

Physiological and Subjective Sexual Arousal in Self-Identified Asexual Women

Lori A. Brotto · Morag A. Yule

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Abstract Asexuality can be defined as a lifelong lack of sexual attraction. Empirical research on asexuality reveals significantly lower self-reported sexual desire and arousal and lower rates of sexual activity; however, the speculation that there may also be an impaired psychophysiological sexual arousal response has never been tested. The aim of this study was to compare genital (vaginal pulse amplitude; VPA) and subjective sexual arousal in asexual and non-asexual women. Thirty-eight women between the ages of 19 and 55 years (10 heterosexual, 10 bisexual, 11 homosexual, and 7 asexual) viewed neutral and erotic audiovisual stimuli while VPA and self-reported sexual arousal and affect were measured. There were no significant group differences in the increased VPA and self-reported sexual arousal response to the erotic film between the groups. Asexuals showed significantly less positive affect, sensuality-sexual attraction, and self-reported autonomic arousal to the erotic film compared to the other groups; however, there were no group differences in negative affect or anxiety. Genital-subjective sexual arousal concordance was significantly positive for the asexual women and non-significant for the other three groups, suggesting higher levels

of interoceptive awareness among asexuals. Taken together, the findings suggest normal subjective and physiological sexual arousal capacity in asexual women and challenge the view that asexuality should be characterized as a sexual dysfunction.

Keywords Asexuality · Genital arousal · Vaginal pulse amplitude · Hypoactive sexual desire disorder · Sexual attraction

Introduction

Human asexuality is, loosely defined, as the absence of sexual attraction. In the last several years, there have been a number of empirical examinations focused on the description of asexuality and the characterization of asexual individuals. The only existing study to explore the prevalence of asexuality found that approximately 1% of the population report a lack of sexual attraction (Bogaert, 2004) and therefore likely identify as “asexual.” Others who have studied asexuality have employed differing definitions, including: a lack of sexual behavior (Rothblum & Brehony, 1993), a lack of sexual orientation (Storms, 1980), and a lack of sexual desire or excitement (Prause & Graham, 2007). With the emergence of Google, this allowed individuals who previously had great difficulty finding and interacting with other asexuals online to easily locate one another and develop an online group where questions and answers could be posed, and experiences could be shared and explored. The largest online web-community of asexuals, known as the Asexuality Visibility and Education Network (AVEN), was founded in 2001 by Jay, and the group came to define themselves another way—focusing on the lack of sexual attraction but adding that “every asexual experiences sexual desire and arousal somewhat differently” (Jay, 2003).

L. A. Brotto
Department of Obstetrics and Gynaecology, University of British Columbia, Vancouver, BC, Canada

M. A. Yule
Department of Psychology, University of British Columbia, Vancouver, BC, Canada

L. A. Brotto (✉)
Division of Gynaecologic Oncology, University of British Columbia, 2775 Laurel St., 6th Floor, Vancouver, BC V5Z 1M9, Canada
e-mail: lori.brotto@vch.ca

The development of this “community,” led by AVEN’s founder, Jay, has facilitated the emergence of an online “asexual identity” (Scherrer, 2008), as the structure of AVEN’s pages were specifically designed around “the process of identity formation” (Jay, 2003, p. 6). As the curious but not-yet-self-identified asexual navigated from “static pages” providing basic information and a definition of asexuality to the interactive “web forum,” a collective identity of asexuality was thought to emerge (Jay, 2003; Scherrer, 2008). The labeling and identification of oneself as asexual is a major aim of AVEN and the asexuality movement, and likely represents something akin to the homosexuality identity movement of the 1950s and 1960s that was facilitated by the Mattachine society (Sears, 2006). More than a vehicle for facilitating identity formation, AVEN is also used to transform this collective identity into collective action, providing education to the greater public with the goal of lessening stigma associated with asexuality.

There has been a recent frenzy of media attention on asexuality (e.g., 20/20, 2006; CNN Showbiz Tonight, 2006; Fox News Dayside, 2006; Montel Williams Show, 2007; The View, 2006; Tucker Carlson, 2006), some of which has suggested that asexual individuals experience a type of sexual dysfunction known as Hypoactive Sexual Desire Disorder (HSDD), and that this group may represent the polar lower end of the desire continuum (Montel Williams Show, 2007). The implications, if this assumption is correct, are significant given the current climate of sexual pharmaceuticals and increasing concentration on diagnosing, treating, and curing low sexual desire (Tiefer, 2002, 2006). Upon the asexual’s presentation to the sex therapy clinic, perhaps at the insistence of a distressed and dissatisfied partner, there may be a premature temptation on the part of the clinician to seek pharmaceutical and/or hormonal treatments for the lifelong lack of sexual interest. However, the existing data suggest that asexuals do not experience distress nor want to be “fixed” (Brotto, Knudson, Inskip, Rhodes, & Erskine, 2010; Pagan Westfall, 2004), making asexuality fundamentally different from HSDD. And although a subgroup of women with HSDD similarly report being satisfied with the prospect of never having sex again, what seems to separate this group from asexuals is that the latter report *never* having experienced desire or sexual attraction whereas the former may have experienced desire at some point but then lost it. In reality, the precise delineation between lifelong HSDD and asexuality is unclear, and this “gray zone” requires further study.

In one qualitative study with four asexuals, Prause and Graham (2007) noted that sexual arousal, in addition to sexual desire, might also be impaired. One female participant expressed that a sexually explicit film would have no effect on her sexual arousal (though sexual arousal was not assessed in that study). In a follow-up quantitative phase, Prause and Graham therefore predicted that asexuals would report lower levels of sexual arousal compared to a group of non-asexuals

and that this might be due to a higher threshold for sexual arousal in the former. If this were true, it was hypothesized that the asexuals would show lower scores on a measure of sexual arousability. A low score on the Sexual Arousability Inventory (Hoon, Wincze, & Hoon, 1976) was the best predictor of membership in the asexual compared to the sexual group. Moreover, low scores on the dyadic sexual desire and the solitary sexual desire subscales of the Sexual Desire Inventory (Spector, Carey, & Steinberg, 1996) as well as the sexual excitation subscale of the Sexual Inhibition and Sexual Excitation Scales (Janssen, Vorst, Finn, & Bancroft, 2002) also significantly predicted asexuality group membership. Thus, in addition to Prause and Graham’s speculations about low desire best differentiating asexuals from sexuals, it was, in fact, measures of arousability that best distinguished the groups. Prause and Graham suggested that measuring sexual arousal with psychophysiological instruments might further elucidate if these observed group differences in arousal might also apply to asexuals’ sexual physiological responding.

In a more recent study designed to explore sexual response and distress in asexuals, 187 asexual men and women completed a web-based questionnaire followed by in-depth telephone interviews with a subset of 15 asexuals (Brotto et al., 2010). Among those asexuals who had been sexually active in the past 4 weeks, women showed low arousal scores on the Female Sexual Function Index (Rosen et al., 2000) comparable to a larger validation group of women with Female Sexual Arousal Disorder (FSAD; Wiegel, Meston, & Rosen, 2005). However, asexual men showed normal levels of erectile functioning (the analogue of arousal in men) on the International Index of Erectile Functioning (Rosen et al., 1997), suggesting that if arousal was impaired, it might be a feature only of female and not of male asexuality. In the qualitative phase of this study, several asexuals spoke about their genitals in somewhat technical, emotionally bare language and most believed that they lacked a sexual arousal response (Brotto et al., 2010).

Although this limited research proposes that genital sexual arousal in asexuals might be impaired (along with self-reported desire), to date, there have been no studies of asexuals’ psychophysiological sexual response to a competent sexual stimulus, and prior studies that have measured sexual arousal utilized a self-report questionnaire focused on retrospective recall over a fixed period of time. Thus, the extent to which asexuals’ self-reports of lack of sexual arousal reflect subjective only, physiological only, or both aspects of sexual responding is unknown.

Sexual psychophysiological techniques have been used in research throughout the twentieth century, and more recently have been used in studies of sexual orientation. The field gained widespread interest following the work of Masters and Johnson (1966) who studied the sexual arousal patterns of their patients using a variety of physiological measures. In women, vaginal

photoplethysmography is one of several psychophysiological techniques (Sintchak & Geer, 1975). It involves a tampon-shaped, usually acrylic, probe, which emits infrared light and provides an index of absorbed light corresponding to the degree of genital congestion. The study of vaginal photoplethysmography has led to some important advances in our understanding of women's sexual response. For example, whereas men show patterns of genital arousal that correspond to their stated sexual orientation (Rieger, Chivers, & Bailey, 2005), lesbian and heterosexual women showed the same degree of increase in vaginal pulse amplitude (VPA; the more sensitive and specific index in vaginal photoplethysmography), regardless of their stated sexual orientation and irrespective of the stimuli shown—whether heterosexual, homosexual, or non-human primate (Chivers, Rieger, Latty, & Bailey, 2004; Chivers, Seto, & Blanchard, 2007). If such “target non-specificity” was a feature of all women, including asexuals, then one might predict that asexual women would show a similar degree of genital response to stimuli compared to heterosexual and lesbian women despite their stated preference for no sexual partners.

Another reason why one might predict similar VPA responses in asexual women compared to other sexual orientation groups stems from the recent finding that the majority (77%) of asexual women had engaged in masturbation—the average frequency of which was once/month (Brotto et al., 2010), a result that replicates previous research indicating that asexuals did not differ significantly from non-asexuals in their desire to masturbate (Prause & Graham, 2007). Although this speculation is based on indirect reasoning, it is possible that because a high level of genital arousal is necessary for orgasm to occur (Basson et al., 2003; Masters & Johnson, 1966), and because orgasm is a positive reinforcer of masturbation (Herbenick et al., 2009), it may be that asexuals experience a normal level of genital arousal which, in part, provides incentive for their masturbatory activity.

If, on the other hand, asexuality was simply one manifestation of a lifelong sexual dysfunction, as has been suggested by some (see review of this topic on the online asexuality blog by Pretzelboy, 2009), then one might hypothesize lower levels of sexual arousal while being tested in a controlled laboratory environment with potent sexual stimuli. There is some limited evidence for this assertion: In some select subgroups of women, those with self-reported genital arousal impairments were found to have significantly lower VPA compared to a sexually healthy comparison group (Brotto, Basson, & Gorzalka, 2004; Pieterse et al., 2008; Wincze, Albert, & Bansal, 1993), and women with HSDD were found to have different patterns of activation on functional magnetic resonance imaging compared to women without HSDD (Arnou et al., 2009). Thus, if asexuality was characterized by atypical sexual response in the form of lack of sexual excitement, then one might predict significantly lower levels of physiological arousal in asexual women compared to women of other sexual orientation groups.

The concordance between subjective and psychophysiological sexual arousal has been a very important and interesting aspect of study in the vaginal photoplethysmography literature. This research has consistently shown a low correlation between self-reported sexual arousal and VPA across numerous studies (as summarized in the meta-analysis by Chivers, Seto, Lalumiere, Laan, & Grimbos, 2010), and concludes that women show significantly less genital-subjective concordance than men. In their review, Chivers et al. predicted that concordance would be low when actual genital responding was low. It follows, therefore, that if VPA was low in asexual women, genital-subjective concordance might also be low due to inability to detect changes in blood flow (Heiman, 1977).

The aim of the present study was to compare genital and subjective sexual arousal in a sample of asexual women with responses to women from other sexual orientation groups (heterosexual, homosexual, and bisexual women). We predicted lower levels of self-reported sexual arousal in the asexual women compared to the other groups. Regarding VPA, we predicted that if asexuality was characterized by atypical sexual responses, then we would find lower VPA in the asexuals compared to the other three groups, but we hypothesized no significant group differences in VPA if asexuality was not reflective of problematic sexual responding. We included a homosexual and bisexual sample of women based on the conclusions of Chivers et al. (2004, 2007) that women show a non-target specific pattern of genital responding. Thus, we expected that all groups of women would show the same pattern of VPA to the heterosexual stimuli. We also explored the degree of concordance between genital and subjective sexual arousal in each of these subgroups separately.

Method

Participants

A total of 38 women between the ages of 19 and 55 years participated in this study (10 heterosexual, 10 bisexual, 11 homosexual, and 7 asexual), and were assigned to sexual orientation group according to self-identification. Participants were recruited through several separate avenues, including postings on local websites (e.g., Craigslist), on the AVEN online web-community, through the university's human subject pool, and through advertisements in the community. The wording of advertisements differed depending on which sexual orientation group was being targeted. Two separate ads were used to target asexuals. Both ads read, “Do you experience a lack of sexual attraction towards others?” and “Do you find it hard to relate when people talk about sexual attraction?” The first ad also included the text “The Sexual Health Lab is looking for female participants who identify as asexual,

straight, lesbian or bisexual to take part in a study on sexual orientation.” The second ad deliberately did not contain any reference to self-identification as asexual. Both ads further read “If you can relate to the statements above, please contact us for more information about this study.” The majority of asexual women ($N = 6$) were recruited via the AVEN website and one asexual woman was recruited via the second ad. Self-identification as asexual was further verified in person according to the free-response item on the demographic questionnaire that asked women to write their sexual orientation status.

The average age of participants was 28.1 years for heterosexuals ($SD = 3.8$), 22.8 years for bisexuals ($SD = 4.4$), 36.3 years for homosexuals ($SD = 11.1$), and 33.6 for asexuals ($SD = 9.9$), and there was a significant group difference in age, $F(3, 34) = 5.76, p < .01$, with bisexual women being younger than the other groups. There were no significant group differences in highest level of education achieved, $\chi^2(3) = 5.58, p < .05$, with the majority of participants (100% of homosexual, 90% of bisexual, 91% of homosexual, and 86% of asexual) having at least some post-secondary university education.

Fifty percent of heterosexuals, 70% of bisexuals, 63% of homosexuals, and 28% of asexuals indicated that they were currently in a committed relationship, and these proportions differed significantly, $\chi^2(3) = 10.21, p < .05$, with asexuals being least likely to be in a relationship. The majority (70–90% across groups) identified themselves as European/Canadian.

Measures

Demographic Information

Participants were asked to complete demographic information on ethnicity, sex/gender, sexual orientation, occupation, annual income, education, presence of sexual concerns, relationship status, number of sexual and romantic partners, and masturbation frequency. All questions were in a free-response format given the finding that asexuals respond differently to forced choice versus free response formats in answering questions about gender and sexual orientation (Brotto et al., 2010; Prause & Graham, 2007), apart from questions pertaining to education, relationship status, and masturbation frequency, which had forced-choice response options.

Female Sexual Function Index (FSFI)

The FSFI (Rosen et al., 2000) is a 19-item scale assessing six domains of sexual function: desire, subjective arousal, lubrication, orgasm, satisfaction, and pain during sexual activity over the past month. Items were rated on a 6-point scale, with lower scores indicating lower levels of sexual functioning, and a zero score indicating no sexual activity in the past month. The

desire domain included items such as “Over the past 4 weeks, how often did you feel sexual desire or interest?” Examples of items from the arousal domain included: “Over the past 4 weeks, how often did you feel sexually aroused (“turned on”) during sexual activity or intercourse?” and “Over the past 4 weeks, how confident were you about becoming sexually aroused during sexual activity or intercourse?” The total FSFI score was obtained by summing the scores from the individual domains, with higher scores on this measure indicating better levels of sexual function. If one domain subtotal could not be calculated (due to missing items), then neither could the FSFI total score. The FSFI has been validated as an appropriate tool to differentiate between women with and without FSAD (Wiegel et al., 2005), has a high degree of internal consistency (Cronbach’s α of 0.82 and higher), and high test–retest reliability ($r = .79$ – $.86$). In light of some conceptual and statistical problems identified by Meyer-Bahlburg and Dolezal (2007), adjustments were made to the scoring of the FSFI in the current study in that any woman who had not engaged in sexual activity over the preceding month received “missing value codes” for items inquiring about sexual response during sexual activity (as opposed to receiving a zero score, which erroneously inflates scores denoting dysfunction (Brotto, 2009)). Missing coded items were then excluded from the calculation of the FSFI total score and were not included in the calculation of the mean for that subscale across all participants.

Detailed Assessment of Sexual Arousal (DASA)

The DASA is an unpublished questionnaire that has been found to significantly differentiate aspects of sexual arousal in women with arousal difficulties (Basson & Brotto, 2003). Subscales include: mental excitement, genital tingling/throbbing, genital wetness, and pleasant genital sensations, with each subscale assessing level of arousal in response to a variety of different forms of sexual stimulation (e.g., from verbal/written stimuli to breast stimulation to various forms of genital stimulation). Items were rated on a 1–7 Likert scale from (1) low to (7) intense.

Sexual Desire Inventory (SDI)

The SDI (Spector et al., 1996) is a 15-item self-administered questionnaire intended to be a specific measure of sexual desire. Unlike the FSFI subscale of desire, which focuses on frequency and intensity of feeling desire, the SDI attempts to capture a cognitive (rather than behavioral) aspect of sexual desire, and produces a total SDI score as well as dyadic and solitary desire subscale scores. Individuals not in a relationship are able to receive a score on the dyadic subscale, as the items focus on sexual thoughts and desires involving a partner, and not sexual behavior, as illustrated with the following item on the SDI: “During the past month, how often have you had sexual thoughts involving a partner?” The SDI has been

validated with non-clinical populations of healthy women and men. Items were rated on an 8-point scale, with higher scores indicating better levels of sexual desire.

Film Scale

The Film Scale (Heiman & Rowland, 1983) is a 34-item self-report questionnaire that assesses perception of genital sexual arousal (e.g., warmth in genitals, genital pulsing or throbbing), subjective sexual arousal (e.g., turned on), autonomic arousal (e.g., faster breathing, faster heart beat), anxiety, positive affect (e.g., pleasure, interested, excited), negative affect (e.g., worried, angry, disgusted), and sensuality-sexual attraction (e.g., sensuous, a desire to be close to someone, sexually attractive) in response to sexual stimuli. Items were rated on a 7-point Likert scale from (1) not at all to (7) intensely in which participants indicated how much they endorsed each item at the present moment.

Psychophysiological Recording

Genital arousal was measured using the vaginal photoplethysmograph and the VPA signal was the primary endpoint given that it is a sensitive and specific measure of genital arousal (Laan, Everaerd, & Evers, 1995). A single vaginal probe (Behavioral Technology Inc., Salt Lake City, UT) measured VPA, which was monitored throughout exposure to each neutral and erotic film segment. VPA was recorded on a personal computer (HP Pentium MLaptop), which collected, converted (from analog to digital, using a Model MP150WSW data acquisition unit [BIOPAC Systems, Inc.]), and transformed data, using the software program AcqKnowledge III, Version 3.8.1 (BIOPAC Systems, Inc., Santa Barbara, CA). The signal was band-pass filtered (0.5–30 Hz) and a sampling rate of 200 samples/s was used for VPA throughout the neutral and erotic film exposure. Artifact smoothing took place following visual inspection of the data by an investigator who was blind to the sexual orientation group of the participant, and data were subsequently analyzed in 30-s segments. For analyses of VPA, we compared the first three 30-s segments of the neutral condition to the last five 30-s segments of the erotic condition. The probe was disinfected in a solution of Cidex OPA (ortho-phthalaldehyde 0.55%), a high level disinfectant (Advanced Sterilization Products, Irvine, CA, USA), promptly following each session.

Sexual Stimuli

Participants viewed a 3-min neutral film (either a documentary about lei making or a travelogue about Hawaii) followed by an 8-min erotic film (a Candida Royalle, female-friendly film consisting of progressively increasing sexual intensity of heterosexual manual genital stimulation, oral sex, and penile-vaginal intercourse clips which were spliced together and

joined by accompanying background music). A 1-min segment in which the word “Relax” was displayed on the television screen with no audio output preceded these films. Participants watched one of two film sets, each containing a neutral and erotic segment, and previous research has supported the similarity of women’s arousal to and ratings of these two film sets (Brotto, Basson, & Luria, 2008).

Procedure

Our university’s clinical research ethics board approved all procedures. Participants responding to community and online advertisements took part in a telephone screening process with one trained female research assistant in which the procedures of the study were described and any questions answered. They were told that they would be watching heterosexual films and that if this were objectionable to them, they could withdraw from the study. None withdrew following the telephone screening. The purpose of the screening was also to ensure that women in the “probable asexual” group did not meet criteria for HSDD. To do so, a series of questions based on the DSM-IV-TR criteria for HSDD (American Psychiatric Association, 2000) were asked by a trained interviewer. Although women may have met criterion A (i.e., absent/deficient desire for sexual activity), none met criterion B (i.e., marked distress). Women in the other sexual orientation groups were similarly asked if they experienced any sexual difficulties with the intent that any woman who did would be excluded; none met this exclusion criterion.

Participants were tested from 2008 to 2009 in a psychophysiological research room located in the university hospital, which contained a comfortable reclining chair, two bookcases, a large screen TV, an intercom, and a sink with small cupboard unit. A thin blanket was placed over the seating area of the chair. Following written consent, participants were tested by a female researcher.

Next, participants completed the questionnaire battery in the private psychophysiology room and were provided with further instructions about the vaginal photoplethysmograph and the remainder of the procedures. The researcher then left the room while participants inserted the probe and informed the researcher of their readiness via intercom. In order to habituate to the testing environment, participants were encouraged to relax on a comfortable reclining chair for a 10 min period after the probe was inserted but before watching the video segments. Subjective sexual arousal and affect were assessed at the end of the adaptation period using the Film Scale.

Following the completion of the Film Scale, the video sequence began. The audio component was delivered via wireless headphones. Immediately after the video sequence, participants filled out a second Film Scale, which asked them to evaluate how they felt during the last (erotic) film. They were then instructed to remove the probe and meet the researcher in a separate room where they had their finger-lengths measured using a standard

computer scanner (data not presented here). Participants were debriefed and provided with either \$20 remuneration or 2 course credits, depending on recruitment method.

Statistical Analyses

Baseline group comparisons used analysis of variance (ANOVA) followed by the Tukey's multiple comparisons test in cases of a significant overall effect. Given the significant group difference in age, we conducted a repeated measure ANOVA with age as the covariate (ANCOVA) for all sexual arousal endpoints. There was no significant Film \times Age interaction, $p > .05$. We thus did not covary for age in remaining analyses and instead conducted a series of Group \times Film ANOVAs. Effect sizes for all repeated measures analyses were calculated with the partial eta-squared (η^2).

Results

Measures of Sexual Function

Due to incomplete data from one asexual, information on masturbation frequency was based on six asexuals. There were no significant group differences in masturbation frequency, $F(3, 33) < 1$, with a mean frequency of between one to three times per month (Table 1), and these rates were comparable to those in a previous study of masturbation frequency in asexuals (Brotto et al., 2010). According to the FSFI, four (57%) out of seven asexuals had been sexually active, either alone or with a partner, in the past 4 weeks. The corresponding rates for heterosexual, bisexual, and lesbian women were: 90, 100, and 82%. There was a significant overall ANOVA effect on the FSFI Desire subscale, $F(3, 37) = 8.67, p < .001$. A Tukey's test showed the asexual women to have significantly lower scores than the heterosexual ($p = .001$), bisexual ($p < .001$), and homosexual ($p = .011$) women, with none of the other groups significantly differing from one another. There were no significant overall ANOVA effects on FSFI Arousal, $F(3, 31) = 1.88$; FSFI Lubrication, $F(3, 30) < 1$; FSFI Orgasm, $F(3, 31) < 1$; FSFI Satisfaction, $F(3, 25) = 1.41$; FSFI Pain, $F(3, 22) < 1$; or the FSFI Total Score, $F(3, 21) < 1$ (Table 1). Scores on the FSFI subscales of Desire, Arousal, and Lubrication in the present study were also comparable to those of asexual women in previous research (Brotto et al., 2010); however, asexual women in the present study had slightly higher scores on the FSFI subscales of Orgasm and Pain and slightly lower scores on the Satisfaction subscale.

On the DASA, there was a significant overall ANOVA for mental sexual arousal, $F(3, 34) = 15.79, p < .001$; genital tingling/throbbing, $F(3, 34) = 12.44, p < .001$; genital wetness, $F(3, 33) = 4.19, p = .013$; and pleasant genital sensations, $F(3, 34) = 12.51, p < .001$. For each of the four subscales, asexuals

scored significantly lower than every other group of women, with no significant between-group differences between the heterosexual, homosexual, or bisexual women (Table 1).

Due to one participant not completing the SDI, information on desire for solitary and dyadic sex was based on six asexuals. On the SDI Dyadic subscale, the overall ANOVA was significant, $F(3, 33) = 12.83, p < .001$, with a Tukey's test showing significantly lower dyadic desire in the asexuals compared to the heterosexual ($p < .001$), homosexual ($p < .001$), and bisexual ($p < .001$) women. The overall ANOVA was not significant on the SDI Solitary subscale, $F(3, 33) < 1$, indicating no significant group differences in desire for solitary sexual activity (Table 1).

During the neutral baseline period, there were no significant group differences on any measure of subjective sexual arousal, affect, or perceived autonomic arousal on the Film Scale, all $ps > .05$.

Physiological Sexual Arousal

There was a significant main effect of Film on VPA, $F(7, 231) = 30.77, p < .001$, partial $\eta^2 = 0.48$, such that the erotic film increased VPA in all groups. There was no significant Group \times Film interaction, $F(21, 231) < 1$, partial $\eta^2 = 0.04$ (Fig. 1).

Self-Reported Sexual Arousal

On subjective sexual arousal, there was a main effect of Film, $F(1, 34) = 61.33, p < .001$, partial $\eta^2 = 0.64$, such that subjective arousal increased after the erotic film. There was no significant Group \times Film interaction, $F(3, 34) < 1$, partial $\eta^2 = 0.06$ (Fig. 2A). On perceived physical sexual arousal, there was a significant main effect of Film, $F(1, 34) = 101.34, p < .001$, partial $\eta^2 = 0.75$, such that the erotic film significantly increased reports of perceived genital arousal. There was also a marginally significant Group \times Film interaction, $F(3, 34) = 2.52, p = .075$ which suggested that there was a more robust increase in perceived genital arousal in the non-asexual groups compared to the asexual group; however, the effect size was small, partial $\eta^2 = 0.18$ (Fig. 2b). On the sensuality-sexual attraction domain of the Film Scale, there was a significant Group \times Film interaction, $F(3, 34) = 3.41, p = .028$, partial $\eta^2 = 0.23$, which revealed significant increases in sensuality-sexual attraction with exposure to the erotic film in the heterosexual, homosexual, and bisexual women but no significant change among the asexual women (Fig. 2c).

Self-Reported Affect

There was a significant Group \times Film interaction on positive affect, $F(3, 34) = 2.96, p = .046$, partial $\eta^2 = 0.21$, which showed that only the non-asexual groups experienced a significant

Table 1 Sexual behavior measures as a function of group

Measure	Group				<i>p</i>
	Heterosexual (<i>n</i> = 10)	Bisexual (<i>n</i> = 10)	Homosexual (<i>n</i> = 11)	Asexual (<i>n</i> = 7)	
Masturbation ⁱ					
Never	3 (30%)	1 (10%)	2 (18.2%)	2 (33.3%)	ns
Few times/year	1 (10%)	2 (20%)	3 (27.3%)	1 (16.7%)	
Once/month	1 (10%)	0 (0%)	1 (9.1%)	1 (16.7%)	
2–3/month	2 (20%)	1 (10%)	0 (0%)	1 (16.7%)	
Once/week	0 (0%)	0 (0%)	3 (27.3%)	0 (0%)	
2–4/week	2 (20%)	6 (60%)	2 (18.2%)	0 (0%)	
Once/day	1 (10%)	0 (0%)	0 (0%)	1 (16.7%)	
>Once/day	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	
FSFI desire ^a	3.90 (1.55)	4.38 (1.23)	3.38 (1.32)	1.37 (0.29)	<.01
FSFI arousal ^b	4.87 (1.58)	4.77 (1.20)	4.67 (1.24)	3.00 (1.82)	ns
FSFI lubrication ^b	4.90 (1.47)	5.22 (1.22)	5.27 (0.87)	4.60 (1.14)	ns
FSFI orgasm ^b	5.02 (1.56)	4.76 (1.40)	4.80 (1.61)	4.30 (1.58)	ns
FSFI satisfaction ^{c,j}	4.67 (1.25)	4.67 (1.30)	5.20 (0.56)	– ^h	ns
FSFI pain ^{b,j}	5.45 (0.83)	5.30 (0.97)	5.20 (1.60)	– ^h	ns
FSFI total score ^d	28.61 (7.15)	28.21 (7.11)	28.47 (7.23)	– ^h	ns
DASA mental arousal ^e	5.56 (1.11)	5.29 (0.67)	4.63 (1.43)	2.19 (0.76)	<.001
DASA genital tingling/throbbing ^e	5.23 (1.15)	5.27 (0.91)	4.72 (1.47)	2.21 (0.81)	<.001
DASA genital wetness ^e	4.86 (1.65)	4.56 (1.32)	4.61 (1.51)	2.48 (1.43)	<.01
DASA pleasant genital sensations ^e	5.96 (1.24)	5.64 (0.79)	4.71 (1.65)	2.28 (1.41)	<.001
SDI dyadic ^{i,f}	39.30 (14.58)	46.20 (6.89)	38.27 (13.96)	10.33 (5.16)	<.001
SDI solitary ^{i,g}	11.70 (7.83)	11.80 (6.83)	10.45 (5.28)	7.00 (6.20)	ns

Absolute ranges: ^a 1.2–6, ^b 0–6, ^c 0.8–6, ^d 2–36, ^e 1–7, ^f 6–62, ^g 2–23; ^h not available; ⁱ based on 6 asexuals; ^j based on 1 asexual so data are not presented *ns* non-significant

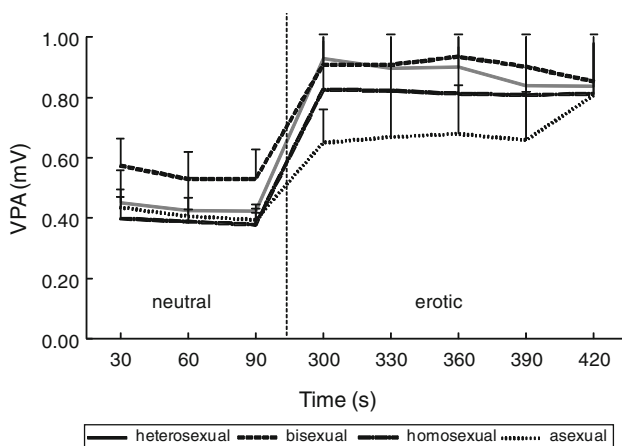


Fig. 1 Effects of neutral and erotic stimuli on vaginal pulse amplitude (VPA) during the first 90 s of neutral and last 150 s of erotic film conditions. Error bars indicate standard error of measurement (SEM)

increase in positive affect with the erotic film (Fig. 3a). On negative affect, there was neither a main effect of Film, $F(1, 34) < 1$, partial $\eta^2 = 0.02$, nor a significant Group \times Film interaction, $F(3, 34) = 1.71$, partial $\eta^2 = 0.13$ (Fig. 3b). Anxiety significantly decreased following exposure to the erotic film in all groups, $F(1, 32) = 10.07$, $p = .003$, partial $\eta^2 = 0.24$, with no Group \times Film interaction, $F(3, 32) < 1$, partial $\eta^2 = 0.04$ (Fig. 3c).

Self-Reported Autonomic Arousal

There was a significant interaction between Group and Film on self-reported autonomic arousal, $F(3, 34) = 5.06$, $p = .005$, partial $\eta^2 = 0.31$, as well as a main effect of erotic film, $F(1, 34) = 40.08$, $p < .001$, partial $\eta^2 = 0.54$. Multiple comparison revealed a significant increase in autonomic arousal with the

Fig. 2 Effects of neutral and erotic stimuli on **a** subjective sexual arousal, **b** self-reported physical sexual arousal, and **c** sensuality-sexual attraction in heterosexual, bisexual, homosexual, and asexual women. *Error bars indicate SEM*

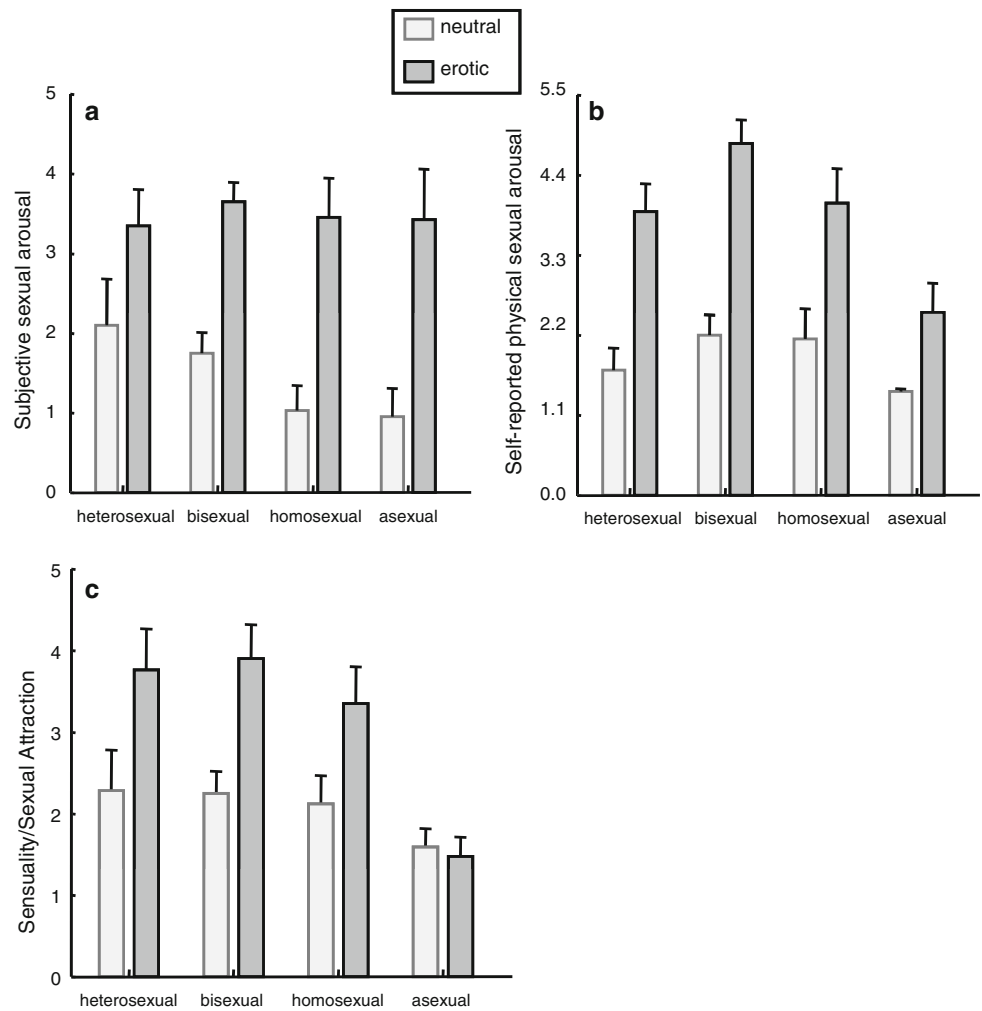
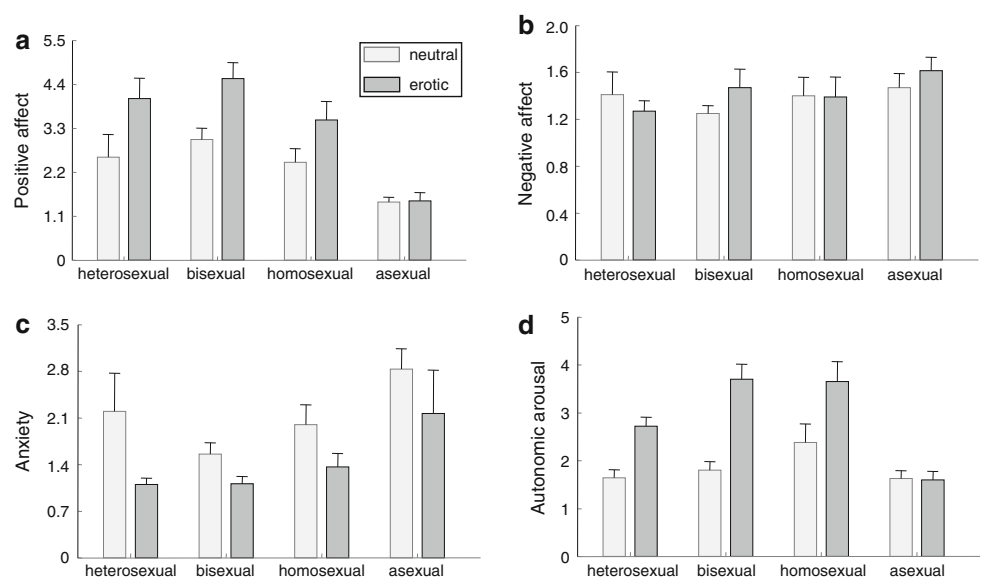


Fig. 3 Effects of neutral and erotic stimuli on **a** positive affect, **b** negative affect, **c** anxiety, and **d** autonomic arousal in heterosexual, bisexual, homosexual, and asexual women. *Error bars indicate SEM*



erotic film in all groups except the asexuals, where there was no significant increase (Fig. 3d).

Physiological-Subjective Concordance

Difference scores between erotic and neutral stimulus conditions were calculated for subjective sexual arousal and perceived physical sexual arousal. A percent change score was calculated for VPA ((erotic – neutral)/neutral). The Pearson product-moment correlation was then calculated between these transformed variables and examined in each group separately. Among the asexual women, there was a strong positive correlation between VPA and subjective sexual arousal ($p = .036$) and perceived genital arousal ($p = .05$). As can be seen by the scatterplots for the asexual women, these results were not accounted for by outliers, and instead, represent a relatively linear pattern (Fig. 4). Correlations between VPA and self-report measures were not significant for any of the other three subgroups (Table 2).

Discussion

Summary of Findings

Overall, the findings revealed no significant differences between asexual women and heterosexual, homosexual, or bisexual women in the genital arousal response to a heterosexual audiovisual erotic stimulus in a controlled, laboratory environment. Instead, all women showed a significant increase in response to the erotic film. A main effect of Film was also found for subjective sexual arousal in that all groups showed a significant increase, with no significant group differences. On perceived genital arousal, there was a trend towards a Group \times Film interaction such that there was less of an increase among the asexuals compared to the other groups; however, this did not reach statistical significance. Given the small effect size, this effect might not be magnified with a larger sample. As predicted, there was a significant Group \times Film interaction on the sensuality-sexual attraction domain of the Film Scale such that there was a significant increase following the erotic film in all groups except the asexual women.

On other self-report measures of affect, there was a significant Group \times Film interaction for positive affect to the erotic stimulus such that asexuals did not show the increase in positive affect with the erotic stimulus seen by the other groups. There were no main effects of group or film on negative affect, and anxiety decreased by a similar magnitude for all women with exposure to the erotic stimulus. Interestingly, there was a significant Group \times Film interaction for autonomic arousal in that all women showed a significant increase with the erotic film except the asexuals.

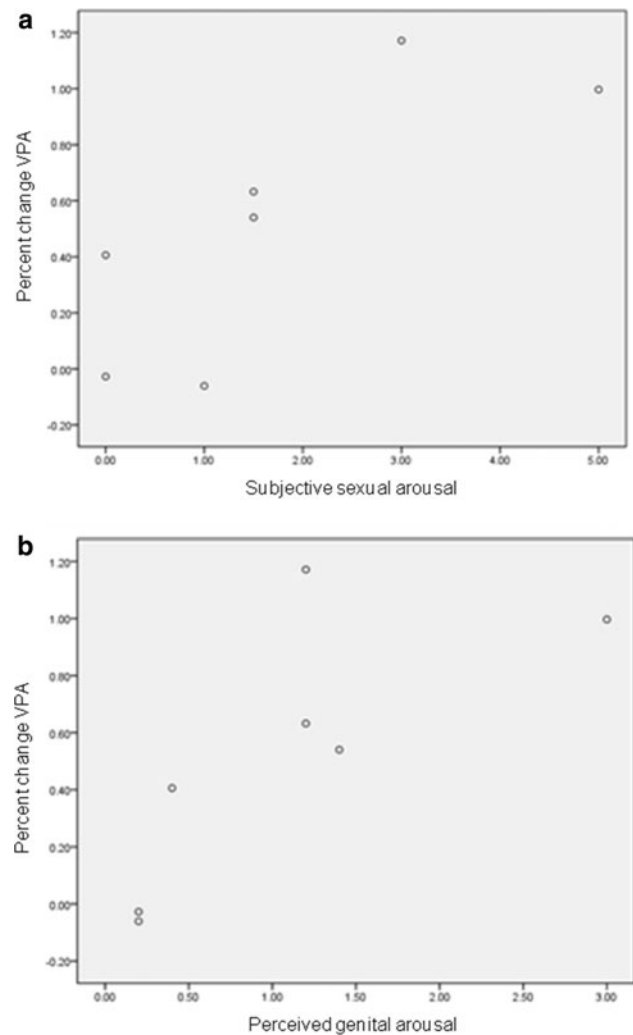


Fig. 4 Scatterplots of **a** percent change in VPA vs. subjective sexual arousal, and **b** percent change in VPA vs. self-reported physical sexual arousal for asexual women ($n = 7$)

Genital Arousal Responses

The lack of a significant Group \times Film interaction on VPA cannot only be attributed to low sample sizes given that the effect size (partial η^2) was small. Nonetheless, these results should be replicated in a larger sample of asexuals. In women, physiological measures such as VPA (Brotto et al., 2004; Pieterse et al., 2008) and fMRI (Arnou et al., 2009) have been found to differentiate women with and without sexual dysfunction in some studies but not in others (Laan, van Driel, & van Lunsen, 2008). Our findings lend support to the speculation (Bogaert, 2006; Brotto et al., 2010; Pagan Westfall, 2004) that asexuality is not a sexual dysfunction—or perhaps, more precisely, it is not a disorder of sexual arousal. In studies exploring VPA differences with regard to sexual orientation, heterosexual and homosexual women did not differ, regardless of the stimulus type shown (Chivers & Bailey, 2005; Chivers

Table 2 Correlations between percent change in VPA and perception of genital sexual arousal and subjective sexual arousal as a function of group

	Perception of genital sexual arousal	<i>p</i>	Subjective sexual arousal	<i>p</i>
Heterosexual	$r(9) = .327$	ns	$r(9) = -.038$	ns
Bisexual	$r(9) = -.229$	ns	$r(9) = -.108$	ns
Homosexual	$r(10) = -.392$	ns	$r(10) = -.247$	ns
Asexual	$r(6) = .753$.05	$r(6) = .787$.036

Note: Values represent Pearson product moment correlation coefficients. df in parentheses

et al., 2004, 2007; Peterson, Janssen, & Laan, 2010). That asexual women responded to heterosexual stimuli despite their stated preference for no sexual partners is consistent with the target non-specificity seen in hetero- and homosexual women. Specifically, work by Chivers et al. has consistently shown that, among women, there is the same (strong) magnitude of VPA among different sexual orientation groups to stimuli depicting male–male, female–female, and male–female actor pairings, despite the fact that self-reported arousal levels corresponded with the stimuli of their stated preference. Our data also showed that bisexual women—who previously have not been the subject of VPA research—had the same magnitude of VPA increase as all other groups. If our speculation that target non-specificity is a phenomenon as pertinent to asexual women as it is to women of other sexual orientation groups, then this also suggests that conclusions drawn about the automaticity of women’s sexual responding, which may have evolved to be adaptations to promote facile genital penetration and minimize physical damage (Chivers et al., 2007), also extend to asexual women. Furthermore, one might also speculate that asexual women’s VPA responses to male–male and female–female erotic stimuli would be as robust as their currently observed responses to male–female stimuli, and would not differ from heterosexual and homosexual women.

Subjective Arousal Responses

There were no significant group differences in sexual arousal when measured by the self-report FSFI or when measured in response to a laboratory stimulus. However, on the DASA, which assesses different components of sexual arousal (i.e., mental sexual arousal vs. genital tingling vs. lubrication vs. pleasant genital sensations), asexual women reported significantly lower levels than the other three groups. These data suggest that with a competent sexual stimulus (such as the conditions during the psychophysiological assessment), asexuals showed a robust subjective sexual arousal response that did not significantly differ from non-asexuals. Moreover, because FSFI arousal ratings were based only on those (asexuals) who were sexually active (57%), the lack of significant group differences suggests that asexuality does not interfere with a sexually active woman’s ability to become aroused. The arousal patterns of sexually inactive women are unknown, and it is possible that if all women were included in the FSFI arousal

domain analysis, lower scores would have been revealed in this group.

Since all women were included in analyses of laboratory-induced subjective arousal and this showed an overall significant increase, this suggests that, regardless of current sexual activity, asexual women are capable of experiencing subjective sexual arousal in response to a sexual stimulus. One recent study that examined subjective sexual arousal based on the degree of “absorption” (i.e., the ability to immerse oneself in a stimulus without being distracted by other competing stimuli; Koukounas & McCabe, 1997) in the erotic film found that those women who were given instructions to become more absorbed in the film showed higher levels of subjective sexual arousal compared to those who were instructed to view as a passive observer (Sheen & Koukounas, 2009). Because lack of absorption has been associated with difficulties with information processing and possibly attentional disruption (Cranston-Cuevas & Barlow, 1990), our findings suggest that these cognitive and attentional pathways, which are important for sexual responding, are intact in asexual women, and any stated apathy towards sexual stimuli or activity is not due to faulty cognitive or attentive processes.

There was a significant Group \times Film interaction on sensuality–sexual attraction in the predicted direction with all women except the asexuals showing a significant increase to the erotic stimulus. The individual items comprising this subscale include: “a desire to be close to someone” and “sexually attractive.” Given that asexuals define themselves according to a lack of sexual attraction (Jay, 2005), our findings suggest that despite asexuals’ normal sexual arousal response to competent stimuli, they do not experience the corresponding motivation to direct that excitement towards a potential sexual mate. Clarity on this may be gleaned by considering the incentive motivation model of sexual response, which posits that each individual has a sexual response system that can be activated by competent sexual stimuli (Both, Everaerd, & Laan, 2007; Everaerd & Laan, 1995). A component of the model is the disposition to respond to those stimuli with some form of sexual activity, which, in and of itself, then generates sexual desire. This “disposition” is likely influenced by central and peripheral neurotransmitter–hormone interactions (Laan & Both, 2008), and can be measured by reflexes of the Achilles tendon, reflecting an “action tendency” (Both, van Boxtel, Stekelenburg, Everaerd, & Laan, 2005). The model views sexual desire as an

emergent property of having engaged in sexual activity—and not the opposite. For asexuals, our data support the speculations of Bogaert (2006), which suggest intact arousability to sexual cues; however, there are likely problems in how this experienced arousability is translated into sexual activity. The resulting lack of desire, therefore, is expected. If the incentive motivation model applies to asexuals, this explains, then, why physiological sexual arousal is intact (reflecting normal arousability to competent sexual stimuli), why sexual desire is reduced (because desire emerges after sexual activity), and suggests that future research should explore the psychological and neurobiological underpinnings of why the activated sexual response does not translate into a sexual action tendency as it does in non-asexuals (Both, Spiering, Everaerd, & Laan, 2004).

Taken together, the findings of no group differences on subjective sexual arousal to the erotic film (all women) and no group differences on recalled sexual arousal (for only recently sexually active women) suggest that none of the women in this study experienced impairments in subjective sexual arousal. In other words, asexual women in this study are not likely to meet criteria for a Subjective Sexual Arousal Disorder according to criteria proposed by the American Urological Association Foundation (Basson et al., 2003).

Concordance Between Genital and Subjective Sexual Arousal

The significant genital-subjective sexual arousal correlation seen in the asexual group but not in the other groups was a novel and intriguing finding. It suggests that with increases in genital sexual arousal, there was a corresponding increase in subjective arousal seen *only* in asexual women. A meta-analysis exploring sex differences in concordance concluded, after reviewing 134 studies, that correlations were significantly lower for women ($r = .26$) than they were for men ($r = .66$) (Chivers et al., 2010). Each of the studies included in the meta-analysis, however, was based on sexual, and not asexual, women. In the present study, the correlation between VPA and subjective arousal was 0.79 and with perceived genital arousal was 0.75—magnitudes much more similar to concordance rates seen in men. Thus, Chivers et al.'s conclusion that “low concordance between self-reported and genital sexual arousal may be the norm for many women” (p. 46) may apply only to sexual, but not to asexual women. Because higher interoceptive awareness (i.e., awareness of sensations originating from within the body) in men has been cited as a possible reason for sex differences in concordance (Chivers et al., 2010), our data suggest that asexual women may be *more* interoceptively aware of genital response than are sexual women. At first glance, this may make the findings with regard to lower self-reported autonomic arousal in asexuals seem contradictory. However, it is possible that the three sexual groups misinterpreted their sexual arousal as indicating an autonomic arousal

response whereas the asexual group—being more interoceptively aware—accurately reported a low autonomic response as such.

Why might asexual women be *more* interoceptively aware than sexual women (similar to men)? Perhaps the lack of sexual activity among asexuals leads them to be highly attuned to the (rare) times when they do experience genital arousal. By comparison, heterosexual, homosexual, and bisexual women, who are accustomed to becoming sexually aroused during desired sexual events, may be less attuned to subtle increases in genital arousal evoked in a laboratory. If this line of reasoning is correct, it suggests that the higher level of interoceptive awareness in asexual women had a direct impact on their degree of cognitive sexual excitement, just as is seen in men where self-reported and genital arousal response are highly related.

Do Group Differences in Affect Account for the Findings?

The significant group difference in positive affect to the erotic film was expected and suggests that, whereas for sexual women, the erotic stimulus was perceived as being associated with pleasure, interest, attraction, excitement, and femininity, the asexual women did not experience any such increase. This finding was consistent with previous findings, which showed that asexuals discuss sexual arousal (and masturbation) using technical, emotionally bare descriptions (Brotto et al., 2010). Asexuals provided non-sexual explanations for why they engaged in masturbation, and the latter was more associated with tension relief than with sexual pleasure. The lack of group differences in negative affect suggests that the arousal generated by the erotic stimuli did not evoke more negative affect for asexual women as one might have expected. Thus, it is not the case that sexual stimuli are perceived negatively (as is the case with Sexual Aversion Disorder; APA, 2000); rather, sexual stimuli were perceived with no increase in positive and no increase in negative affect, i.e., they were perceived neutrally and non-sexually.

Is Asexuality a Disorder of Sexual Desire?

In this study, sexual desire, as measured by the FSFI, was significantly lower in asexuals compared to the other three groups. Because sexual desire is defined on the FSFI as “a feeling that includes wanting to have a sexual experience, feeling receptive to a partner’s sexual initiation, and thinking or fantasizing about having sex” (Rosen et al., 2000), it is not surprising that asexuals, who lack sexual attraction, responded significantly lower than the other three groups (who presumably do have sexual interest directed towards someone else). Similarly, the Dyadic subscale of the SDI was significantly lower in asexuals. However, asexuals’ scores on the Solitary

SDI subscale did not significantly differ from the sexual groups of women, and were consistent with that of Prause and Graham (2007). Taken together, these findings suggest that desire for sexual activity *with another individual* is significantly lower in asexual women compared to other sexual orientation groups; however, desire for solitary sexual activity was the same in asexual women compared to sexual women, and was consistent with the masturbation frequency data. Although the significantly lower levels of partner-related sexual desire may suggest that asexuals fit the criteria for HSDD, the fact that they do not experience distress (Criterion B in DSM-IV-TR; APA, 2000) means that they do not meet diagnostic criteria. Furthermore, following from incentive motivation theory (Everaerd & Laan, 1995), which presumes that sexual desire follows sexual activity, the absence of desire in asexuals is expected in light of their absent/infrequent sexual activities.

Limitations

Our asexual sample was small ($n = 7$) and this represents a potential limitation of the findings. Another limitation relates to the use of heterosexual stimuli only. Because a more complete test of target non-specificity would necessitate showing a variety of sexual stimuli to participants, this suggests that some of our conclusions regarding the universality of target non-specificity in women should be understood to be speculations based on the data presented. It is also important to note that our sample of asexual women may not be representative of all asexual women given that they agreed to the viewing of erotic stimuli. Because asexuality is defined as lack of sexual attraction, there may not be an incentive to voluntarily participate in any experimental procedure that involved presentation of undesired stimuli. However, because asexuals are motivated to participate in research that would lead to a greater understanding of asexuality (Jay, 2005), we do not believe that our findings lack external validity. In fact, because we used a variety of different advertisements, some of which mentioned “asexuality” and others which instead focused on “do you lack sexual attraction?” we believe that we recruited women who may have been at varying levels in their degree of awareness and acceptance of their asexuality, thereby enhancing the external validity of the findings.

Conclusions

Overall, we found a significant psychophysiological sexual response in the laboratory among asexual women that did not differ from responses seen in groups of heterosexual, bisexual, and homosexual women. Moreover, subjective sexual response did not differ between the groups, but self-reported sensuality-sexual attraction in response to the erotic film was significantly lower among the asexual women, as expected.

Interestingly, concordance between genital and subjective sexual arousal was significantly positive for asexual women, and non-significant for the other groups of women, suggesting greater interoceptive awareness of genital excitement in asexual women.

The findings have implications for our conceptualization of asexuality and suggest that, contrary to recent media speculations, asexuality may not be a sexual dysfunction given that arousability pathways appear intact (insofar as our measures test them). Moreover, because the proposed DSM-5 criteria for Sexual Interest/Arousal Disorder require the presence of distress or impairment (Brotto, 2010; Graham, 2010), asexuality would not fall under this definition given asexuals’ lack of distress. The clinical implication of this conclusion means that the asexual woman who is prompted to seek sex therapy at the insistence of a distressed (sexual) partner should not be the recipient of taught sexual skills to boost sexual desire nor should she be a target for pharmacological and/or hormonal intervention to boost desire. Rather, the (sexual/asexual) couple might be the focus of relationship therapy aimed at how to negotiate her lack of sexual attraction and what agreements can be reached about sexual activity that sufficiently appease both partners (e.g., agreeing that sexual activity may take place consensually but without interest for it on her part).

Taken together, these results add to the small but growing literature on asexuality. What remains to be studied are whether there are neural correlates to the lack of sexual attraction, whether there are other (non-sexual) biological indicators pointing to asexuality being a sexual orientation (e.g., digit ratio measurement), and further understanding the mechanisms by which romantic and sexual aspects of attraction may become de-coupled. The scientific study of asexuality might also be advanced by systematic comparisons of asexuality (which is lifelong) versus acquired HSDD in order to understand how these populations might be distinct.

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