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What Are the Biopsychological Mechanisms of Human Sexuality?

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ABSTRACT

In this paper I explored the biological basis of human sexuality including sex drive and sexual orientation in order to assist people with learning about their own sexuality, and how sexual identity and preference is linked to biological mechanisms. Studies have found that hormone levels, such as testosterone, influence our sexuality, that physical sexual arousal can affect our subjective sexuality and cause us to make sexual behavioural choices we wouldn't make when unaroused, and that there are physical differences in the brain's amygdala between homosexual and heterosexual brains. In my first (correlational) study, I tested the strength of these relationships by examining naturalistic daily changes in their variables longitudinally over a two-week period. I measured the level of testosterone using a period tracking app, physical arousal using a set scale, amygdala activity through the heartbeat, and the amount of sexual activity with journal entries. Data in this correlational study showed significant correlations of sexual activity with testosterone level, physical arousal, and amygdala activity. Based on the strength of correlation found between physical arousal and sexual activity, I then conducted a second (experimental) study to test for specifically a causal relationship between these two variables. Over a two-week period, on alternating days the participant was assigned to either a high physical arousal day (watching pornographic videos) condition or a low physical arousal (no pornographic videos) condition and the effect this had upon sexual activity that day was measured. The results from the experimental study failed to find a causal role of physical arousal on sexual activity. A possible practical application of the current findings are the ability to know best when to engage in sexual activity to get pregnant, though the true cause of human sexuality still remains to be discovered.

1. Introduction

1.1 Research Problem

Human sexuality has become a central topic in the last decade, yet we still have an insignificant amount of information about it. We need to learn where our sexuality comes from and what influences it, whether genetics or otherwise. Our sex drive influences our everyday decisions and actions; we need to be aware of how our animalistic drive governs our lives. Sexual preference, and orientation, is progressing in today's society and it is finally giving us a chance to study why our sexual preferences are what they are. Sexuality is something an

abundant proportion of the world's population will struggle with at one point or another in their lives, and the more we know about sexuality the better we can assist the people in our society.

1.2 Literature Review

Hormones, testosterone and others, have been shown to affect our sexuality and how strong it is. Van Goozen, et al. (1997) studied how different hormones in the female menstrual cycle effect how strong you react to males and their sexuality. They followed a number of women across one of their menstrual cycles, testing their hormone levels regularly and keeping track of their sexual contact. Higher levels of both intercourse and masturbation were recorded across the ovulatory phase. The women were also shown to take charge in their sexual encounters more often in the ovulatory phase as well. The study concludes with data from the hormone tests, which shows higher hormone levels, testosterone, progesterone, cortisol and more, in the ovulatory phase especially in those who did not have any premenstrual complaints or issues. This study shows that women's hormones are responsible for their sexuality and sexual interest.

Sexuality has to start somewhere, and it could start in the prenatal environment. There could be many things that influence it, but a study done by Reinisch, et al. (2017) suggests that one of the many things that influences our sexuality is the prenatal environment. Children who had progesterone, a drug that has been regularly given to expectant mothers to prevent miscarriages (pp.1241), given to them in the prenatal phase were less likely to self identify as heterosexual and more likely to be involved in non-heterosexual behaviours (pp.1245). This study shows how important environmental influences are to the development of our sexualities even as early as the first trimester of our prenatal lives.

Our genetics also play a roll in our sexuality. Sanders et al. (2015) conducted a massive study looking for a genetic link to homosexuality in males. The study looked at DNA samples from 908 family members, 793 homosexual brothers, 33 heterosexual brothers, 49 mothers and 33 fathers (pp. 1381). The DNA results showed a strong linkage from male sexual orientation to chromosome 8 and a few other spots in our DNA (pp.1384). These results point significantly to a genetic connection to sexual orientation. We might not know yet what exactly contributes towards sexual orientation, but we are getting closer with every study of genetics.

Our physical sexual arousal can affect our subjective sexuality. A study done by Ariely & Loewenstein (2006) involving 35 male university students found that men reported things to be attractive while in a state of arousal that they would not have reported in a state of non-arousal (pp. 93). When aroused, the males in the study reported they were more likely to engage in date-rape behavior including encouraging a woman to drink more or even drugging her if it meant the outcome was sex (pp. 94). While this study had its limitations, it shows a clear biopsychological connection between our physical sexual arousal and our sexual behavioural choices.

Sexual preference can be seen in the brain. Savic & Lindström (2008) performed a study that looked at the brain's responses to sex pheromones in homosexual and heterosexual subjects. PET scans and MR images were used to compare the asymmetry in the participants' brains. Similarities in the amygdala, the part of our brain that deals with emotions, were found in homosexual men and heterosexual women as well as

heterosexual men and homosexual women. This study shows us that there is a link between the part of our brains that is genetically different due to our sexual characteristics and our sexual orientation. This study and its findings will hopefully encourage a closer look into the biopsychological mechanism of human sexuality.

1.3 Hypotheses

Based on the above literature review, we predicted the following hypotheses:

- Hypothesis #1: If testosterone levels increases then sexuality increases.
- Hypothesis #2: If physical sexual arousal increases then your subjective sexuality increases.
- Hypothesis #3: If brain activity increases in the amygdala then sexuality increases.

2. Methods

2.1 Participant

The author of this paper served as the participant in its studies. The participant is a 23 year old cis gendered female. The participant was an undergraduate student at Camosun College who completed the current studies as an assignment for Psyc 215 ("Biological Psychology").

2.2 Materials and Procedure

2.2.1 Correlational Study Methods

I first performed a correlational study to test concurrently all three of the hypotheses by examining naturalistic daily changes in their variables longitudinally. The participant kept a study journal with her at all times over this study's two-week period in order to record self-observations of the following three variables: (1) testosterone level, (2) physical arousal, (3) amygdala activity, and (4) sexual activity.

To measure the level of testosterone, the participant kept track of her menstrual cycle. The ovulatory phase, about the 14th day of the cycle, is where testosterone is the highest. The participant used a period tracking app, called Clue, on a cell phone which calculated approximate ovulatory phase after the input of 1 cycle (see Appendix A). The first day of the menstrual cycle was counted as testosterone level 1 and then count up to the ovulation day, testosterone level 14, and then counted back down to the last day of the menstrual cycle, testosterone level 1. Appropriate testosterone levels were recorded in a journal which were then used in the final data.

To measure physical arousal the participant documented it in a journal everyday on an arousal scale from 0-5, with 0 being not aroused at all during the day and 5 being aroused all day (see Appendix B). This arousal scale was based off someone who is awake for a period of 15 hours a day, the amount of physical arousal does not include hours during sexual activity. The journal documentations were done immediately before going to sleep at the same time every evening so that physical arousal could be used in the final data.

Amygdala activity was scored using a measurement of heart rate. Heart rate, measured in BPMs, was taken and recorded in a journal first thing in the morning upon waking up to provide a baseline. Every day a YouTube clip was found with a jump scare located in it. Heart rate, measured in BPMs, was taken again immediately after jump scare and recorded in the same journal to track amygdala activity. The two heart rate measurements were subtracted from each

other and the difference of the two was used in the final data.

Sexual activity was kept track of using a journal. The participant kept track of sexual contact including intercourse, oral stimulation, as well as masturbation. The person who initiated the sexual contact was noted as 'participant' or 'other'. Each contact initiated by the participant was counted as 2 (initiated and participated in sexual activity) and each contact not initiated by the participant as 1 (participated in sexual activity). If the participant attempted to initiate sexual activity and their partner refused, a mark of 1 was also added (attempted to initiate sexual contact). A total for the end of each day was noted and used in the final data.

To assess the strength and statistical significance of associations between variables predicted by our three hypotheses, I performed Pearson product moment correlations of their predictor variables (testosterone, physical arousal, and amygdala activity) with their outcome variable (sexual activity). For testing Hypothesis #1, I correlated testosterone level, using the menstrual cycle, during the day with the amount of sexual activity during the day. For testing Hypothesis #2, I correlated the participants physical arousal, using an arousal scale of 0-5, during the day with the amount of sexual activity during the day. For testing Hypothesis #3, I correlated the amygdala activity, using a difference of heart rate in BPM, for each day with the amount of sexual activity during the day. A correlation coefficient was considered statistically significant if the probability of its random occurrence (p) was < .05 (i.e., less than 5% of the time expected by chance alone).

2.2.2 Experimental Study Methods

Based on the strength of the correlation between physical arousal and sexual activity found in our correlational study, I then chose to conduct an experimental study to test for a causal relationship between these two variables from Hypothesis #2.

I manipulated the independent variable, physical arousal, over a two-week period by randomly assigning participant each day to either a high physical arousal day condition or a low physical arousal condition. This experiment was unable to use a double-blind procedure. Experimental days involved watching one pornographic video between 2-5 minutes long, in the morning to increase physical arousal over the whole day. On control days no pornographic video was viewed. Sexual activity was kept track as previously described in the correlational study. This behavioural measurement helped keep the study as objectives possible.

The experiment was done in an A/B scenario. 'A' was the experimental days and 'B' was the control days. The experimental and control days alternated every day.

To assess the statistical significance of differences seen in sexual activity on high physical arousal experimental days vs. low physical arousal control days, *t*-tests were performed. An average difference between conditions was considered statistically significant if, using a two-tailed distribution (i.e., allowing this difference to be positive or negative), the probability of its random occurrence (p) was < .05 (i.e., less than 5% of the time expected by chance alone).

3. Results

3.1 Correlational Study Results

Table 1 shows significant correlation between all 3 predictor variables, testosterone level, physical arousal and amygdala activity, with the outcome

variable, sexual activity. Testosterone level was significantly correlated with sexual activity ($r = 0.56$, $p = 0.034936$; see Figure 1). Physical arousal was significantly correlated with sexual activity ($r = 0.83$, $p = 8.39E-05$; see Figure 2). Amygdala activity was significantly correlated with sexual activity ($r = 0.56$, $p = 0.035518$; see Figure 3). The strongest correlation was found between physical arousal and sexual activity.

3.2 Experimental Study Results

No significant difference was found between the high physical arousal condition (pornographic video) and low physical arousal condition (no pornographic video) as shown in Table 2 ($p = 0.54$; see Figure 4).

4. Discussion

4.1 Summary of Results

For this project I hypothesised that sexual activity would be positively correlated with testosterone level (Hypothesis #1), physical arousal (Hypothesis #2) and amygdala activity (Hypothesis #3). The data from all three correlational studies, testosterone level, physical activity and amygdala activity (Hypothesis #1,#2, and #3) supported a significant positive correlation with sexual activity. Unfortunately, the results of the experimental study did not support a causal role of physical arousal and sexual activity.

4.2 Relation of Results to Past Research

The significant positive correlation between testosterone level and sexual activity was inline with research done previously. Van Goozen, et al. (1997) found that female sexuality is positively correlated with higher levels of testosterone during their menstrual cycle. Unfortunately, I was not able to use the same number of women in this research project or test as many hormones with blood draws as Van Goozen, et al. (1997). Despite this, the conclusions remain similar suggesting a strong relationship between testosterone levels and sexual activity.

Previous research aligned with my hypothesis of physical arousal positively correlates with sexual activity. Ariely & Loewenstein (2006) found that physical arousal was correlated with engagement in sexual activity among college men. Although the participant in this study was a woman a significant positive correlation was still found. This suggests a strong relationship between physical arousal and sexual activity. However, after preforming an experimental study I was unable to find a significant causal relationship between physical arousal and sexual activity. Limitations for this experimental study included not being able to perform a double-blind procedure, only having one participant, and being in school full time therefore not having the time or energy to engage in sexual activity even if there was a desire. The previous study done by Ariely & Loewenstein (2006) was an experimental study but focused only on men, therefore a similar study done on women could see drastically different results.

My correlational study again aligned with previous research suggesting a positive correlational relationship between amygdala activity and sexual activity. Savic & Lindström (2008) had much more advanced screening techniques for the brain and was able to assess brains of people with different sexualities. I was only able to assess my own brain, without the advanced technology that was available to Savic & Lindström (2008), but still managed to find a positive

correlation using the less advanced technique of a heartbeat. The fact that I was still able to collect data that ended in a positive correlation between amygdala activity and sexual activity suggests that there is a strong relationship between these two variables.

4.3 Implications of Results

Possible practical applications of the current findings are the ability to feel less ashamed about our sexuality because it is a natural process that is influenced by many different parts of our body. Odd's suggest that the time a female is the most sexually active is when her testosterone level is highest around the time of ovulation, which means if you are trying to get pregnant your body is trying to help you know when it is the best time to engage in sexual activity.

The original studies were conducted to learn as much as possible about the different influences of human sexuality. The findings, while not causal, still supported a correlational relationship between testosterone level, physical arousal and amygdala activity with sexual activity. The true cause of human sexuality still remains to be discovered.

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Table 1

Correlation coefficient (r) values, with number of daily trials (n) per correlation in brackets.

Variables correlated	*r*(n)
Testosterone level & Sexual activity	*0.56*(*14*)*
Physical Arousal & Sexual activity	*0.83*(*14*)*
Amygdala Activity & Sexual activity	*0.56*(*14*)*

* $p < .05$.

Table 2

Descriptive statistics on sexual activity for a high physical arousal condition and a low physical arousal condition.

Condition	Statistic	Sexual activity
High Physical Arousal	Mean	0.86
(Pornographic Video)	S.D.	0.90
	n	*7*
Low Physical Arousal	Mean	0.57
(No Pornographic Video)	S.D.	0.79
	n	*7*

Sexual Activity was measured on a 0-10 Scale, where 0=No Sexual Activity and 10=10 Sexual Activities

Figure 1

Scatterplot of testosterone level and sexual activity.

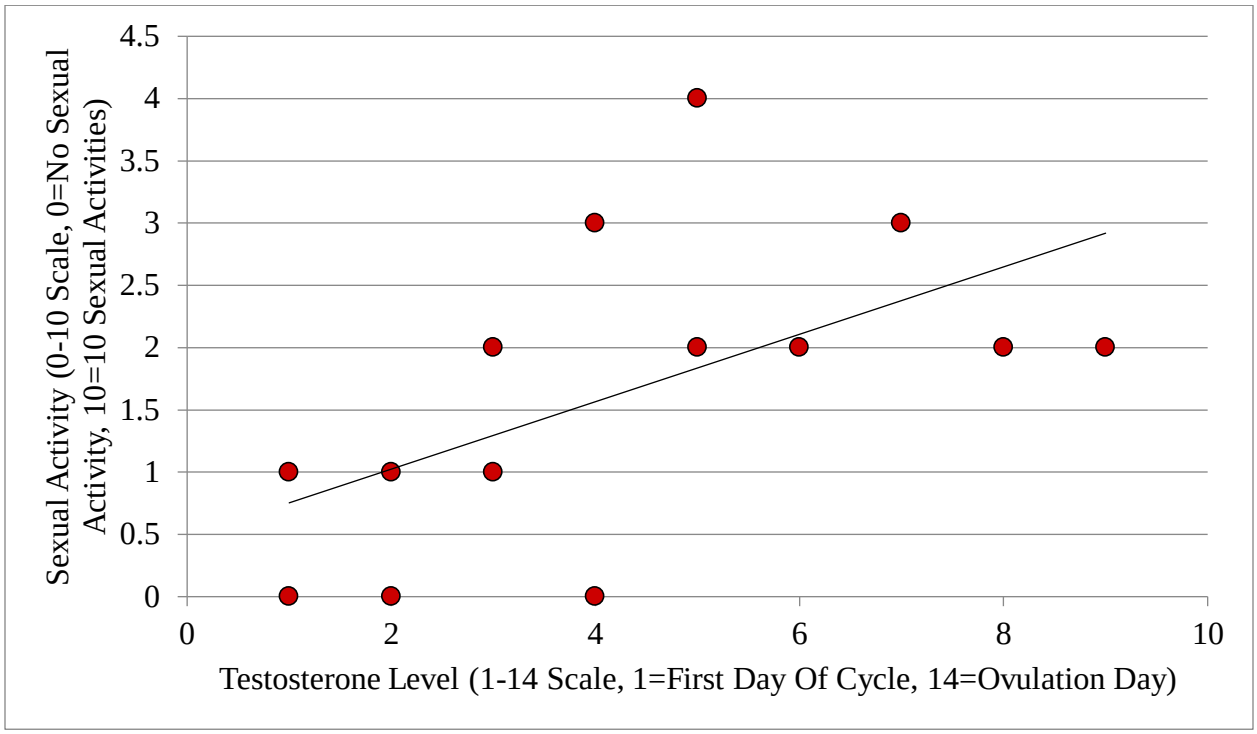


Figure 2

Scatterplot of physical arousal and sexual activity.

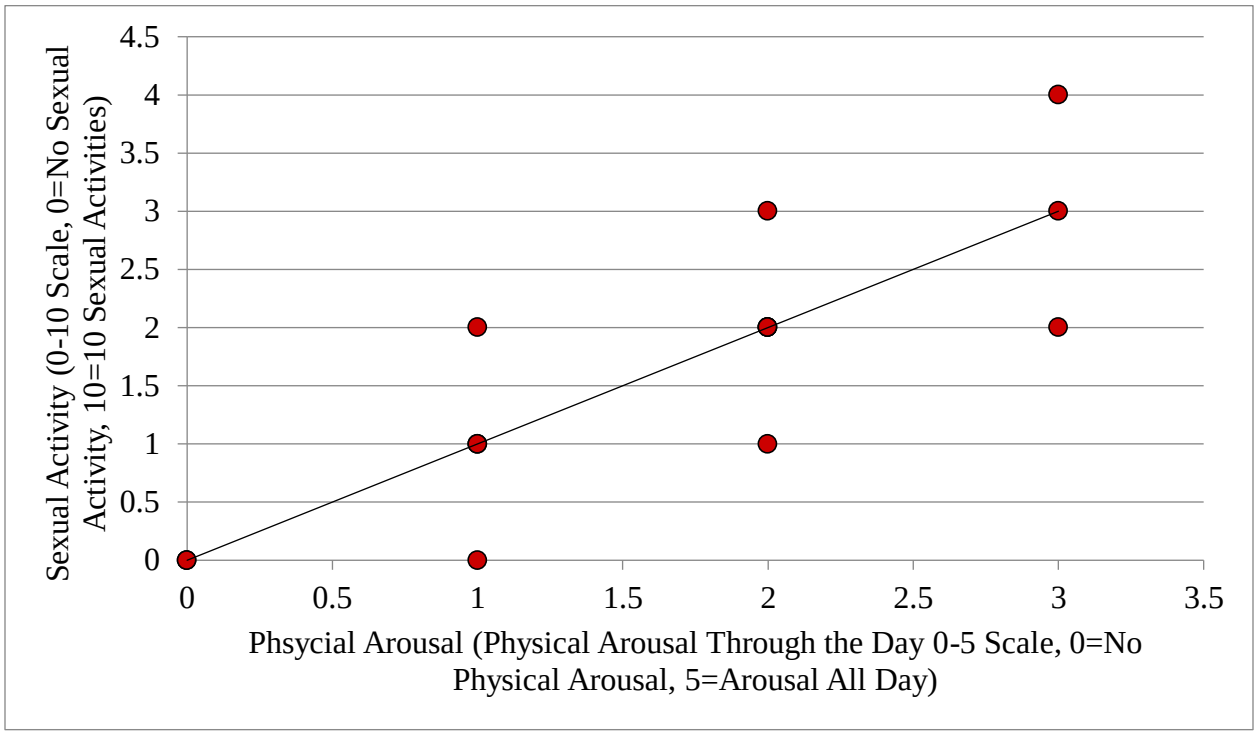


Figure 3

Scatterplot of amygdala activity and sexual activity.

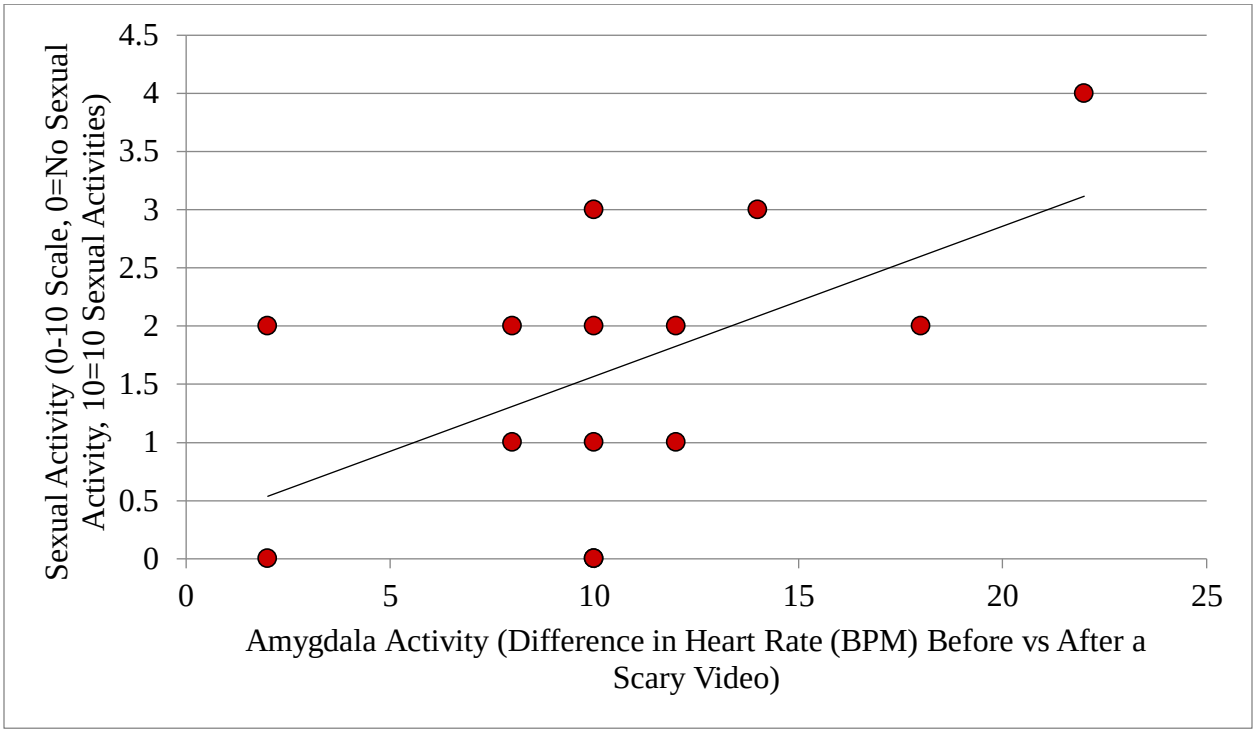
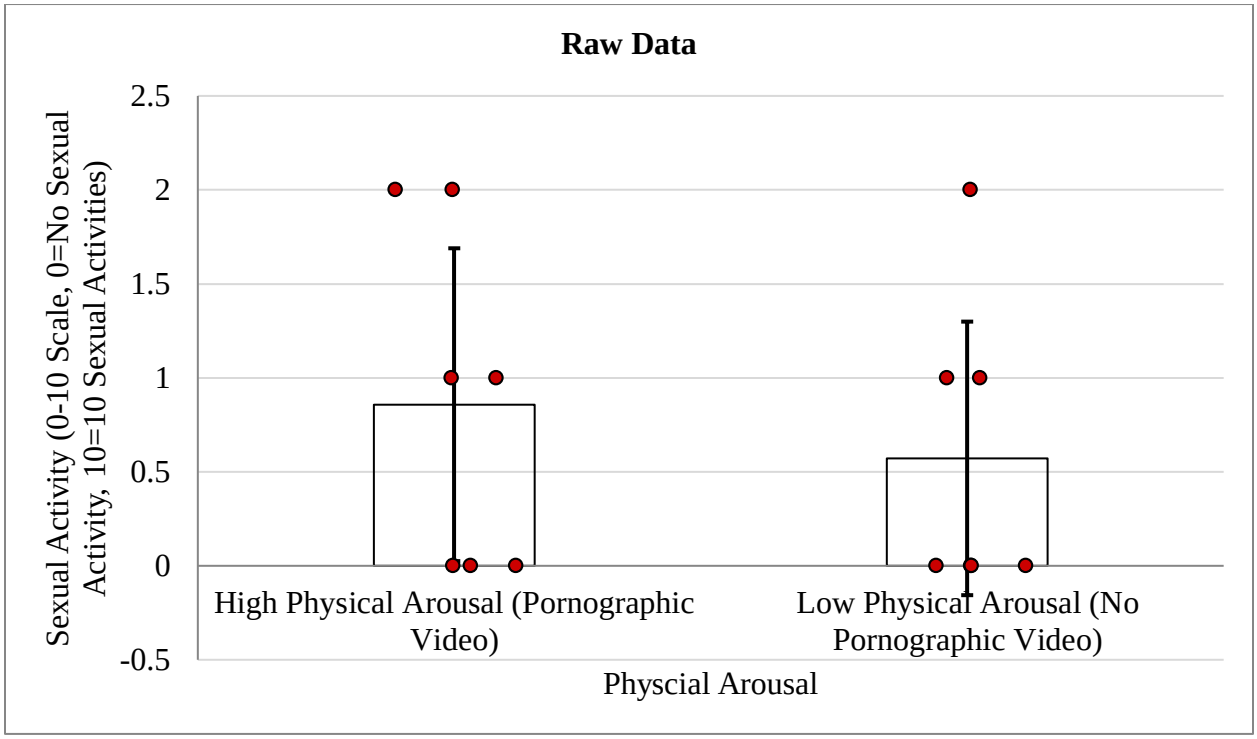


Figure 4

Bar graph of average sexual activity across high physical arousal condition and low physical arousal condition, with error bars showing ± 95% confidence levels.



Appendix A

Menstrual Calendar

October 2020						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Nov 20	Nov 21	Nov 22	Nov 23	Nov 24	Nov 25	Nov 26 Period Day 1 Testosterone 1
Nov 27 Testosterone 2	Nov 28 Testosterone 3	Nov 29 Testosterone 4	Nov 30 Testosterone 5	1 Testosterone 6	2 Testosterone 7	3 Testosterone 8
4 Testosterone 9	5 Testosterone 10	6 Testosterone 11	7 Testosterone 12	8 Testosterone 13	9 Approximate Ovulation Day Testosterone 14	10 Testosterone 13
11 Testosterone 12	12 Testosterone 11	13 Testosterone 10	14 Testosterone 9	15 Testosterone 8	16 Testosterone 7	17 Testosterone 6
18 Testosterone 5	19 Testosterone 4	20 Testosterone 3	21 Testosterone 2	22 Testosterone 1	23 Approximate Period Day 1	24 Testosterone 2

25 Testosterone 3	26 Testosterone 4	27 Testosterone 5	28 Testosterone 6	29 Testosterone 7	30 Testosterone 8	31 Testosterone 9

Based on "Clue" the period tracking app. Period days are filled with red. Fertile days are filled with pink. Ovulation day is filled with yellow. Approximate next period is filled with rose.

Appendix B

Arousal Scale

0 1 2 3 4 5

0: No arousal during the course of the day (0 hours a day)

1: Little arousal during the course of the day (1-3 hours a day)

2: Some arousal during the course of the day (4-6 hours a day)

3: Aroused quite a few times during the course of the day (7-9 hours a day)

4: Arousal a lot of the time during the course of the day (10-12 hours a day)

5: Aroused most of the course of the day (13-15 hours a day)