CORRESPONDENCE

Assessing physiologic changes during sexual activity using wearable devices: a pilot study

IJIR: Your Sexual Medicine Journal; https://doi.org/10.1038/s41443-023-00702-8

TO THE EDITOR:

Sexual activity is a fundamental aspect of human life that is still not well-understood from a physiologic standpoint. The classical physiological model of human sexual response, first proposed by Masters and Johnson in 1966, included four phases: excitement, plateau, orgasm, and resolution [1]. However, since then, there has been a paucity of literature that measures objective physiological changes with sexual activity, with most studies relying on subjective measures such as self-reported sexual arousal and satisfaction that are limited in their accuracy and reliability [2]. While some prior work has investigated the physiology of sexual activity, the existing literature is either limited in scope or focuses on specific aspects of sexual function such as genital response [3]. In our current study, we leverage wearable device technology to overcome these limitations. Wearable devices such as smartwatches have emerged as an ideal tool for monitoring physiological parameters, such as heart rate, blood pressure, and oxygen saturation levels [4]. Recent advancements in these devices have led to significant changes in their design, functionality, and availability, making it possible to measure physiological changes during various activities, including sexual activity. In addition, these devices are connected to the cloud and continuously monitor physical activity and vital signs, allowing for real-time remote data acquisition. Such quantitative measurements of physiological changes during sexual activity can contribute to a better understanding of human sexuality. Understanding these physiological changes is critical to improve overall knowledge on sexual health and, in turn, may assist in developing more effective treatments for sexual dysfunction. To the best of our knowledge, this is the first study to examine physiological parameters in heterosexual couples during sexual activity using smartwatches. By doing so, we hope to provide valuable insights into the mechanisms that underlie human sexuality.

After IRB approval at the University of Miami (Protocol #20220880), study volunteers without sexual dysfunction in a heterosexual, sexually active relationship were asked to wear the FitBit Versa 3 (Fitbit LLC, United States, San Francisco, CA; Fig. 1) for 6 weeks. Subjects had to be more than 18-years old. To maintain subject anonymity, encrypted, de-identified data from the Fitbit was sent via the Fitbit app on subjects' smartphones to a single member of the research team. Subjects were asked to complete weekly online surveys to log the number of sexual encounters during the preceding week, which day and time the encounters occurred, the type of sexual encounter (penetrative/oral/erogenous touching), whether orgasm was achieved, and whether the sexual encounter(s) was satisfying on a 1–5 Likert scale. The study design is outlined in Fig. 2A.

Data from five individuals (two heterosexual couples and one individual in a heterosexual relationship) demonstrated the feasibility of using wearable devices to assess heart rate variability during sexual activity. Over the course of the 6-week pilot study, we analyzed data from 32 unique sexual encounters. Study participants had between 0 and 4 sexual encounters per week, averaging 1.53 ± 0.74 encounters. Sexual activity included, but was not limited to, penetrative intercourse, oral stimulation, and erogenous touch. Multiple types of sexual activities occurred during each encounter, however, penetrative intercourse was the most abundant with 24 instances. There were 15 instances of oral stimulation, and 12 instances of erogenous touch (Table 1). Average reported satisfaction with sexual encounters was 4.45 ± 0.68 out 5.

Heart rate was recorded via Fitbit worn by participants during each encounter and normalized to the resting heart rate. Data recorded from Fitbits indicated that heart rate during sexual activity in both males and females closely mimics the classical four-phase model of human sexual response [1], with an excitement phase (initial rise in heart rate), plateau phase, orgasm (peak heart rate), and resolution phase (decrease back to baseline heart rate) (Fig. 2B, C).

This preliminary data shows that wearable device technology is feasible for measuring physiological parameters during sexual activity, providing baseline data for future studies among individuals with sexual dysfunction. Our data highlights the potential of wearable technology to measure physiologic changes during sexual activity in a convenient and reliable fashion. Specifically, by using a smartwatch like the Fitbit Versa 3, we

Fig. 1 Fitbit Versa 3 device. Adapted from: Fitbit LLC; https://www.fitbit.com/global/se/products/smartwatches/versa3.

Received: 21 March 2023 Revised: 14 April 2023 Accepted: 18 April 2023

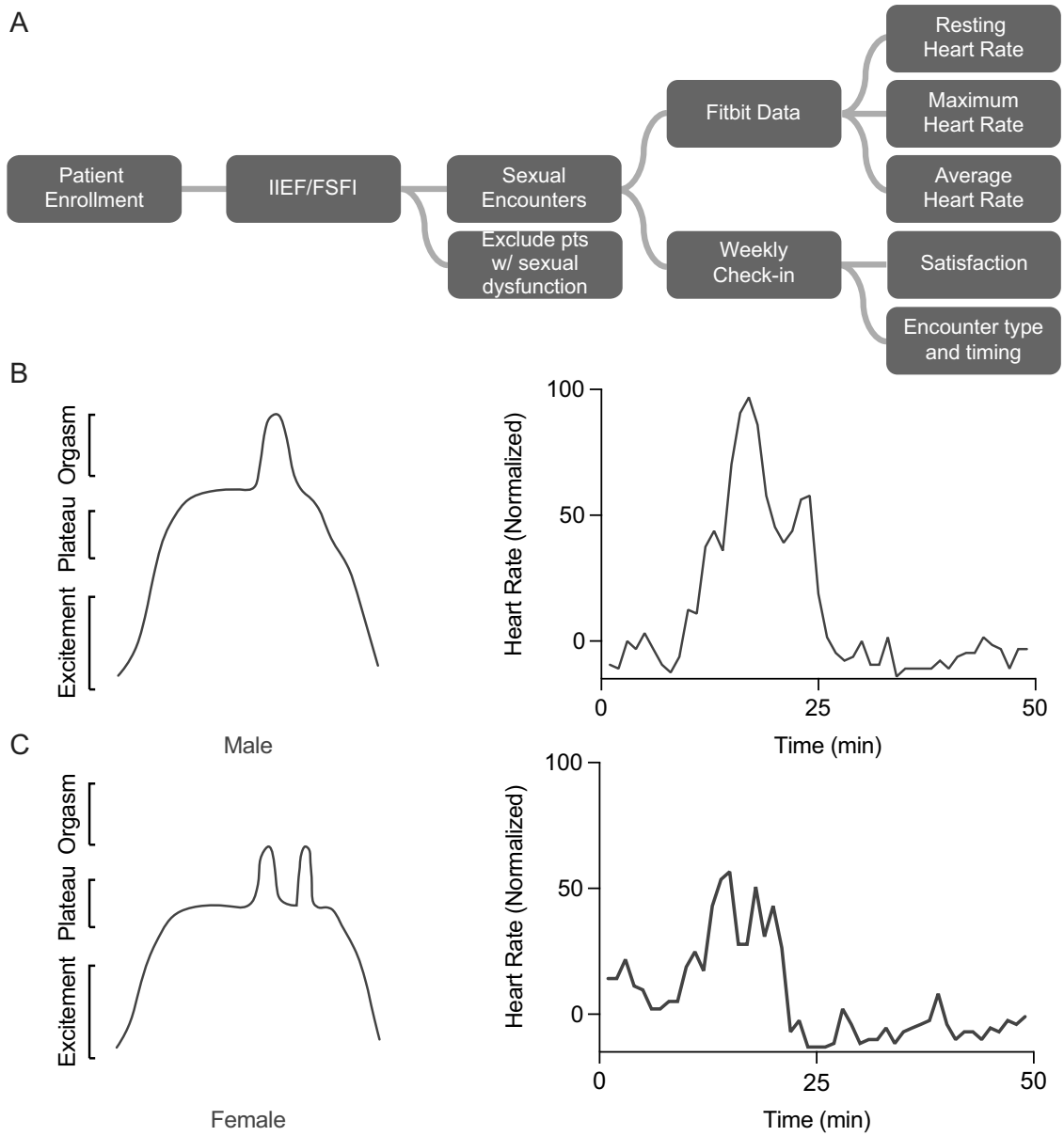

Fig. 2 Study procedure and primary outcome measures. A Study procedure. Individual participants in a stable, sexually active relationship for at least 3 months were enrolled. In this feasibility study, only patients with no baseline sexual dysfunction as measured by International Index of Erectile Function (IIEF) or Female Sexual Function Index (FSFI) were enrolled. Heart rate was continuously measured via Fitbit wearable device. Resting heart rate, as well as maximum and average heart rate during sexual encounters were measured. Patients were also asked to complete a weekly survey regarding the time, type, and satisfaction with sexual encounters over the preceding week. Four-stage sexual response cycle (excitement, plateau, orgasm, and resolution) in males (**B**) and females (**C**) adapted from: Masters, William H., Virginia E. Johnson, and Reproductive Biology Research Foundation (U.S.). 1966. Human sexual response. Right panel shows representative heart rate data from a single sexual encounter between one heterosexual couple. Heart rate is shown as percent difference from resting heart rate. Normalized resting heart rate is indicated at 0. Heart rate data in males (**B**) and females (**C**) mimics the sexual response cycle, with an increasing excitement phase, a plateau phase, peak during orgasm, and resolution with return to baseline heart rate.

were able to monitor heart rate variability during sexual encounters in both males and females. Because our heart rate data so closely recapitulates the original four-phase model of human sexual response, our data is also indicative of the accuracy of wearable devices in measuring the physiologic parameters of sexual activity. These findings contribute to the limited existing literature on objective physiologic measurements during sexual activity and emphasize the potential of wearable technology in monitoring physiological changes in sexual encounters.

The use of wearable technology in research and clinical settings has important implications for the field of sexual health. In research, wearable devices such as the Fitbit may provide a convenient and non-invasive method for studying sexual satisfaction and physiological changes during sexual activity. This could lead to a better understanding of human sexuality and provide valuable insight into the development of effective treatments for sexual dysfunction.

Based on the preliminary data collected in our study, wearable device technology shows great potential in measuring physiological parameters during sexual activity. Future studies can build on our findings by exploring the use of other types of wearables to measure additional physiological parameters such as skin conductance, respiration rate, and body temperature. Additionally, further research

Table 1. Type of sexual encounter and overall satisfaction.

Characterization of Sexual Encounters		
	n	**%**
Type of Encounter		
Penetrative	24	75%
Oral Stimulation	15	47%
Erogenous Touch	12	38%
Satisfaction		
1	0	0%
2	0	0%
3	8	14%
4	18	31%
5	32	55%

could focus on using wearable technology to track sexual behavior and patterns over time, allowing for more comprehensive and longitudinal analysis of sexual health. Another important direction for future research is to investigate the use of wearable technology in clinical settings. Wearables may be utilized in the assessment and treatment of sexual dysfunction, providing clinicians with objective measures of sexual functioning and satisfaction. For instance, the measurement of physiologic parameters associated with sleep could provide clinicians further insight into the physiologic changes associated with testosterone deficiency [5], while heart rate monitoring could provide further insight into the physiology of premature ejaculation and erectile dysfunction of non-organic origin [6, 7]. Wearables could also be used to monitor the effectiveness of sexual health interventions and therapies, providing valuable insights into the development of more targeted and personalized treatments. In conclusion, the use of wearable technology in the field of sexual health has the potential to revolutionize the way we study and treat sexual dysfunction.

Farhan M. Qureshi[1,2], Farah Rahman[1], Russell Saltzman[1], Nicholas Deebel[3], Braian Ledesma[1], Lisa A. Paz[4], Joshua White[1], Akhil Muthigi[1] and Ranjith Ramasamy[1]✉

[1]*Desai Sethi Urology Institute, University of Miami Miller School of Medicine, Miami, FL, USA.* [2]*Medical Scientist Training Program, University of Miami Miller School of Medicine, Miami, FL, USA.* [3]*Department of Urology, Wake Forest Baptist Medical Center, Winston-Salem, NC, USA.* [4]*Lisa Paz Clinic, Miami, FL, USA.*
✉*email: ramasamy@miami.edu*

REFERENCES

1. Masters WH, Johnson VE. Reproductive Biology Research Foundation (U.S.). Human Sexual Response, 1st edn. (Little, Brown: Boston, 1966).
2. Rosen RC, Revicki DA, Sand M. Commentary on "Critical flaws in the FSFI and IIEF". J Sex Res. 2014;51:492–7.
3. Woodard TL, Diamond MP. Physiologic measures of sexual function in women: a review. Fertil Steril. 2009;92:19–34.
4. Fuller D, Colwell E, Low J, Orychock K, Tobin MA, Simango B, et al. Reliability and validity of commercially available wearable devices for measuring steps, energy expenditure, and heart rate: systematic review. JMIR Mhealth Uhealth. 2020;8:e18694.
5. Agarwal P, Singh SM, Able C, Kohn TP, Herati AS. Sleep Disorders are associated with testosterone deficiency and erectile dysfunction- a U.S. claims database analysis. Int J Impot Res 2022. https://doi.org/10.1038/s41443-022-00649-2 Online ahead of print.
6. Rowland DL. Genital and heart rate response to erotic stimulation in men with and without premature ejaculation. Int J Impot Res. 2010;22:318–24.
7. Harte CB. The relationship between resting heart rate variability and erectile tumescence among men with normal erectile function. J Sex Med. 2013;10:1961–8.

AUTHOR CONTRIBUTIONS

Conceptualization: FMQ, FR, RS, LAP, JW, AM, RR. Investigation: FMQ, FR, ND. Methodology: FMQ, FR, RS, ND, AM, RR. Writing: FMQ, FR, ND, BL, JW, AM. Editing: FMQ, FR, ND, BL, JW, AM, RR.

FUNDING

This work was supported by National Institutes of Health Grant R01 DK130991 and Clinician Scientist Development Grant from the American Cancer Society to Ranjith Ramasamy.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

Correspondence and requests for materials should be addressed to Ranjith Ramasamy.