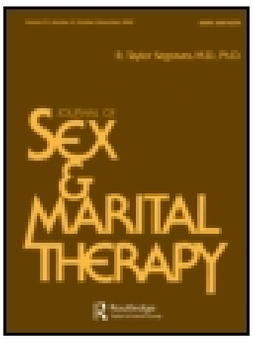

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Interoception and Awareness of Physiological Sexual Arousal in Women With Sexual Arousal Concerns

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ABSTRACT

Laboratory studies assessing physiological genital arousal have largely failed to find differences between women with and without female sexual arousal disorder (FSAD). Therefore, it is possible that women with FSAD may be unaware of their genital arousal response. The present study examined the extent to which women with FSAD can report their genital arousal response, as well as the role of interoception (body awareness) in this relationship. Additionally, this study examined the influence of interoception on the relationship between subjective and genital arousal. Twenty-six women who met criteria for FSAD (M age = 29.5, SD = 8.1 years) watched an erotic film and completed a series of questionnaires. Physiological (i.e., genital) and perceived genital arousal were measured continuously throughout the film. Results indicated women were able to perceive their level of physiological arousal. Greater levels of interoception were linked with stronger relationships between perceived and physiological arousal, but not between subjective and genital arousal. Methodological and clinical implications are discussed.

Introduction

The *International Statistical Classification of Diseases and Related Health Problems* (10th rev.; *ICD-10*; World Health Organization, 2004) and the former *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000) diagnosis of female sexual arousal disorder (FSAD) is characterized by the recurrent inability to attain or maintain sufficient genital arousal. However, findings from laboratory studies that compare genital responses between women with and without FSAD do not clearly support this diagnostic classification (e.g., Brotto, Basson, & Gorzalka, 2004; Brotto, Klein, & Gorzalka, 2009; Laan, van Driel, & van Lunsen, 2008; Meston, Rellini, & McCall, 2010). For example, Laan, van Driel, and van Lunsen (2008) found no differences in vaginal pulse amplitude (VPA) mean,[1] maximum,[2] or latency[3] (i.e., time to maximum) between women with or without FSAD on any of these measures. Others have identified potential differences when grouping women into theoretical subtypes of FSAD (i.e., genital, subjective, and combined genital and subjective arousal dysfunction; Basson et al., 2003), though have still failed to find differences between women with heterogeneous FSAD and controls (Brotto et al., 2004; Meston et al., 2010).

Several explanations have been offered for why laboratory studies fail to discriminate between women with and without sexual dysfunction on genital measures. These include the possibility that traditionally

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[1] A mean VPA score was obtained by subtracting each participant's mean baseline VPA from her mean VPA during the erotic film.

[2] A maximum VPA score was obtained by subtracting each participant's mean baseline from her highest 30-second epoch of VPA.

[3] Latency was calculated by identifying the length of time it took each participant to reach her maximum VPA score.

used analytic techniques may be insufficient for the analysis of genital arousal data as they may mask potential variations in response patterns (Rellini, McCall, Randall, & Meston, 2005), that FSAD may be more subjective than physiological in etiology (Laan et al., 2008), and that genital arousal may be minimally noticed in women (Basson, 2002). With regard to the latter speculation, the possible lack of awareness of one's genital arousal response has also been proposed as an explanation for the low, variable rates of sexual concordance (i.e., agreement between subjective and physiological arousal) that are typically found in women (see Chivers, Seto, Lalumièr, Laan, & Grimbos, 2010, for a review). It is thought that the inability to detect one's physiological state complicates the integration of genital cues into one's subjective arousal state, thus affecting concordance.

While many laboratory studies have examined the relationship between subjective and genital arousal in women, few studies have explored the relationship between women's awareness of their genital arousal and their physiological level of genital responding (e.g., genital blood flow). One early study found that nearly half of the women in the sample reported minimal or no change in their perceived arousal despite exhibiting an increase in physiological arousal in response to an erotic film (Heiman, 1977). In this study, perceived arousal was measured through a Likert-type questionnaire, and physiological arousal was measured as the change in average VPA from baseline to exposure to the erotic film. A drawback to this study is that perceived arousal was measured retrospectively after the presentation of the erotic film. Research has shown that retrospective responding can be influenced by one's current state (Salovey, Sieber, Jobe, & Willis, 1994), potentially resulting in biased or inaccurate responses. To our knowledge, the only study to utilize contemporaneous measurements of both physiological (i.e., VPA) and perceived arousal found a strong linear relationship between these measures in sexually functional women (Handy & Meston, 2016). This suggests that the use of continuous, as opposed to retrospective, measurement may play an important role in detecting this relationship. It was also found that women who were high in interoception (bodily awareness) were better able to detect and report their genital arousal. Interoception refers to the sensitivity to stimuli originating from within the body, such as the ability to detect one's heartbeat or respiration rate (Garfinkel & Critchley, 2013). Interoception was also found to facilitate concordance, or agreement, between women's subjective and physiological arousal. Unfortunately, the study focused only on sexually functional women; the extent to which women with sexual difficulties are aware of their genital arousal has yet to be examined. Thus, the present study attempts to build upon this initial work by examining genital awareness in women with arousal-specific concerns.

Whether women with arousal-specific concerns are aware of their genital response has important treatment implications. If women with sexual difficulties are unaware of their genital arousal, then treatments focused solely on increasing blood flow to the genitals may not be highly effective. Rather, it may be necessary to first teach women to detect, or to direct their attention to, bodily sensations associated with genital arousal. Thus, the current study had three objectives. The first was to examine whether women with sexual arousal difficulties are aware of their genital arousal response. In line with past speculations, we hypothesized that women would not exhibit a significant relationship between physiological (i.e., VPA) and perceived (i.e., self-reported) genital arousal. The second objective was to determine whether higher levels of interoception positively affect the relationship between women's physiological and perceived arousal. It was hypothesized that women who were better able to listen to their bodily sensations, thus having greater levels of interoception, would exhibit a greater ability to detect their genital arousal response. Third, we sought to examine whether interoception influences the relationship between subjective and physiological arousal. We expected that awareness of one's genital response would increase the relationship between physiological and subjective arousal.

Method

Participants

Twenty-six women were recruited through advertisements posted in the local community. Women were eligible to participate if they were at least 18 years of age, premenopausal, fluent in English, heterosexual or bisexual (lesbian women were excluded due to the content of the erotic stimulus), reported no history

Table 1. Participant characteristics ($N = 26$)

	Mean (*SD*)	Range	*n* (%)
Age	29.5 (8.1)	19–47	
Ethnicity			
African American/Black			9 (34.6)
Caucasian/White			11 (42.3)
Hispanic			4 (15.4)
Native American			1 (3.8)
Other			1 (3.8)
Education			
High school graduate or GED			4 (15.4)
Some college			12 (46.2)
Four-year college degree			6 (23.1)
Advanced degree			4 (15.4)
Relationship Status			
Single, dating			6 (23.1)
In a committed relationship			14 (53.8)
Married			6 (23.1)
Relationship length (months)	65.4 (47.1)	1–180	

of sexual abuse, had been sexually active within the past four weeks, and reported currently experiencing difficulties with genital sexual arousal. Participants' sexual functioning was assessed with the Female Sexual Function Index (Rosen et al., 2000) and a brief screening for FSAD based on *ICD-10* criteria. Women were considered to have acquired generalized FSAD if they (a) reported experiencing reduced or absent genital sensations for the past six months or longer; (b) reported that this was not situational in nature; (c) self-identified as having an arousal problem; (d) were distressed by this problem; and (e) scored below the clinical cutoff on the FSFI (see Wiegel, Meston, & Rosen, 2005). See Table 1 for participant characteristics.

Procedure

After participants provided informed consent, the experimenter provided a brief information session delineating the difference between subjective arousal (being "turned on" in one's mind) and physiological arousal (feeling physically aroused in one's genitals). This was done to ensure that participants understood this distinction and could therefore report solely on their perceived arousal during the assessment. Participants were instructed to attend to their genital arousal during the films and to move an arousometer (Rellini et al., 2005) throughout the films to indicate their level of perceived arousal. To assess baseline levels of subjective arousal, participants completed Heiman and Rowland's (1983) Film Scale. Participants inserted a vaginal photoplethysmograph before viewing an eight-minute film presentation composed of a neutral (two minutes) and an erotic (six minutes) film clip, during which their physiological and perceived arousal were measured. To assess the change in subjective arousal from before to after stimulus exposure, participants completed a second Film Scale when the film concluded. Participants then completed a questionnaire on genital attending (see Table 2) and the Multidimensional Assessment of Interoceptive Awareness questionnaire (Mehling et al., 2012). They were then instructed to remove the vaginal photoplethysmograph and to get dressed. They were compensated $25.00 for their time. This study was approved by the Institutional Review Board at the University of Texas at Austin.

Measures

Physiological arousal

A vaginal photoplethysmograph was used to assess women's physiological arousal to the film presentation. A data acquisition unit, Model MP150 (BIOPAC System, Inc.), and a software program, AcqKnowledge version 3.8.1 (BIOPAC Systems, Inc., Santa Barbara, CA), were used for the transformation of analog/digital data. The VPA signal was sampled 200 times per second and the amplitude of each pulse

Table 2. Descriptive statistics for the attention to genital cues questionnaire.

	n (%)
How often do you attend to your genital sensations during sexual arousal and/or sexual activity?	
Almost always	7 (33.3)
Most times	4 (19.0)
Sometimes	7 (33.3)
A few times	3 (14.3)
Almost never	0 (0.0)
How easy/difficult is it for you to attend to your genital sensations during sexual arousal and/or sexual activity?	
Not difficult	4 (19.0)
Slightly difficult	10 (47.6)
Difficult	5 (23.8)
Very difficult	2 (9.5)
Extremely difficult or impossible	0 (0.0)
How important is being aware of your genital sensations to your mental sexual arousal (how turned on you feel in your mind)?	
Very important	16 (76.2)
Moderately important	4 (19.0)
Equally important/unimportant	0 (0.0)
Moderately unimportant	1 (4.8)
Not at all important	0 (0.0)

Note: Five participants reported not attending to genital sensations during sexual activity; therefore, results presented in this table are based on the 21 women who reported that they do attend to genital sensations.

wave was recorded in millivolts. Research has found VPA to be a sensitive and reliable (Laan, Everaerd, & Evers, 1995) index of genital sexual arousal in women.

Perceived arousal

Perceptions of genital sexual arousal were measured continuously during the film presentation with an arousometer (Rellini et al., 2005). The arousometer is a computer mouse attached to a lever ranging from 0 to 7, which the participant moves throughout stimuli presentation to indicate their perceived level of physiological arousal. The device is positioned on a small table at the side of the participant's chair. The participant begins with the lever at 0 and is instructed to move the mouse to indicate changes in state. The arousometer has been validated for use in capturing changes in subjective arousal (Rellini et al., 2005), however in the present study it was used to measure perceptions of increasing or decreasing physiological arousal throughout exposure to the erotic stimulus.

Subjective arousal

Subjective arousal was measured with the subjective arousal subscale of the Heiman and Rowland's (1983) Film Scale. The subscale contains three items assessing subjective arousal, which includes an assessment of overall "sexual arousal," feelings of "mental sexual arousal," and one reverse-scored item reflecting feeling "sexually turned off." Items are rated on a 7-point Likert scale ranging from 1 (*not at all*) to 7 (*intensely*) and are summed into single subjective arousal scores for each of the two time points (i.e., before and after the film presentation).

Genital attending

Genital attending was measured with the Attention to Genital Cues questionnaire (author-constructed scale, unpublished). This scale consists of five questions that assess genital attending during situations of sexual activity. It includes one question on whether the respondent typically attends to her genital arousal, one question assessing frequency, one assessing difficulty, one assessing the importance of attending to genital sensations during sexual arousal, and one free-response item. Items are scored on a 5-point scale, and respondents are instructed to indicate what is generally true for them. See Table 2 for descriptive statistics in the current sample.

Table 3. Descriptive statistics for each of the MAIA subscales.

	Mean	*SD*	Range
Noticing	3.78	1.04	1.25–5.00
Not-Distracting	2.47	1.24	0.00–5.00
Not-Worrying	2.59	0.94	1.00–5.00
Attention Regulation	2.95	1.20	0.71–5.00
Emotional Awareness	4.14	0.83	2.00–5.00
Self-Regulation	3.22	1.12	1.00–5.00
Body Listening	3.31	1.24	1.00–5.00
Trusting	3.58	1.25	0.33–5.00

Note. MAIA = Multidimensional Assessment of Interoceptive Awareness (Mehling et al., 2012).

Interoception

Interoception was measured with the Multidimensional Assessment of Interoceptive Awareness questionnaire (MAIA), a 32-item self-report questionnaire that measures interoceptive bodily awareness (Mehling et al., 2012). Questions are answered on a 6-point Likert scale ranging from 0 (*never*) to 5 (*always*). The MAIA has eight dimensions: noticing (e.g., "I notice where in my body I am comfortable"), not-distracting (e.g., "when I feel pain or discomfort, I try to power through it"), not-worrying (e.g., "I can notice an unpleasant body sensation without worrying about it"), attention regulation (e.g., "I can return awareness to my body if I am distracted"), emotional awareness (e.g., "I notice how my body changes when I am angry"), self-regulation (e.g., "I can use my breath to reduce tension"), body listening (e.g., "I listen for information from my body about my emotional state"), and trusting (e.g., "I trust my body sensations"). No total score is calculated for the MAIA. The MAIA has been shown to have good reliability, established by Cronbach's alpha, ranging from $\alpha = 0.66$ to $\alpha = 0.87$ across the eight dimensions. Past research has linked higher scores on the body listening subscale with greater awareness of genital arousal, and higher scores on the noticing subscale with greater levels of concordance in women (Handy & Meston, 2016), therefore these two subscales were used in this study. See Table 3 for descriptive statistics in the current sample.

Sexual function

To assess participants' level of sexual function, they completed the Female Sexual Function Index (FSFI; Rosen et al., 2000), a 19-item self-report questionnaire assessing desire, arousal, lubrication, pain, orgasm, satisfaction, and overall sexual functioning. Total scores range from 2 to 36, where poorer sexual function is represented by lower scores. According to previous research, the FSFI has been found to have good internal reliability ($r = 0.89$–0.97), test-retest reliabilities ($\alpha = 0.79$–0.88), and has confirmed discriminant validity in discriminating between women with and without sexual complaints (Meston, 2003; Rosen et al., 2000; Wiegel et al., 2005). See Table 4 for descriptive statistics in the current sample. Participants were also screened for FSAD by assessing their current experience of genital sexual arousal by referencing specific genital responses thought to be typically experienced during sexual activity (e.g., tingling, throbbing, warmth).

Table 4. Descriptive statistics for each of the FSFI subscales.

	Mean	*SD*	Range
Desire	2.88	0.95	1.20–4.80
Arousal	2.79	0.77	1.20–4.50
Lubrication	3.17	1.18	1.20–6.00
Orgasm	2.24	0.95	1.20–4.00
Satisfaction	3.00	1.07	1.20–4.80
Pain	4.95	1.25	2.00–6.00
Total	19.05	4.12	11.50–26.20

Note. FSFI = Female Sexual Function Index (Rosen et al., 2000).

Data reduction

Physiological data was assessed for movement artifacts upon data collection. Artifact smoothing was performed by hand following visual inspection of the data by one of the study investigators who was blinded to any additional participant data. Data were then binned into five-second epochs representing mean peak-to-peak VPA response, yielding a total of 96 data points per participant. Perceived arousal was also binned into five-second epochs to align with the reduced physiological data.

Data analysis

Primary analyses were conducted in R 3.2.3 (R Core Team, 2015) using the nlme package (Pinheiro, Bates, DebRoy, Sarkar, & R Core Team, 2017) for linear and nonlinear mixed effects. Growth curve modeling (GCM) was implemented to examine the extent to which participants' perceived level of genital arousal could predict their VPA. GCM is a modeling technique that conducts within-subject analyses of the relationships between predictor and outcome variables, and uses the products (i.e., coefficients) as outcome variables for use in between-subject analyses. That is, GCM analyzes data with regard to *individual growth*. This is particularly useful when examining VPA as baseline VPA varies from person to person, and GCM allows for each participant to serve as her own control. In this study, all equations were modeled with repeated measures. The slopes and intercepts were entered as random, thus allowing them to vary across participants (Baayen, Davidson, & Bates, 2008). A model used to test the relationship between VPA and perceived genital arousal used the following formula:

$$\mathrm{Y(VPA)_{ij}} = \beta_{00} + \beta_{10}(\mathrm{time})_{ij} + \beta_{20}\left(\mathrm{perceived}\right)_{ij} + \mathrm{r_{ij}}$$

where $\mathrm{Y(VPA)_{ij}}$ is the $_{i}$th participant's VPA at the $_{j}$th time point, allowing for the assessment of VPA across participants and time. In this example, $(\mathrm{perceived})_{ij}$ is a continuous representation of perceived arousal for the $_{i}$th participant at the $_{j}$th time point. Additionally, β_{00} is the participant-specific intercept, β_{10} is the participant-specific slope, and $\mathrm{r_{ij}}$ are the residuals. The reverse equation was also assessed (i.e., perceived arousal predicted by VPA). If a significant relationship were to emerge, an additional analysis was planned to determine if the body listening subscale of the MAIA moderates this relationship, as this subscale has been implicated in prior research on sexually functional women (Handy & Meston, 2016). The mixed model containing the body listening subscale as a moderator was as follows:

$$\mathrm{Y(VPA)_{ij}} = \gamma_{00} + \gamma_{10}(\mathrm{time})_{ij} + \gamma_{20}\left(\mathrm{perceived}\right)_{ij} + \gamma_{02}\left(\mathrm{perceived}\right)_{ij}{}^{*}\left(\mathrm{bodylistening}\right)_{i} + \mathrm{u_{0j}} + \mathrm{r_{ij}}$$

Concordance analyses were conducted in SPSS version 23 using Pearson's *r* parametric correlations. Change in genital arousal was calculated by subtracting each individual's mean genital arousal during the neutral film from her mean genital arousal during the erotic film, dividing this score by her mean genital arousal during the neutral film and multiplying by 100 to yield a percent change. Change in subjective arousal was calculated as a percent change using pre-film and post-film means. Percent changes were then standardized within participants. As in Handy and Meston (2016), the noticing subscale of the MAIA was added to the equation to determine whether interoception could explain any additional variance in concordance.

Results

Effect of the erotic stimulus on sexual arousal

To ensure the erotic film produced a sexual response among participants, analyses of vaginal (VPA) and subjective responses were conducted. A GCM with time as the sole predictor of VPA indicated that the erotic film significantly increased VPA among women, $\beta = 0.01$, $t2{,}521 = 17.47$, $p < .001$. Additionally, paired-samples *t* tests indicated that the erotic film was also effective at increasing subjective arousal, $t(25) = -5.52$, $p < .001$. This finding indicates that the erotic film was effective in increasing sexual arousal in this sample.

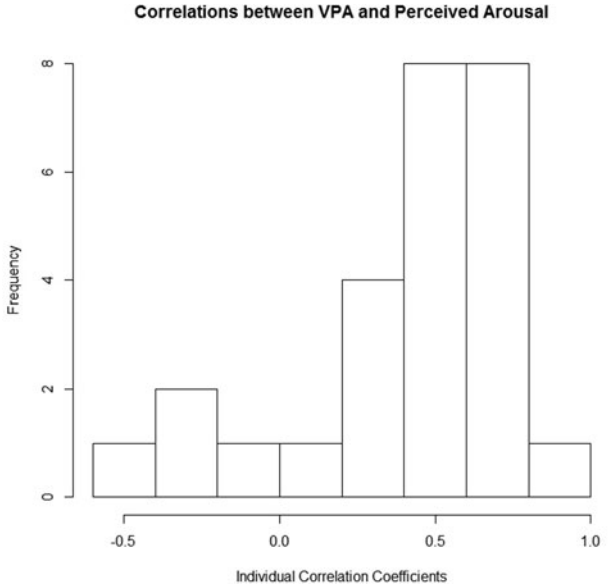

Figure 1. Frequencies of the individual difference correlation coefficients reflecting the strength of the relationship between each participant's vaginal pulse amplitude (VPA) and perceived arousal.

Relationship between VPA and perceived arousal

Women's VPA and perceived arousal were correlated with a large effect (median $r = 0.53$). Please refer to Figure 1 for a graphic representation of individual correlation coefficients. To examine the degree to which women's continuous perceptions of their genital arousal (using the arousometer; Rellini et al., 2005) covaried with their physiological arousal, we conducted two, two-level growth curve models. The null models (i.e., models with no predictors) were significant (both ps $< .001$), suggesting that multilevel modeling was appropriate. Within the multilevel model, VPA and perceived arousal significantly covaried with VPA as the outcome, $\beta = 0.22$, $t2{,}521 = 16.55$, $p < .001$. This coefficient indicates that for every one standardized unit of VPA, women showed an average corresponding increase of 0.22 units of perceived arousal (Table 5).

VPA and perceived arousal also significantly covaried within the multilevel model with perceived arousal as the outcome, $\beta = 0.44$, $t2{,}521 = 16.30$, $p < .001$. This coefficient indicates that for every one

Table 5. Growth curve modeling results indicating significant relationships between VPA, perceived arousal, and body listening over time.

Results for the model with VPA as the outcome variable					
Predictor	β	*SE*	*df*	*t* ratio	*p* value
Time	0.001	0.001	2521	17.478	0.001
Perceived arousal	0.215	0.013	2521	16.554	0.001
Body listening	–0.017	0.134	24	–0.127	0.900
Perceived arousal* Body listening	0.140	0.010	2520	14.360	0.001
Results for the model with perceived arousal as the outcome variable					
Predictor	β	*SE*	*df*	*t* ratio	*p* value
Time	0.005	0.001	2521	66.647	0.001
VPA	0.441	0.027	2521	16.302	0.001
Body listening	–0.100	0.078	24	–1.278	0.213
VPA Body listening	0.002	0.003	2520	0.727	0.467

Note. *SE* = standard error; *df* = degrees of freedom.

standardized unit of perceived arousal, women showed an average corresponding increase of 0.44 units of VPA. These findings suggest that there is a positive relationship between women's physiological and perceived arousal (Table 5).

To better understand genital attending in naturalistic situations, women completed the Attention to Genital Cues questionnaire. The majority of women (21 out of 26) indicated that they typically attend to genital sensations during sexual arousal and/or activity. More than 70% (15 out of 21) of this subgroup said that attending to their genital sensations was either "slightly difficult" or "difficult." Despite this, the majority of this subgroup (17 out of 21) reported that attending to their genital sensations was "very important" to their subjective arousal. This suggests that the relationship between VPA and perceived arousal may contribute to subjective arousal in women. See Table 2 for complete results of the Attention to Genital Cues questionnaire.

Relationship between interoception, VPA, and perceived arousal

To determine whether interoception influenced the relationship between physiological (i.e., VPA) and perceived arousal, the body listening subscale of the MAIA was entered into the GCM equation as a moderator. The body listening subscale was selected as it has been implicated in past research assessing the relationship between VPA and perceived arousal in sexually functional women (Handy & Meston, 2016). Body listening was found to significantly moderate this relationship, such that greater scores on the body listening scale led to a greater association between VPA and perceived arousal. This model was only significant when VPA was the outcome, $\beta = 0.14$, $t2{,}520 = 14.36$, $p < .001$ (Table 5). Post hoc simple slopes analyses indicated that significant gains in agreement between VPA and perceived arousal were made for women with high (+1 *SD*), average, and low (–1 *SD*) levels of body listening (see Figure 2). This suggests that women with greater body listening are better able to detect and report changes in their genital sexual arousal.

Relationship between interoception, VPA, and subjective arousal

A parametric correlation (Pearson's *r*) analysis was conducted to examine the relationship between VPA and subjective arousal (represented as percent change scores). These variables were not significantly

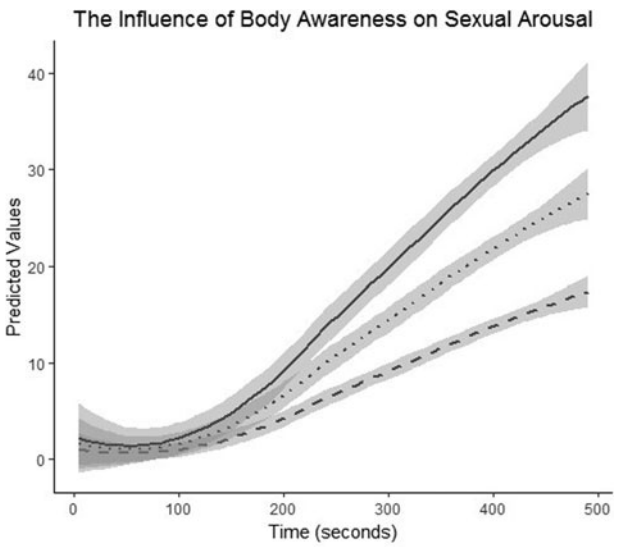

Figure 2. The plotted GCM indicating differences in the predicted values (i.e., the interaction between VPA and perceived arousal) over time at low (–1 *SD*), average, and high (+1 *SD*) levels of body listening. Here, the dashed, dotted, and solid lines reflect values at low, average, and high levels of body listening, respectively. GCM = growth curve modeling; VPA = vaginal pulse amplitude.

related, $r = -0.02$, $p = .943$. A multiple regression was then used to examine the extent to which the noticing subscale influences the relationship between VPA (entered as the predictor variable) and subjective arousal (entered as the outcome variable). Counter to our hypothesis, the noticing subscale (as conducted in Handy & Meston, 2016) did not significantly add to this relationship, $\beta = -29.68$, $t(25) = 1.24$, $p = .229$. In other words, the ability to notice bodily changes did not influence the relationship between subjective and physiological sexual arousal in this sample of women with FSAD.

Discussion

This study used continuous measures of both perceived and physiological (i.e., VPA) arousal to examine whether women with FSAD are able to detect their genital responses. In contrast to earlier findings (e.g., Laan et al., 2008), women in this study were able to perceive and report their genital arousal. We attribute this finding to the continuous and contemporaneous assessment of these constructs. Perceived arousal is commonly assessed retrospectively after the presentation of the erotic stimulus using a self-report questionnaire. In the present study, we assessed perceived arousal in real time, during the presentation of the erotic stimulus. There are two advantages to this methodology. First, women vary in what they find sexually arousing, therefore, their VPA may also change throughout the presentation of different sexual scenes (i.e., foreplay, oral sex, and vaginal penetration). Continuous measures capture these potential changes in arousal, thus providing a more accurate reflection of what each woman experiences. Second, it is unclear which aspects of the film women are referencing when using retrospective, discrete questionnaires. If a woman's arousal is inconsistent (e.g., if she finds foreplay more arousing than oral sex), it is unclear which aspect of the film she would refer to when reporting her level of perceived arousal, or if she would somehow calculate an average of her arousal throughout the film.

The finding that women were able to perceive their genital arousal replicates previous research conducted in sexually functional women (Handy & Meston, 2016), and extends the findings to women with sexual arousal concerns. This is important, as it suggests that women both with and without arousal concerns are aware of changes in their genitals. As such, the inability to recognize when one is aroused may not explain sexual arousal-specific concerns in their entirety. Rather, there may be other factors contributing to these difficulties. For example, physiological factors such as diminished genital sensations, which has been linked to weak pelvic floor muscles (Chambless, Caputo, Bright, & Gallagher, 1984; Shafik, 2000), may be at play. If a woman is aware of her genital arousal but the sensations she detects are weak, then enhancing her genital sensations may help to alleviate her sexual arousal-specific concerns. For some women, there may also be psychological components contributing to these concerns. It is possible that women with sexual arousal-specific concerns may misinterpret genital cues associated with sexual arousal. If a woman is aware of her physiological arousal, as data from the present study suggest, but does not interpret such feelings as sexual in nature, she may not recognize that her body has become aroused. This could, in turn, negatively impact her sexual experience.

In this study, women with higher scores on the body listening subscale of the MAIA were better at detecting their genital arousal. That is, women who were more aware of general bodily sensations were more aware of changes in their genitals during periods of sexual arousal. Research in other domains has also noted that interoception plays a role in detecting one's emotional state (Wiens, Mezzacappa, & Katkin, 2000), heartbeat (Whitehead, Drescher, Heiman, & Blackwell, 1977), and respiratory rate (Daubenmier, Sze, Kerr, Kemeny, & Mehling, 2013). Thus, if a woman reports being unable to detect changes in her genitals during states of sexual arousal, techniques focused on increasing interoception could improve awareness of her genital arousal.

Interoception is a central component of mindfulness, which refers to a nonjudgmental awareness of the current moment (Bishop et al., 2004). Research surrounding mindfulness has increased nearly tenfold over the past decade (American Mindfulness Research Association, 2016). Engagement in mindfulness practice has been associated with a variety of positive health outcomes, such as decreases in depressive symptoms (see Piet & Hougaard, 2011, for a review), decreases in anxiety (see Hofmann, Sawyer, Witt, & Oh, 2010, for a review), and improvements in sexual function (e.g., Paterson, Handy, & Brotto, 2016). Mindfulness has also been associated with an increased recognition of physiological arousal in response

to sexual stimuli (Silverstein, Brown, Roth, & Britton, 2011). For example, Silverstein and colleagues (2011) compared women's reaction time to sexual stimuli before and after engaging in mindfulness training. They found that, after meditation training, women were significantly faster at reporting states of bodily arousal following exposure to the sexual images than women who did not receive this training. The authors attributed women's heightened ability to register changes in their bodies to increases in interoception. The present study demonstrated that women with higher levels of interoception were better able to recognize genital changes following exposure to sexual stimuli. This suggests that individual differences in interoception may play a role in the ability to detect bodily changes.

One recent study linked higher scores on the noticing subscale of the MAIA with greater concordance, or agreement between subjective and physiological sexual arousal, in sexually functional women (Handy & Meston, 2016). Although women in the present study appeared to be aware of their genital changes, interoception did not influence concordance. In other words, women with greater scores on the noticing subscale showed no greater agreement between their subjective and physiological arousal than women with lower scores. The fact that the noticing subscale was unrelated to concordance in this sample suggests that, for women with FSAD, being aware of one's genital arousal may not be sufficient for increasing the agreement between their physiological and subjective arousal. It is possible that other factors, such as the appraisal of genital arousal sensations, may be more salient in women with FSAD, thus impacting sexual concordance. If a woman frequently experiences difficulties attaining or maintaining genital arousal, it is possible that she may begin to associate the experience of sexual arousal with frustration or anxiety. Attaching a negative emotional valance to one's sexual arousal could negatively affect sexual function, as has been seen in women with childhood sexual abuse histories (Pulverman & Meston, 2016), and potentially subjective arousal. Alternatively, it is feasible that the genital arousal response of women with FSAD may be less robust than that of sexually functional women, making it more difficult to detect bodily cues associated with sexual arousal. However, past research has not found large differences in genital responding between sexually functional women and women with FSAD (e.g., Laan et al., 2008). Similarly, significant increases in VPA to the erotic films were found in the present study, therefore it is unlikely that being aware of one's bodily sensations is only beneficial when the signal (i.e., genital arousal) is robust.

There are a few limitations to the present study that warrant mention. First, no healthy control group was included in this study. The lack of a healthy control group limits the interpretability of these results, as we cannot determine whether these results are unique to women with FSAD. Second, this study was conducted in a laboratory setting; therefore, the results presented in this article may not be generalizable to women's experiences in a natural setting. One study comparing laboratory and ambulatory (i.e., at home) assessment of sexual arousal found that sexually functional women exhibited significantly greater levels of VPA at home compared to in the laboratory. This was not found to be the case for women diagnosed with hypoactive sexual desire disorder (HSDD); women with HSDD exhibited similar VPA responses at home and in the laboratory (Bloemers et al., 2010). It is possible that women with other forms of sexual difficulties (such as sexual arousal-specific concerns) may exhibit similar response patterns.

It is also possible that, when in one's personal milieu, it is more difficult for women to perceive their genital arousal than when they are in a laboratory with minimal distractions. Results from the Attention to Genital Cues questionnaire support this theory; almost three quarters of the women who indicated that they attend to their genital arousal at home reported that it was at least "slightly difficult" to do so. Therefore, results presented in this article may be unique to a laboratory setting. Similarly, women in this study were specifically told to attend to their genital arousal throughout the assessment. This was done to capture women's ability to detect their genital arousal, however, it limits our understanding of how frequently women would normally pay attention to their genital sensations had they not been instructed to do so. This could also have inadvertently served as a form of treatment; if women in this study did not typically attend to their genital arousal, simply instructing them to notice their genital arousal could have improved their physiological or subjective arousal response during the session. Despite these limitations, similarities between this study and past research (Handy & Meston, 2016) strongly suggests that women, both with and without FSAD, are able to identify their genital arousal sensations. Future research should examine women's awareness of their genital arousal in a real-life sexual scenario to

better understand whether women are able to attend to their genital arousal at home in a typical sexual situation.

Though concordance has not been shown to be indicative of greater sexual function, it is often thought to be a marker of treatment-related improvements in sexual function among women with sexual arousal dysfunction (Brotto, Basson, Smith, Driscoll, & Sadownik, 2015). As such, results from the present study have implications for research and treatment development. Increasing women's bodily awareness, while important for increasing women's awareness of their genital sensations, may not be able to increase concordance rates in women with FSAD on its own. It is possible that the awareness of one's genital arousal did not influence concordance in this sample because of how they interpreted these bodily cues. If one doesn't interpret genital changes as sexual in nature, then it is reasonable to believe that being aware of these sensations would not influence other aspects of arousal, such as concordance. This could potentially explain why the present study did not replicate previous research indicating that being aware of one's bodily arousal influences sexual concordance in sexually functional women (Handy & Meston, 2016). Future research should examine the interpretation of sexual arousal in women with FSAD, as it is possible that sexually functional women and women with FSAD interpret the experience of sexual arousal differently. Altering one's interpretation of sexual arousal may be an important aspect of treating arousal-specific concerns.

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