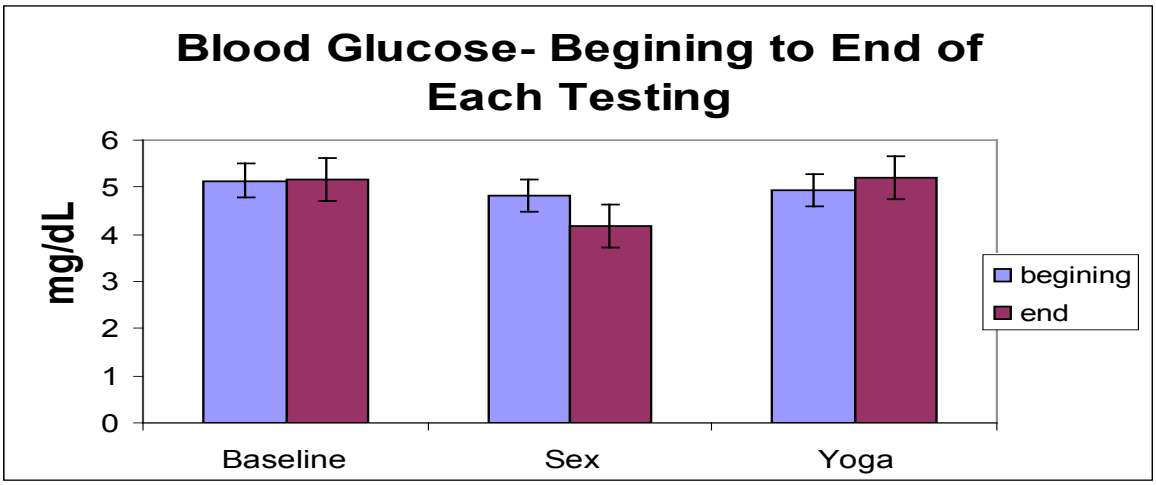


Figure 11. Fluctuations in Testosterone from the beginning to the end of each testing session.

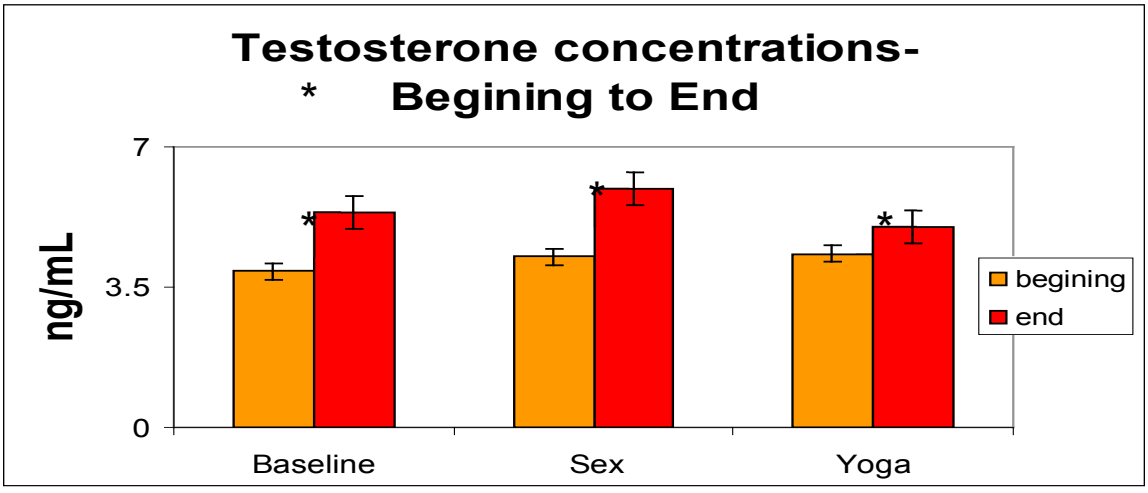
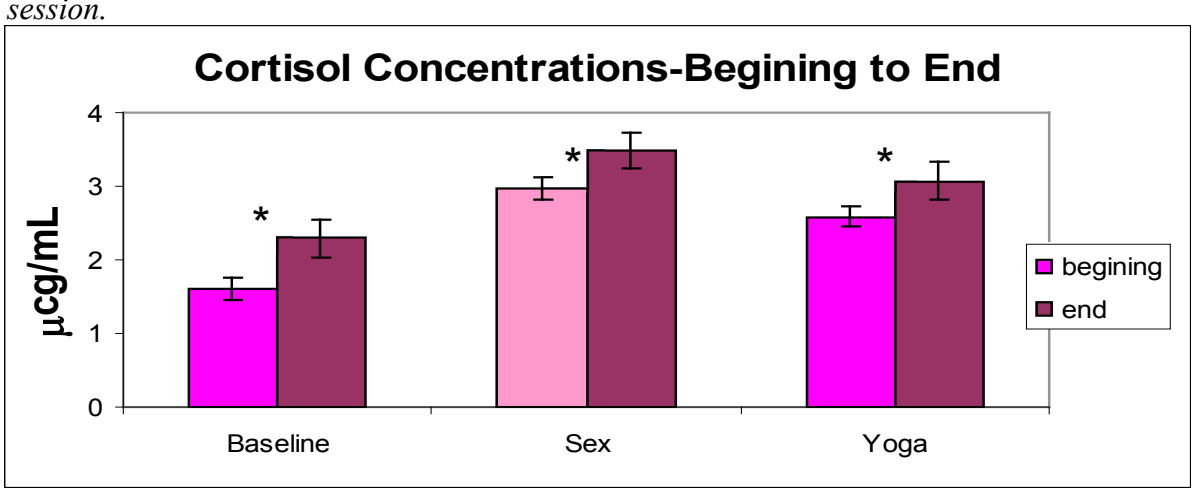


Figure 12. Fluctuations in cortisol from the beginning to the end of each testing session.



Correlations

Pre-testing systolic blood pressure on the morning following sex correlated significantly with total orgasm rating value (r = -.72, p = .015- *see Figure 13*), with the affective dimension of the ORS (r = -.76, p = .019- *see Figure 14*), and with the emotional intimacy component of the ORS (r = -.90, p= .011- *see Figure 15*). Diastolic blood pressure did not correlate significantly with orgasm rating, neither where there any significant correlations between orgasm ratings of yoga and systolic blood pressure on the following morning (*see Figures 16-18*). None of the vital signs on the mornings following sex or yoga correlated significantly with their respective ORS scores on the mornings following sexual activity and/or yoga.

Figure 13. Correlation of total orgasm rating score (sex) and systolic blood pressure on the morning following sexual activity.

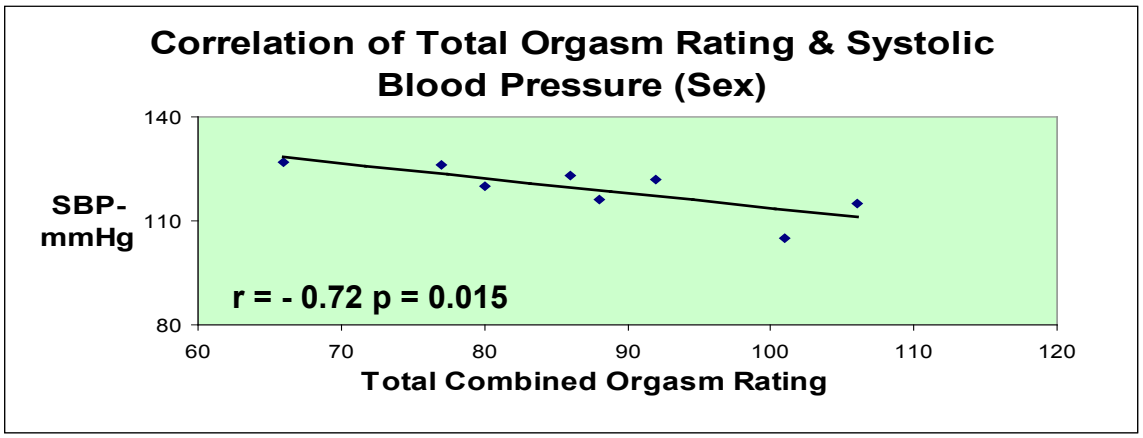


Figure 14. Correlation of the affective dimension of the ORS (Sex) and systolic blood pressure on the morning following sex.

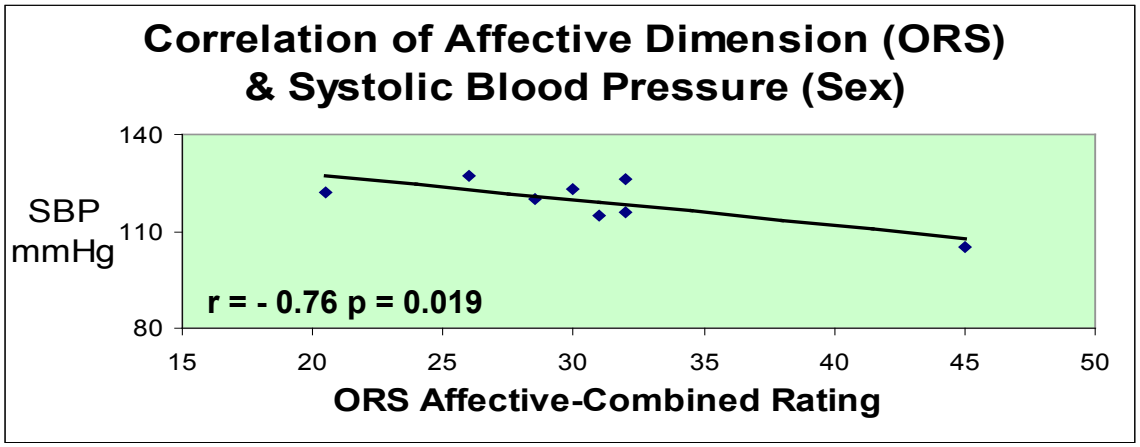


Figure 15. Correlation of the emotional intimacy component of the ORS (sex) and systolic blood pressure on the morning following sex.

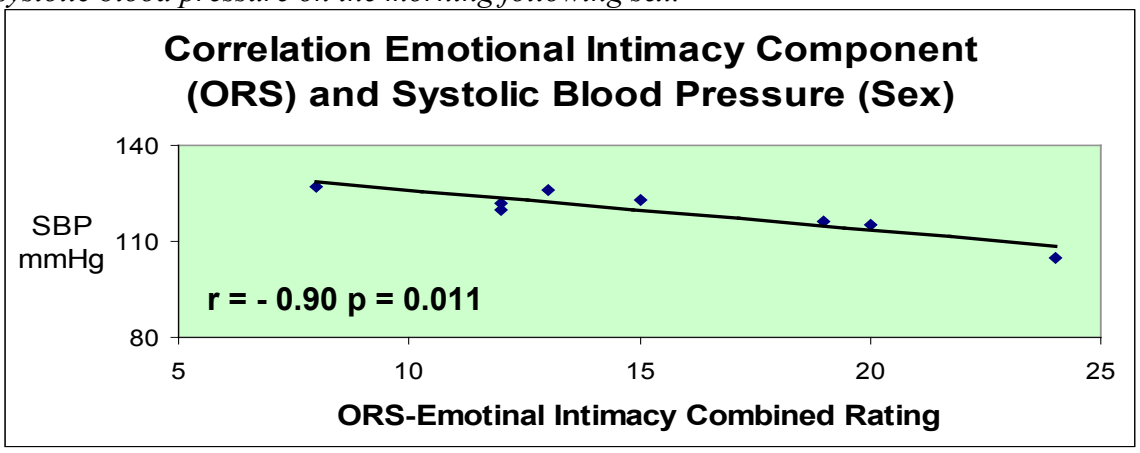


Figure 16. Correlation of Pre-Testing Systolic Blood Pressure on the morning following Yoga and the Combined ORS Score.

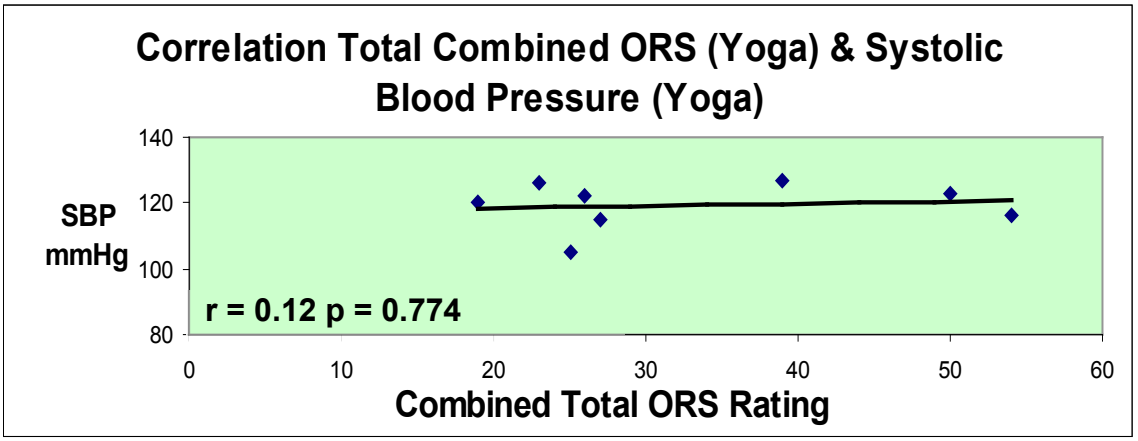


Figure 17. Correlation of pre-testing systolic blood pressure on the morning following yoga and affective dimension ratings.

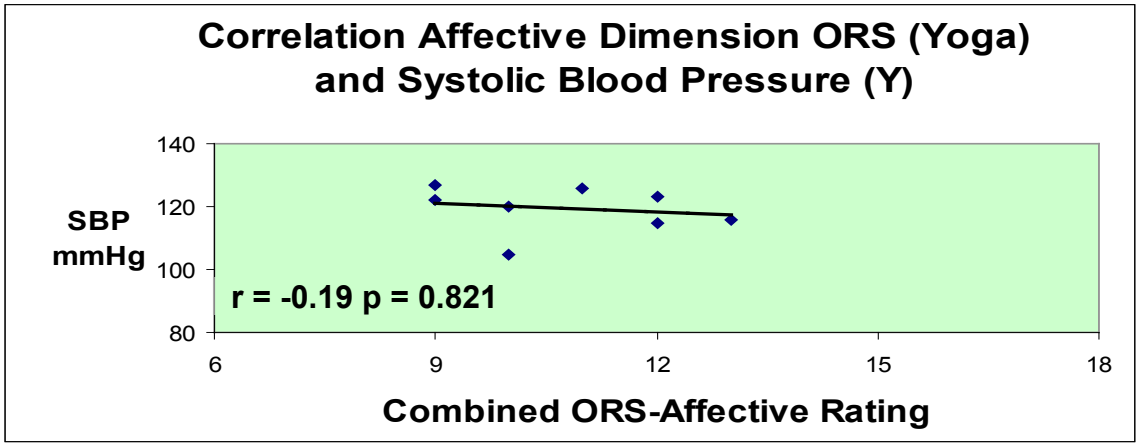
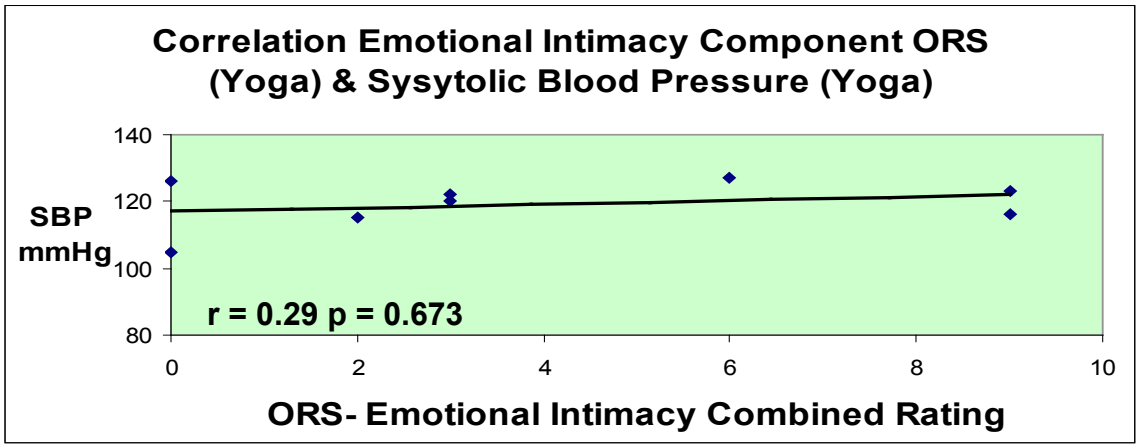


Figure 18. Correlation of pre-testing systolic blood pressure on the morning following yoga and the emotional component ratings.



DISCUSSION

The results of the present study indicate that sexual activity does not acutely influence athletic performance. Our data also suggest that the exertive effort of sexual activity does not affect athletic performance because no significant difference was found between the performance results for each condition. We also found a negative relationship between pre-testing systolic blood pressure on the morning following sexual activity (S-PBR-s) and total orgasm rating but also the affectionate component of sexual activity.

Our findings expand on previous studies relating to this subject. Like Boone and Gilmore (1995), we too found that aerobic capacity was unaffected by sexual activity. Also, like Johnson (1968) we found no effect of sexual activity on hand grip strength. Pre-testing testosterone concentrations were unaffected by sexual activity or yoga, as expected from a review of the literature. (Kraemer *et al.,* 1976; Dabbs & Mohammed, 1992) and pre-testing cortisol concentrations were significantly higher on the mornings following sexual activity and yoga but well within normative physiological values. Finally, testosterone and cortisol concentrations were increased at the end of each testing regardless of the condition, as they are expected during exercise.

If sexual activity and the alleged residual fatigue from the RP did indeed carry over to the following morning and have an effect on athletic performance, we would have seen significant decreases in exercise capacity (Gibson *et al.,* 1993), increased glucose consumption, higher then normal pre-testing cortisol levels (Strickland *et al.,* 1998) and decreased self-reported morning relaxation levels in the sexually active and/or sexually exertive/yoga conditions. This was not the case.

Our data also revealed a significant negative correlation between Pr-SBP-s and total orgasm rating. More precisely, a strong and significant negative correlation was found between Pr-SBP-s and the affectionate dimension and emotional

intimacy component of the ORS. These findings can be retraced to the events that take place within the human body and particularly nervous system at orgasm.

Physiologically, orgasm represents the release of neuromuscular tension and is the climax of sexual activity. The release of neuromuscular tension is a reflex that is characterized by a release of brain opioids and endocannabinoids causing a sensation of euphoria and relaxation. After orgasm however, increased prolactin and oxytocin concentrations in blood and nervous system and the increased action of the inhibitory agents lead to sensations of decreased sexual drive and satiety. This is the refractory period (RP). If the effects of the RP were to be carried over to the time of competition, this would be detrimental towards overall athletic performance. However as we know, the RP has not been reported to exceed 30 minutes (Aversa et al., 2000; Mondaini et al., 2003; Ekmekçioglu et al., 2005; Levin, 2009). Furthermore, the half life of prolactin in blood is roughly 100 minutes (Parra *et al*., 2004) and in our case performance tests were carried out nearly 12 hours after sexual activity and after a night of sleep.

No known studies have explored the relationship between affection, orgasm and blood pressure, Although one study found a negative correlation between genital arousal and cortisol changes during mental sexual stimulation in 19 women (Hamilton & Meston, 2010) Moreover, the beneficial effects of sexual activity on blood pressure and health have been documented (Brody *et al*., 2006, 2006, 2008; Hamilton & Meston, 2010). These events can be attributed to the physiological as well as psychosocial properties of intercourse, the sedative properties of the opioids and endocannabinoids released at orgasm and oxytocin, a hormone released during sexual arousal, orgasm and pair bonding, colloquially known as the “love hormone”. These effects include: increases in parasympathetic tone, heart rate variability, blood pressure variability (Brody, 2008, 2006) anabolic activity, intelligence, analgesia and decreased serum cortisol concentrations (Hamilton & Meston, 2010), Oxytocin in particular has been linked with tranquility (Heinrichs *et al.,* 2008), but also decreases in anxiety, social stress and

depression. Increased plasma oxytocin levels have been reported to decrease blood pressure in humans for up to ten days (Petersson *et al.,* 2003). In addition, the cognitive, mood elevating effects of intercourse have been reported to be beneficial towards physical and mental health but also towards blood pressure (Gallup *et al.,* 2002, Frauman, 1982). All of the above phenomena are known to facilitate decreases in blood pressure acutely and over time. In terms of our study, the relaxational and gratifying benefits of sexual activity have been documented to decrease frustration and regular sexual activity would in this case be considered favourable in sports where concentration and self-control are important.

Our findings imply a modulatory effect of sexual activity on blood pressure, presumably via the pathways related to relaxation, and suggest a possible long-term effect on performance-determining variables and a beneficial effect on health. In retrospect, the human body is designed to respond to stress with alarm and resistance, such as increased heart rate and blood pressure; In contrast, low starting blood pressure and a rapid adjustment in response to the alarm are signs of calmness and adaptation but also of health and fitness. One study has nonetheless shown that people who regularly engage in peno-vaginal intercourse experience a similar and better response to stress then their non-sexually-active counterparts (Brody *et al.,* 2006). A better response meant a smaller increase in blood pressure as compared to the abstinent populations. This can lead to decreased stress in anticipation of competition and even enhance performance.

The purpose of yoga was to imitate the energetic cost of sexual activity without arousal. Yoga is known for tension relief and rejuvenation. One could expect the relaxational properties of yoga to have a similar effect on blood pressure as orgasm; however this was not the case. In fact, we found no relationship between our 15 minute basic yoga exercise and blood pressure on the following morning. In addition, ORS ratings for yoga did not correlate significantly with any of the performance tests, hormone levels or vitals. To rationalize our findings, one can

compare the after effects of sexual activity and yoga: First, as opposed to sexual activity, yoga does not induce a release of opioids and endo-cannabinoids which contribute to the tension relieving effect of sexual stimulation nor do the affectionate and intimate characteristics of sexual activity apply to hatha-yoga. Secondly, yoga is known for sensations of rejuvenation and increased drive for activity whereas after sexual activity, the human body is in a state of satiety. Lastly, where a typical yoga session lasts about an hour, the 15 minute yoga exercise that our participants completed would in theory not be sufficient to stimulate the tension relieving quality of yoga.

The present study focused on the physical aspects of typical athletic performance. Future studies should also include a psychological analysis, a personality inventory and a questionnaire regarding athlete's beliefs and habits in order to assess attitudes towards the subject at hand. Whether or not one should abstain from sexual activity is as much a psychological issue as it is physiological, as unjustified beliefs and fallacies can lead to erratic behaviour and have a detrimental impact on performance. Mohammed Ali and others like him believe that sexual activity results in decreased focus and more importantly decreased aggression, either through residual fatigue from the RP or testosterone loss through ejaculation. In the case of our study, circulating T levels remained unaltered by sexual activity and we did not see any carry over of the RP in our participants' performance measures. Our findings however did not detect any benefit of sexual activity on aggression since we did not test for behavioural effects. This would be of interest to explore in future studies that would look at behaviour after sexual activity in an athletic situation, with a competitive atmosphere including opponents, team mates, fans and coaches, an "ideal situation" which our laboratory setting does not provide. Nevertheless, aggression in sports is required for pushing one's self in individual sports and is even more essential in contact and combative sports.

This is where the topic of frustration vs. aggression appears. Many believe sexual abstinence will increase aggression; however frustration instead of aggression can easily be produced if the results are not the ones expected or if the athlete cannot find another way to decrease both the physical and mental stress of competition and training. A downward spiral can then be created since increased frustration can provoke anxiety and affect the way in which an athlete responds to stress, ultimately thwarting athletic output and even leading to catastrophizing behaviours and self-fulfilling prophecies. The resulting decreased sexual activity frequency can deprive and individual of the previously described benefits that come with coitus, such, relaxation and decreased resting blood pressure. Frustration can also be activated if athletes who do not believe sexual abstinence are denied sexual activity by coaches who either believe in the continuation of the RP and/or use sexual activity as a stimulating reward for satisfactory performance. This can be ruinous to athletic output regardless of the findings of this study, especially if the desired results are not produced, in which case the coach-athlete relationship can be negatively affected. In the worst case scenario these beliefs can develop into a form of an obsessive compulsive behaviour whereby behaviours can either be reinforced by winning or exacerbated by loosing. These conjectures would need to be studied in an "ideal situation" which we cannot provide because it is unrealisable. In brief, sport psychology is as important as the physiology of sexual activity and exercise.

If a study of this nature were to be reproduced, the following additions should be contemplated: The participant pool should be composed of both men and women in order to compare sex differences, primarily athletes, and should be divided according to their sports, since beliefs about sexual activity could vary greatly between athletes in team sports and individual competitors simply because of the difference in the people surrounding the subjects (1-to-1 relationship with coach and other influential characters vs. being the member of a multiplayer team). Future analysis should look into the difference between team sports and

individual sports since player camaraderie might bare an influence on sexual behaviour and enhance the psychosocial benefits of sexual activity, with regards to masculinity, confidence and status within the group. In our situation, recruiting women was more difficult then expected, which is why we resorted to testing men, primarily. The male-female difference in response to sexual activity would be of great interest, particularly because of the disenfranchising of women's sports and of female sexual behaviour and because of differences in orgasm frequency and RP duration. A bigger sample size should also be sought, however given the nature and maturity of the subject this can be challenging and proper marketing strategies should be developed. It is worthwhile to note that when approached about the current study, the most common question was that of financial compensation. Tests that evaluate agility and other kinesiological variables simultaneously are warranted since human functioning is the sum of multiple systems working in unison. In our case this was not possible since we did not have the proper facilities for such tests. If whole teams were to be tested, sport specific performance tests should be included, as they will be most identical to the actions of carried out during competition.

Athletes when sluggish are revitalised by love-making and the voice is restored from being gruff and husk" Pliny the Elder, 77 AD

Sex the night before solidifies my core feeling of happiness."
Lynn Jennings, distance runner

CONCLUSION

Our findings indicate that sexual activity does not create short term impairments to athletic performance, no less then a yoga session. Furthermore, our findings indicate a small but long term potential for a *beneficial effect* of sexual activity on athletic output and blood pressure since significant correlations were found between orgasm rating on the morning following sex and systolic blood pressure. However this is to be verified and further studies should take into account the beliefs and practices of athletes.

"*It's not the sex that hurts these guys, it's staying up all night looking for it!"*

Casey Stengel former Dodgers manager

Good strikers can only score goals when they have had good sex on the night before a match, Romario

'I certainly never found it had any effect on my performance,' he said. 'Maybe best not the hour before, but the night before makes no odds.'

George Best

APPENDIX and TECHNICAL INFORMATION

This section includes the technical details of this study. First, this section will expand on the performance tests used to test the influence of sexual activity on athletic performance and will then expand on the orgasm rating scale.

PERFORMANCE TESTS

A) PWC_{170}

The Physical Work Capacity 170 (PWC_{170}) is a reliable ergometric test done to measure cardio-respiratory endurance and aerobic power (Motl et al., 2001, Petzl et al., 1988, Goodwin and Cumming, 1966). The capacity to produce energy and do work is calculated by measuring average power output for an exercise at set resistances and then predicting power output at an intensity of 170 beats per minute. The PWC rests on the assumption that the relationship between workload and heart rate is linear (Petzl et al., 1988). Furthermore, this method has also been shown to be accurate in predicting power output at maximal effort (Petzl et al., 1988) and has also been reported to correlate well with VO2 max (Goodwin & Cumming, 1966).

Many variations of the PWC 170 exist, however the principles guiding the testing are the same, in that this is an indirect graded exercise test. The participants will undergo two consecutive 6 minute rides on a bicycle ergometer in which the workloads are selected to produce a heart rate between 120 and 140 b.p.m on the first session and 150 and 170 b.p.m. on the second session. For each session, the average Heart Rate (b.p.m.) and Power Output (watts) are recorded. From, the first and second sets of recordings we can calculate or extrapolate power output at 170bpm.

B) Vertical Jump- Leg Power

The vertical jump is a reliable test widely used to assess leg power (Maulder & Cronin, 2005) and has been found to correlate well with peak power and mean power produced during a Wingate test (Hoffman et al., 2000). The test involves measuring the difference between the standing vertical reach and the maximum height reached at the peak of a vertical jump. The distance travelled will be marked by two velcro-embroiled fingertips on vertical velcro padding. The distance will then be measured using a digital tape measurer. Although unnecessary in this study, kinematical variables such as force, work and velocity, power, momentum and acceleration can be determined mathematically for further analysis.

Leg power is an important determinant of performance in many sports and is also essential from proper manoeuvring. Jump height, propulsion, sprint speed, rapid lateral displacements and kick strength but also the arm movements of certain activities are to a large extent dependant on leg power. Nonetheless, studies have a found a strong relationship between vertical jump distance and performance in many sports (Maulder et al., 2006; Barnes et al., 2007; Burr *et al.,* 2008).

C) Hand Grip Dynamometry- Strength

Hand grip and forearm strength are important to some sports and activities of daily living. Hand grip dynamometry has been used by many researchers as a general indicator of overall strength. In this study, hand grip strength will be measured using a pneumatic hand grip dynamometer (HOSPEQ) to assess forearm strength and by proxy, overall strength. A common problem with the pneumatic dynamometer, as with all dynamometers, is that hand size and positioning can affect results, putting the accuracy of the measurement in question. To surpass this obstacle, we will standardize the holding method. Participants will be instructed to

hold the squeeze bulb at the already delineated equator of the bulb, in a way that the line is positioned along the center of the middle finger.

D) Reaction Time

The time required to react to an external stimulus can make the difference between a head start on the sprint, can determine who will retrieve the ball the fastest or if the goalkeeper will stop a ball or not. A ruler drop test can be done to assess reaction time. A ruler is held between the outstretched finger and thumb of a person and is left to drop. From the point at which the person catches the ruler, we can deduce reaction time with the following kinematical equation:

$$\text{Reaction time} = \sqrt{(2d \setminus a)}$$

Where *d* is the distance from the edge where the ruler is caught and *a* is the acceleration due to gravity, 9.81 m/s^2

E) E.L.I.S.A (Enzyme Linked Immuno-Sorbent Assays)

To determine whether performance modulating hormone availability is altered after sexual activity, Enzyme Linked Immuno-Sorbent Assays (ELISA) will be used to monitor the concentration of norepinephrine, dopamine, serotonin and testosterone. ELISA is an immunological tool used to measure the concentration of various biological agents. The samples will be collected non-invasively from urine (cortisol) and saliva (testosterone).

Salivary T has been shown to be an accurate representation of free testosterone concentration in blood, with a high correlation existing between serum T and saliva T concentrations (Baxendale et al., 1982).

THE ORGASM RATING SCALE

Orgasm Rating Scale

The Mah & Binik orgasm rating scale was used by participants to provide a subjective evaluation of orgasm intensity. The two-dimensional scale consists of 28 participant-rated adjectives used to describe orgasm. Participants graded each adjective on a 0-5 scale according to how well the word described their experience (Mah & Binik 2002, 2005). From the ratings, combined composite scores for physical and cognitive sensations were determined. Examples and details on how the scale was developed and formatted have been previously published in the literature (Mah & Binik, 2002). Along with peak HR, the ORS served the purpose of qualifying orgasm and sexual activity.

I. Mah & Binik's Orgasm Rating Scale

0 1 2 3 4 5

does not describe it at all **describes it perfectly**

PLEASE RATE ALL OF THE WORDS; DO NOT SKIP ANY

absorbed __	blissful __	building __	close __	ecstatic __
elated __	engulfing __	euphoric __	exciting __	exploding __
flooding __	flowing __	flushing __	fulfilling __	hot __
immersing __	loving __	passionate __	peaceful __	pleasurable __
pulsating __	quivering __	rapturous __	relaxing __	rising __
satisfying __	shooting __	shuddering __	soothing __	spreading __
spurting __	swelling __	tender __	throbbing __	trembling __
uncontrolled __	unifying __	unreal __	warm __	wild __

To obtain **total scores for each dimension**: sum the total scores for each component within that dimension to obtain a total score (e.g., for a total score for the Affective dimension, add up the total scores for the Emotional Intimacy and Ecstasy components).

DIMENSION	COMPONENT	ADD UP SCORES FOR…
Sensory:	Building Sensations:	building + swelling
	Flooding Sensations:	flowing + flooding
	Flushing Sensations:	flushing + spreading
	Spurting Sensations:	spurting + shooting
	Throbbing Sensations:	throbbing + pulsating
	General Spasms:	shuddering + trembling + quivering
Affective:	Emotional Intimacy:	close + loving + passionate + tender + unifying
	Ecstasy	ecstatic + elated + euphoric + rapturous
Evaluative:	Pleasurable Satisfaction:	pleasurable + satisfying + fulfilling
	Relaxation:	relaxing + peaceful + soothing

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