

## Sexual Arousal in East Asian and Euro-Canadian Women: A Psychophysiological Study

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DOI: 10.1111/j.1743-6109.2010.01916.x

### ABSTRACT

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**Introduction.** Studies of ethnic differences in self-report measures of sexuality have shown East Asian women to be more sexually conservative and less sexually experienced than Caucasian women. There is also strong evidence supporting the notion of ethnic group differences in general measures of nonsexual psychophysiological arousal; however, there have been no previous studies exploring ethnicity and physiological sexual arousal.

**Aim.** The objective of this study was to explore group differences in self-reported and physiological sexual arousal in Euro-Canadian and East Asian women living in Canada; we also aimed to explore the association between level of acculturation (both mainstream and heritage) and sexual arousal in East Asian women only.

**Methods.** Seventy-five women (N = 38 Euro-Canadian, N = 37 East Asian) completed a battery of questionnaires and underwent psychophysiological sexual arousal testing using the vaginal photoplethysmograph. They also completed a self-report measure of subjective arousal before and after erotic stimulus exposure.

**Main Outcome Measures.** All women completed the Female Sexual Function Index, Vancouver Index of Acculturation, and Sexual Beliefs and Information Questionnaire. Change in genital sexual arousal (vaginal pulse amplitude; VPA), and change in subjective sexual arousal were measured during exposure to erotic stimuli.

**Results.** The groups did not differ in the percent increase in VPA induced by erotic stimuli, nor was there a correlation between VPA and subjective sexual arousal. Among East Asian women alone, neither heritage nor mainstream acculturation was correlated with change in VPA.

**Conclusions.** East Asian and Euro-Canadian women who show similar ratings of sexual behaviors and self-reported sexual arousal do not differ in physiological or subjective arousal induced by erotic stimuli in the laboratory. **Yule M, Woo JST, and Brotto LA. Sexual arousal in East Asian and Euro-Canadian women: A psychophysiological study. J Sex Med 2010;7:3066–3079.**

**Key Words.** Ethnicity; Vaginal Photoplethysmography; Genital Arousal; Psychophysiologic Measure; East Asian; Acculturation

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### Introduction

Despite the obvious diversity of culture between Eastern Asia and North America, there are certain universal values that distinguish individuals from these cultures from each other: specifically, the emphasis placed on collectivism and interpersonal relationships among Eastern cultures and the focus on individualism and personal achievement in the western world [1–3]. Philosophical differences between East Asian (defined here as Chinese, Japanese, and Korean)

and western cultures have long historical roots which may directly bear on sexuality. It is theorized that the reverence for strict moral and social codes in modern Chinese culture has led to the suppression of sexual needs and expression [4] and some have even (inappropriately) characterized Chinese culture as “asexual” [5]. Japan and Korea long ago adopted these Chinese philosophies [6], and thus have been historically influenced similarly with regard to attitudes toward sexuality. Parents today from East Asian countries often expect their children to devote themselves entirely

to their academic studies—seen as an indication of social status—and any association with sexual activity is discouraged as it may be a distraction to excelling academically [7].

On the other hand, contemporary western culture has a comparatively more liberal attitude toward sexual expression and behavior. Masters and Johnsons' research in the 1970s [8], which focused on the giving and receiving of pleasure, opened the door for freedom of sexual expression, and helped to create the North American view of sexuality as recreative (although some may argue that there is a lingering oppressive view of sexuality even in North America). Also, much of the "body work" of the 1970s stemming from Humanistic Sexology with its focus on "hands-on" experience of pleasure in the body was an important factor in sexology's past. East Asian cultures, however, have traditionally viewed sex as procreative, and when compared with Euro-American women, Asian women living in the United States were much less likely to report sex as important and had significantly lower levels of sexual desire and arousal and higher levels of sexual pain [9].

Against this historical cultural background, the potential for ethnic variations in the expression of sexuality has been of great interest to researchers. One method of studying group differences is to compare individuals in North America with those from Asian countries. Chinese medical students, as well as Chinese high school students, had lower scores on measures of sexual knowledge compared to their Euro-American counterparts [10–12]. Further, Chinese college students tended to be significantly less sexually experienced and more sexually conservative when compared with American college students [11,13]. In studies of sexual behavior among North American undergraduates, Asians had less sexual knowledge and held more conservative attitudes toward sexuality when compared with their non-Asian peers [14–17]. They were also more sexually inexperienced and sexually conservative on a variety of sexual behaviors, including interpersonal (e.g., petting, oral sex, intercourse), intrapersonal (e.g., fantasies, masturbation), and unrestricted (e.g., number of partners, number of "one-night-stands") sexual activities [18].

The data on sexual difficulties also bears out these ethnic differences. Female Asian university students reported higher scores on the Vaginismus and Anorgasmia subscales of the Golombok-Rust Inventory of Sexual Satisfaction than their Euro-Canadian counterparts, and also reported more

sexual complaints in general, including Sexual Avoidance, Dissatisfaction and Non-Sensuality [19]. Similarly, the Global Study of Sexual Attitudes and Behaviors, which included almost 14,000 women in 29 different countries, found that lack of sexual interest, inability to reach orgasm, reaching orgasm too quickly, pain during sex, finding sex not pleasurable, and lubrication difficulties were higher in East Asia than in Europe and North America [20]. Further, increasing acculturation (the process in which an individual, upon moving to a new culture, incorporates new information and ideas into their self identity [21]) was associated with fewer sexual problems among Asian women [19], suggesting that affiliation with western culture may be linked to improved sexual response.

Although it is well established that women from East Asian and western cultures differ on a number of self-report measures of sexuality, the possibility that there may be physiological differences in sexual response is highly intriguing. There is a large body of evidence substantiating ethnic group differences in other (nonsexual) measures of physiological arousal. A review of the effects of age, gender, and ethnicity explored several large-scale epidemiological studies evaluating the resting heart rate of African American and Euro-American individuals at several stages of life, including newborns, children, adolescents, and adults [22]. While heart rate tended to differ between ethnic groups through to early adulthood, the groups became more similar with age. Further, healthy African American adults had higher resting blood pressure, as well as lower levels of skin conductance than their Euro-American peers. In a series of review articles and meta-analyses on published evidence of ethnic differences in several physiological variables, Agyemang and colleagues concluded there to be significant differences in blood pressure, pulse-pressure (the difference between systolic and diastolic blood pressure), and nocturnal blood pressure decrease between individuals of European, African, and South Asian descent [23–27]. However, this has been disputed by recent studies [28,29] that found individuals of African American and Euro-American ethnicities to be differentially responsive to laboratory stressors. Similarly, blood pressure reactivity data have demonstrated greater blood pressure responses to challenges in African American adults than Euro-Americans [22], and while South Asian participants had lower resting systolic blood pressure and lower resting heart rate, Euro-American partici-

pants experienced significantly higher heart rate responses when asked to exhibit anger [30]. Further, Shen [31] found no differences in baseline cardiovascular measures between Asian Americans and Euro-Americans, but did find Asian Americans to exhibit significantly lower responses to laboratory stressors than did the Euro-American group. Interestingly, no differences emerged between ethnicities in affective states following each task, suggesting that ethnic differences in cardiovascular reactivity may not be accounted for by perceptions and emotions. Taken together, these data support the notion of ethnic group differences in general measures of psychophysiological arousal.

While there is strong evidence suggesting the existence of ethnic differences in measures of a resting autonomic nervous system, there is no clear pattern as to whether there is lower or higher physiological arousal for any specific ethnic group. There is, however, some evidence that physiological reactions differ between ethnic groups in accordance with the different meanings assigned by the individual to the stimulus presented [32]. A given stimulus will produce less uncertainty and thus less physiological reactivity in an ethno-cultural group where this stimulus is normalized. For example, touch is more common among African American than Euro-American individuals [33], and thus it elicits less of a physiological response (as measured by heart rate and skin conductance) in the former [32]. These effects were strongly influenced by the social context of the experiment, with sex and ethnicity of both the subject and the researcher affecting responses [32,34,35]. Further, Roberts and Levenson [36] compared subjective, behavioral and physiological responses (including cardiovascular, respiratory, electrodermal, and somatic measurements) to emotional film clips with ethnically matched or unmatched actors in several cultural groups, and found that some groups showed altered physiological reactions to members of their own ethnic group. African Americans, for example, showed greater physiological responding to films depicting African Americans, while Chinese Americans showed less physiological activation to films with Chinese American actors.

Although there have been no direct tests of the extent to which ethnic groups differ on physiological sexual arousal, the finding that there are significant ethno-cultural differences in belief systems, and that the latter can impact upon physiological sexual arousal suggests there may be valid

group differences in physiological sexual arousal. Sexually inhibited participants (defined as those having greater sex guilt, perception of oneself as low in sexual arousability, and lacking sexual experience) were found to have a greater physiological response during erotic exposure than “uninhibited” participants, but to report less sexual arousal [37]. Specifically, women with higher sex guilt had higher physiological sexual arousal during the erotic film and subsequent fantasy. On the other hand, those with greater sexual experience reported higher subjective sexual arousal. Models of drive induction, novelty and increased stimulus value have been used to account for these findings, and support the conclusions of Vrana and Rollock [32,34,35] in which familiarity of a stimulus impacts physiological reactivity to that stimulus. Further, while more sexually inhibited women had greater physiological response during an erotic stimulus, they reported lower subjective arousal than those with less sexual inhibition [38]. In light of the finding that East Asian women reported greater sex guilt [39,40], as well a large body of evidence that East Asian women score higher on a number of measures of sexual conservatism [15–18], and are less sexually experienced [18] than Euro-Canadian women, it is reasonable to speculate that East Asian women may have a greater physiological sexual response, as well as greater subjective-physiological desynchrony (i.e., discordance between the extent of genital and psychological sexual arousal) while viewing erotic films, when compared to a Caucasian group.

Vaginal photoplethysmography is a psychophysiological technique of measuring sexual response in women and may provide one window into the automatic reflexivity of women’s sexual arousal, regardless of their level of subjective arousal or attraction (e.g., [41]). The vaginal photoplethysmograph (VPP) [42] is a tampon-shaped probe inserted vaginally; the target endpoint, vaginal pulse amplitude (VPA), is thought to reflect moment-to-moment vasocongestion of the vaginal capillaries, with increasing sexual arousal corresponding to increasing levels of explicitness of the stimuli. VPP has been in use for over 30 years, is a sensitive and specific measure of genital sexual arousal [43], and has been increasingly used in pharmacological and psychological outcome trials [44]. Many studies have indicated a notable discrepancy between self-reported and physiological sexual arousal (e.g., [45–48]), and it has been suggested that women’s sexual response plasticity might account for the finding that their bodies

may respond universally to a stimulus despite the absence of a subjective arousal response [41]. To our knowledge, the vast literature on genital-subjective arousal concordance has never been explored in non-western samples.

The present paper reports on the second phase results of a two part study, and aims to explore the influence of ethno-cultural groups on self-reported and physiological (VPA) sexual arousal. Ethno-culture was quantified in two ways: (i) via self-identified ethnic group—Euro-Canadian vs. East Asian; and (ii) via acculturation measured bidimensionally (heritage and mainstream) in the East Asian women only. Effects of ethnicity and acculturation on participation rates in women's psychophysiological sexual arousal research were also investigated, and results have been reported elsewhere [49]. "Heritage culture" is defined as the culture of birth or upbringing, while the predominant cultural environment is defined as the "mainstream culture." East Asian women have greater levels of sexual conservatism and less sexual experience than Euro-Canadian women [15,40,50], suggesting that viewing erotic films may be more novel and have greater stimulus value, thereby inducing a stronger VPA response compared with the Euro-Canadian group. However, because East Asian women reported lower levels of self-reported sexual arousal, one might also predict a lower VPA response to erotic stimuli. Thus, we predicted that East Asian women would show an altered VPA response compared with an analogous Euro-Canadian sample, and that this disparity between groups would decrease with increasing mainstream, and decreasing heritage, acculturation. We did not, however, hypothesize on the direction of this altered VPA response.

## Method

### Participants

All procedures were approved by our university's ethics review board. Women of Euro-Canadian or East Asian (Japanese, Chinese or Korean) descent were eligible to participate if they were between the ages of 19 and 35 years old and fluent in English. All participants were recruited through two separate advertisements—one posted on the university's online human subject pool and the other posted in the community. Of 148 women who were recruited for this study, 75 agreed to participate in the psychophysiological component (N = 38 Euro-Canadian, N = 37 East Asian). Although this was not measured directly, of those

who declined to participate in the psychophysiological component, several volunteered reasons for not participating. These included being too busy, feeling uncomfortable with watching erotic films, not being offered enough remuneration (\$10 or 1 course credit was offered for participation), and never having used a tampon before and thus not feeling comfortable with inserting the VPP. The 75 women who participated comprised the sample for the current study. The average age of participants was 22.7 years (range 19–35), and Euro-Canadian women tended to be older (23.5 years) than East Asian women (21.9 years); however, this difference was not significant. Fifty-three participants were recruited through the university's human subject pool. There was no significant difference in the proportion of East Asian women recruited from the community (45%) vs. from the university (49%),  $\chi^2(1) = 0.187$ ,  $P > 0.05$ . Ninety-seven percent of Euro-Canadian women were born in a European country or North America. One Euro-Canadian woman reported being born outside of these regions. Forty-three percent of East Asian women were born in Canada, and 51% were born in an Asian country. Two East Asian women reported being born outside of North America or Asia. A  $\chi^2$  analysis comparing ethnic category and place of birth (Europe/North America, Asia, or "other"), revealed a significant group difference,  $\chi^2(2) = 27.646$ ,  $P < 0.001$ . East Asian women had lived in Canada for significantly less time than Euro-Canadian women (14.84 and 19.73 years, respectively),  $F(1,73) = 5.612$ ,  $P = 0.020$ . Sixty-four percent of participants were currently involved in a relationship, with no significant ethnic group differences, and length of relationship was, on average, 24.2 months (range 1 month–10 years). The majority (96%) of women had some level of post-secondary education, and there were no significant group differences on highest level of education.

### Measures

#### Demographics Questionnaire

The investigators developed a number of demographic questions related to age, education, relationship status, and relationship length to further characterize the groups. The data are presented in Table 1.

#### Vancouver Index of Acculturation (VIA)

The VIA [21] is a self-report instrument that assesses bidimensional acculturation using heri-

**Table 1** Ethnic group differences on relationship status and sexual activity

Variable	Euro-Canadian (%)	East Asian (%)
% currently in a relationship <sup>†</sup>	65.8	62.2
% currently sexually active <sup>†</sup>	80.6	66.7
% who have engaged in hugging, kissing or holding hands with a current partner <sup>§</sup>	100	100
% who have engaged in touching with clothing removed with a current partner <sup>**§</sup>	100	76.9
% who have touched their current partner's genitals <sup>**§</sup>	100	76.9
% who have performed oral sex on their current partner <sup>§</sup>	86.2	69.2
% who have had oral sex performed on them by their current partner <sup>**§</sup>	82.8	46.1
% who have engaged in vaginal-penile intercourse with their current partner <sup>**§</sup>	100	76.9

Significant group differences at  $**P < 0.01$ .

<sup>†</sup>Based on N = 38 Euro-Canadians and N = 37 East-Asians.

<sup>‡</sup>Based on N = 36 Euro-Canadians and N = 36 East-Asians.

<sup>§</sup>Based on N = 29 Euro-Canadians and N = 26 East-Asians.

tage and mainstream culture as orthogonal dimensions. The VIA consists of 20 items with 10 domains; cultural traditions, marriage partner, social activities, comfort in professional relationships, entertainment, behavior, maintenance or development of cultural practices, values, humor, and social relationships. Scores on each domain of the VIA range from 0 to 9, with higher scores on the mainstream dimension reflecting greater westernization, and higher scores on the heritage dimension reflecting greater maintenance of one's prior culture and traditions. Both dimensions were found to have good internal consistency in the East Asian validation sample (Cronbach's  $\alpha = 0.92$  for heritage acculturation and 0.85 for mainstream acculturation).

#### Female Sexual Function Index (FSFI)

The FSFI [51] is a 19-item measure assessing six domains of sexual function: desire, subjective arousal, lubrication, orgasm, satisfaction, and pain during sexual activity over the past month. The total FSFI score is obtained by summing the scores from the individual domains, with higher scores on this measure indicating better levels of sexual function. The FSFI has been validated as an appropriate tool to differentiate between women with and without sexual arousal disorder [52], has a high degree of internal consistency (Cronbach's  $\alpha \geq 0.82$ ), as well as a high test-retest reliability ( $r = 0.79-0.86$ ) [51]. In light of some conceptual and statistical problems identified by Meyer-Bahlburg and Dolezal [53], 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 4 weeks was excluded from analyses of all subscales except sexual desire, given that the latter is not dependent on sexual activity [54].

#### Sexual Beliefs and Information Questionnaire (SBIQ)

The SBIQ [55] is a 25-item inventory that assesses information and beliefs regarding sexuality. Participants select "True," "False," or "Don't Know" in response to each item and the total score is computed by summing the number of items that were answered correctly. The total score reflects the accuracy of sexual knowledge. The SBIQ has good internal consistency (Cronbach's  $\alpha = 0.82$ ) and test-retest reliability ( $r = 0.82$ ). This measure was used to compare the level of sexual knowledge between the groups and to explore whether sexual knowledge predicted VPA response.

#### Film Scale

The Film Scale [56] is a 34-item self-report questionnaire that assesses perception of genital sexual arousal, subjective sexual arousal, autonomic arousal, anxiety, positive affect, and negative affect in response to viewing sexual stimuli. Items are rated on a 7-point Likert scale from (1) "not at all" to (7) "intensely" in which participants indicate how much they endorse each item at the present moment.

#### Beck Depression Inventory Second Edition (BDI-II)

The BDI-II [57] is a 21-item self-report questionnaire revised from the original BDI, and designed to assess the severity of depressive symptoms, with items designed specifically to be consistent with criteria for Major Depressive Disorder as defined by the Diagnostic and Statistical Manual of Mental Disorders IV-TR [58]. Each item is rated along a 4-point scale from 0 to 3, with higher numbers reflecting increasing severity of depressive symptoms, and total BDI scores can range from 0 to 63. A score  $\geq 15$  denotes probable depression. In a sample of college students, the internal consis-

tency of the BDI-II was excellent at 0.90, and concurrent validity was good ( $r = 0.76$ ) [59]. The BDI was given to test group differences in depressive symptoms that might account for differences in VPA.

#### Beck Anxiety Inventory (BAI)

The BAI [60] is a widely used, 21-item self-report measure of anxiety symptoms, with higher scores indicating more anxiety. Items are rated on a 4-point scale ranging from 0 "Not at all" to 3 "Severely" and are summed to obtain the total score, which can range from 0 to 63. The BAI has high internal consistency (Cronbach's  $\alpha = 0.92$ ) and test-retest reliability ( $r = 0.75$ ), as well as good convergent and discriminant validity [60]. The BAI was given to test group differences in anxiety symptoms that might account for differences in VPA.

#### Fear of Negative Evaluation (FNE)

The FNE [61] is the measure used most commonly to assess social-evaluative anxiety and need for social approval or avoidance of disapproval. The scale consists of 30 statements and participants are asked to indicate whether each item is true or false in describing how they usually feel. Individuals who score high on the FNE scale tend to behave in ways such that they avoid the prospect of being unfavorably evaluated by others. The FNE has been demonstrated to have adequate internal consistency and test-retest reliability ( $r = 0.78$ ). Given the recent finding of more sex guilt among East Asian vs. Euro-Canadian women [40], the FNE was given to test group differences in fear of negative evaluation that might account for differences in VPA.

#### Procedure

Women were invited to attend the research laboratory located in a large Canadian metropolitan city where, after written consent was obtained, they completed a series of questionnaires on acculturation and sexuality. At the time of questionnaire completion, women were unaware of the psychophysiological testing phase. Following the completion of the questionnaires, women were informed about the sexual arousal testing. Participants who responded to the university advertisement received one course credit for participating. Women who responded to the community advertisements were compensated \$10. Fifty-four percent of participants in the questionnaire-only phase of the study self-identified as East Asian, and contrary to expectations, East Asian women were more likely than Euro-Canadian women to participate in sexual

arousal testing (as discussed in a separate publication [49]). For those women who elected to go on to the psychophysiological testing phase, a Euro-Canadian female researcher explained the procedures and provided detailed instructions on how to insert the probe. After written consent was obtained for the sexual arousal testing and the probe was inserted, participants were encouraged to relax for 10 minutes on a comfortable reclining chair before watching the video segments in order to habituate to the testing environment. Subjective sexual arousal was assessed at this time using the Film Scale.

Following the 10-minute adaptation period, the video sequence began. This involved three separate sections, including a 1-minute "Relax" segment, a 3-minute neutral segment, and an 8-minute erotic segment that depicted a nude Caucasian, heterosexual couple engaging in kissing, genital touching, oral sex, and intercourse. A single vaginal probe (Behavioral Technology Inc., Salt Lake City, UT, USA) measured VPA, which was monitored throughout exposure to each film segment. VPA was recorded on a personal computer (HP Pentium M Laptop) which collected, converted (from analog to digital, using a Model MP150WSW data acquisition unit [BIOPAC Systems, Inc.]), and transformed data, using the software program Acq-Knowledge III, Version 3.8.1 (BIOPAC Systems, Inc., Santa Barbara, CA, USA). The signal was band-pass filtered (0.5–30 Hz), and a sampling rate of 200 samples/second was used for VPA throughout the neutral and erotic film exposure. Artifact smoothing took place following visual inspection of the data by a trained research assistant, and data were subsequently analyzed in 30-second segments, then averaged over the neutral and erotic segments separately, resulting in two data points per subject. The probe was disinfected in a solution of Cidex OPA (ortho-phthalaldehyde 0.55%), a high level disinfectant for 13 minutes, promptly following each session.

Immediately after the video sequence, participants filled out a second Film Scale to evaluate their arousal to the erotic stimuli. They were then instructed to remove the probe and meet the researcher for debriefing in a separate room where they were given the opportunity to ask questions.

#### Results

##### *Sexual and Affective Characteristics of the Sample*

There were no significant ethnic differences in the proportion of women currently in a relation-

**Table 2** Ethnic Group Differences on Scores from the FSFI, SBIQ, BDI-II, BAI, and FNE scale

Variable	Euro-Canadian M (SD)	East Asian M (SD)	t(df)
FSFI Desire <sup>†</sup>	4.28 (1.22)	3.89 (1.23)	1.37 (73)
FSFI Arousal <sup>**‡</sup>	5.17 (0.78)	4.56 (0.99)	2.81 (64)
FSFI Lubrication <sup>‡</sup>	5.44 (0.71)	5.11 (1.06)	1.51 (64)
FSFI Orgasm <sup>‡</sup>	4.78 (1.42)	4.26 (1.34)	1.50 (64)
FSFI Satisfaction <sup>§</sup>	4.81 (1.06)	4.45 (1.30)	1.14 (53)
FSFI Pain <sup>¶</sup>	5.43 (0.95)	5.09 (1.23)	1.14 (51)
FSFI Total Score <sup>††</sup>	29.70 (4.06)	27.93 (4.55)	1.47 (50)
SBIQ <sup>***‡</sup>	18.63 (2.78)	16.38 (2.46)	3.71 (73)
BDI-II <sup>†</sup>	5.55 (4.71)	8.97 (9.11)	-2.03 (54)
BAI <sup>†</sup>	8.29 (7.31)	8.86 (7.71)	-3.63 (73)
FNE <sup>†</sup>	13.39 (7.07)	15.40 (7.58)	-1.19 (73)

Higher scores denote better sexual function (FSFI), more sexual knowledge (SBIQ), higher depressive symptoms (BDI-II), higher anxiety symptoms (BAI), and more fear of negative evaluation (FNE).

<sup>†</sup>Based on N = 38 Euro-Canadians and N = 37 East-Asians.

<sup>‡</sup>Based on N = 37 Euro-Canadians and N = 29 East-Asians.

<sup>§</sup>Based on N = 31 Euro-Canadians and N = 24 East-Asians.

<sup>¶</sup>Based on N = 31 Euro-Canadians and N = 22 East-Asians.

<sup>††</sup>Based on N = 30 Euro-Canadians and N = 22 East-Asians.

Significant group differences at \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

FSFI = Female Sexual Function Index; SBIQ = Sexual Beliefs and Information Questionnaire; BDI-II = Beck Depression Inventory; BAI = Beck Anxiety Inventory; FNE = Fear of Negative Evaluation.

ship,  $\chi^2(1) = 0.11$ ,  $P > 0.05$ , nor in the likelihood of currently being sexually active,  $\chi^2(1) = 1.79$ ,  $P > 0.05$ . Of those who reported being currently sexually active (80.6% of Euro-Canadian and 66.7% of East Asian women), all had engaged in hugging, kissing, or holding hands. Euro-Canadian women were significantly more likely to have engaged in touching with clothing removed,  $\chi^2(1) = 7.51$ ,  $P = 0.006$ , to have received oral sex,  $\chi^2(1) = 8.12$ ,  $P = 0.004$ , to have touched their partner's genitals,  $\chi^2(1) = 7.51$ ,  $P = 0.006$ , and to have experienced intercourse,  $\chi^2(1) = 7.51$ ,  $P = 0.006$ , than their East Asian counterparts. There were no significant ethnic group differences in the proportion of women who had performed oral sex on their partner,  $\chi^2(1) = 2.32$ ,  $P > 0.05$  (Table 1).

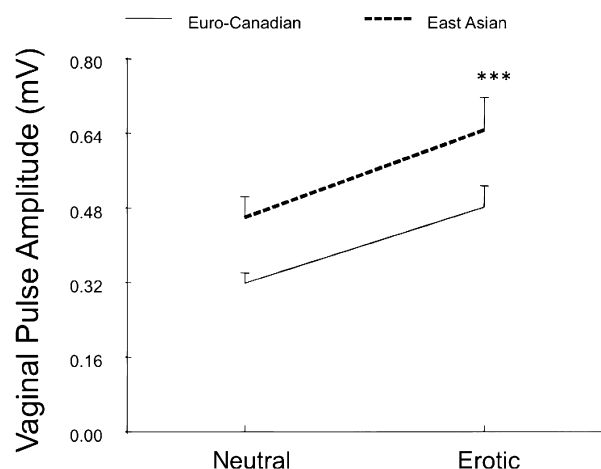
Among women who had been sexually active in the previous 4 weeks, there were no significant differences between ethnic groups on the desire, lubrication, satisfaction, pain or total score subscales of the FSFI. However, Euro-Canadian women had significantly higher scores on the arousal subscale of the FSFI,  $t(64) = 2.81$ ,  $P < 0.01$  (Table 2). When depression, anxiety, and fear of negative evaluation were compared, there were no significant ethnic group differences on any measure (Table 2). Scores on the BDI-II, BAI, and FNE indicated overall low levels of psychological symptoms for both groups. Euro-Canadian women did have significantly more accurate sexual knowledge than their East Asian counterparts, as measured by the SBIQ,  $t(34) = 2.48$ ,  $P < 0.05$  (Table 2).

#### Level of Acculturation among East Asian women

East Asian women were moderately acculturated to both their heritage culture and the mainstream culture—mean scores were 6.42 (SD = 1.25) and 6.72 (SD = 1.31), respectively, on the VIA [21]. Mainstream acculturation scores in the current sample were comparable to previous samples of East Asian females [40,50], however heritage acculturation scores were slightly lower than those observed in previous research, suggesting that our Asian sample held less strongly to the traditional values of their prior culture. There were no significant correlations between the desire, lubrication, satisfaction, pain or total score subscales of the FSFI, and either heritage or mainstream acculturation in the East Asian women. Similarly, there was no significant correlation between sexual knowledge (SBIQ) and either heritage or mainstream acculturation.

#### Sexual Arousal Response to Erotic Stimuli

The effectiveness of the erotic stimuli at eliciting genital (VPA) and subjective sexual arousal in Euro-Canadian and East Asian women was assessed with a within- (neutral and erotic film conditions) and between- (Euro-Canadian and East Asian) subjects repeated measures analysis of variance. The erotic film had a significant main effect of increasing VPA,  $F(1,73) = 20.87$ ,  $P < 0.001$ ,  $\eta^2 = 0.22$  but no significant film by ethnic group interaction,  $F(1,73) = 0.10$ ,  $P > 0.05$  (See Figure 1), indicating that both groups showed the same degree of increased VPA response.



**Figure 1** Effects of erotic film on vaginal pulse amplitude in Euro-Canadian (N = 38) and East Asian (N = 37) women. \*\*\* $P < 0.001$ , error bars indicate standard error.

To examine whether VPA was related to acculturation in the East Asian women, we tested the correlation between mainstream and heritage acculturation and VPA. There were no significant correlations between VPA percent increase and either heritage or mainstream acculturation (Table 3).

As shown in Figure 2, there was a main effect of erotic film on perceived genital arousal,  $F(1,73) = 134.81$ ,  $P < 0.001$ ,  $\eta^2 = 0.65$ ; subjective sexual arousal,  $F(1,73) = 68.20$ ,  $P < 0.001$ ,  $\eta^2 = 0.48$ ; positive affect,  $F(1,73) = 55.10$ ,  $P < 0.001$ ,  $\eta^2 = 0.43$ ; negative affect,  $F(1,73) = 11.92$ ,  $P = 0.001$ ,  $\eta^2 = 0.14$ ; self-reported autonomic arousal  $F(1,73) = 108.08$ ,  $P < 0.001$ ,  $\eta^2 = 0.60$ ; and anxiety,  $F(1,73) = 8.91$ ,  $P < 0.01$ ,  $\eta^2 = 0.11$ . With exposure to the erotic stimulus, all self-report measures

**Table 3** Correlations (Pearson  $r$ ) between Vaginal Pulse Amplitude and domain scores on the FSFI for all women (N = 75), Euro-Canadian women (N = 38), and East Asian women (N = 37), and between Vaginal Pulse Amplitude and acculturation for East Asian women only (N = 37)

Variable	All women	Euro-Canadian	East Asian
FSFI Desire	0.14	0.08	0.20
FSFI Arousal	-0.10	-0.18	-0.03
FSFI Lubrication	-0.19	0.10	-0.26
FSFI Orgasm	-0.27*	-0.23	-0.31
FSFI Satisfaction	0.13	0.16	0.18
FSFI Pain	0.06	0.12	0.09
FSFI Total Score	-0.07	-0.02	-0.05
Heritage acculturation			0.07
Mainstream acculturation			0.02

\* $P < 0.05$ .

FSFI = Female Sexual Function Index.

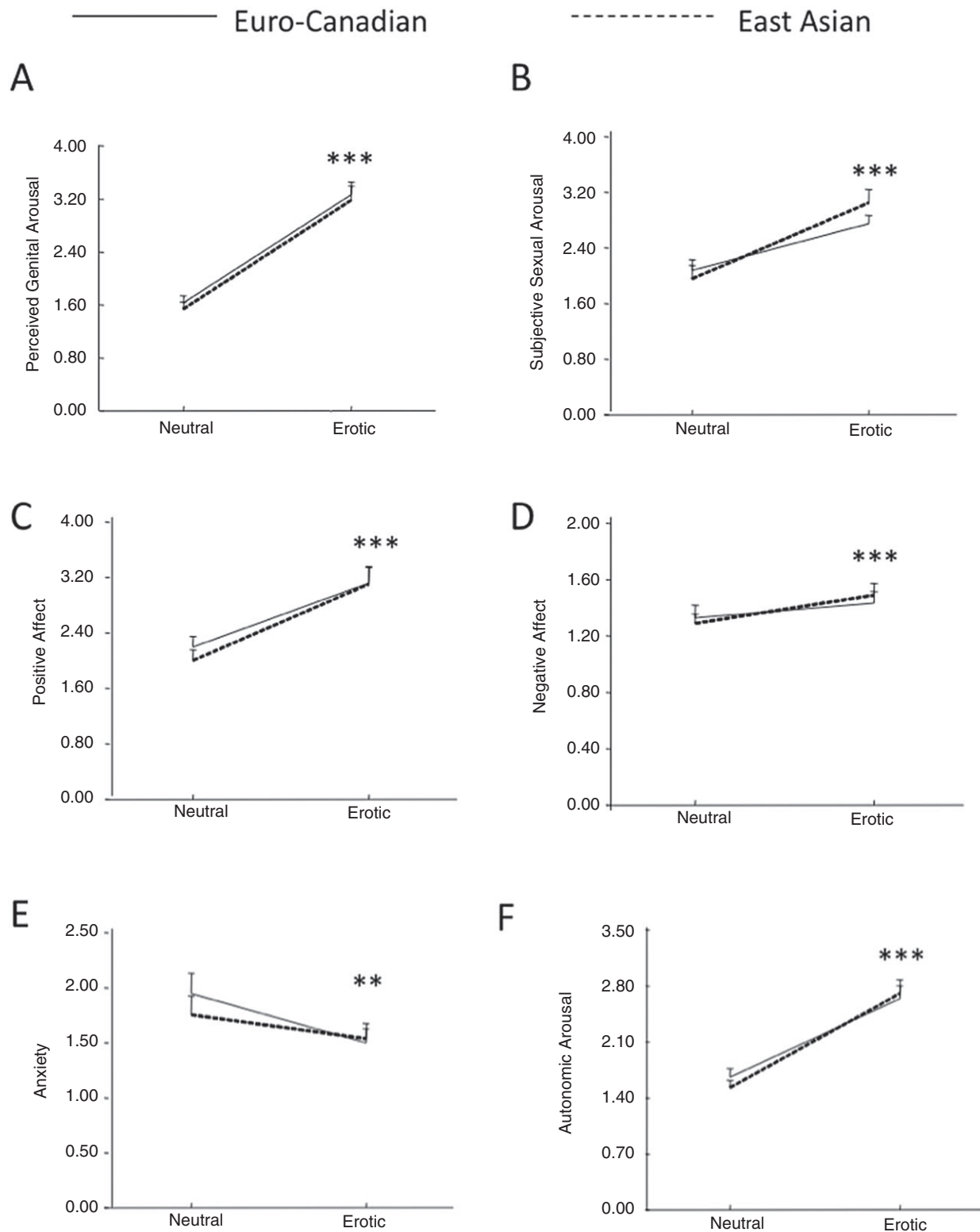
increased with the exception of anxiety, which decreased. There was, however, no significant film by ethnic group interactions on any self-report measure: perceived genital arousal  $F(1,73) = 0.001$ , subjective sexual arousal,  $F(1,73) = 3.92$ , positive affect  $F(1,73) = 0.42$ , negative affect,  $F(1,73) = 1.15$ , anxiety,  $F(1,73) = 1.08$ , and autonomic arousal,  $F(1,73) = 0.88$ , all  $ps > 0.05$ , indicating that the change in each of these measures was not accounted for by any specific ethnic group.

#### Genital-Subjective Sexual Arousal Concordance

To examine concordance, we correlated percent increase in VPA with self-reported perception of genital arousal and subjective sexual arousal. Percent increase in VPA was calculated by taking the difference between mean erotic VPA minus mean neutral VPA, and dividing this difference by mean neutral VPA. For self-report variables, a difference score was calculated between the mean erotic and the mean neutral scores. Difference scores instead of percent change scores in these two subjective endpoints were used given that they are measured on an absolute interval scale whereas VPA is on an ordinal scale without a zero point. A Pearson product moment correlation was then used to correlate the physiological and self-report endpoints. There was no significant correlation between VPA and perceived genital arousal  $r(75) = -0.015$ , nor between VPA and subjective sexual arousal,  $r(75) = 0.12$ ,  $Ps > 0.05$  for the full group. For East Asian and Euro-Canadian women separately, there was similarly no significant correlation between VPA and perceived genital arousal ( $r[37] = -0.06$  and  $r[38] = 0.09$ , respectively), nor between VPA and subjective sexual arousal ( $r[37] = 0.12$  and  $r[38] = -0.05$ , respectively, all  $ps > 0.05$ ). The very low magnitude of these correlations did not even approach significance indicating that they were not a result of insufficient power.

We also correlated VPA percent increase with domain scores on the FSFI—first on the full sample, then separately for each ethnic group. There was a significant negative correlation between VPA percent increase and the orgasm domain for all women,  $r(75) = -0.27$ ,  $P = 0.03$ , but the association lost significance when the Euro-Canadian and East Asian women were examined separately (Table 3). There were no significant correlations between VPA and the desire, arousal, lubrication, pain, or satisfaction domains, nor with the FSFI total score for either the full sample or the separate ethnic groups (Table 3).





**Figure 2** Effects of erotic film on (A) perceived genital arousal, (B) subjective sexual arousal, (C) positive affect, (D) negative affect, (E) anxiety, and (F) autonomic arousal in Euro-Canadian (N = 38) and East Asian (N = 37) women. \*\* $P < 0.05$ , \*\*\* $P < 0.001$ , error bars indicate standard error.

### *Predictors of Genital Arousal Response*

A linear regression was conducted to assess whether depression, anxiety, sexual knowledge, fear of negative evaluation, and sexual function predicted VPA percent increase in all women and Euro-Canadian women only. The overall model was not statistically significant for all women,  $R^2 = 0.29$ ,  $F(10,41) = 1.63$ ,  $P = 0.13$  or for Euro-Canadian women only,  $R^2 = 0.46$ ,  $F(10,19) = 1.60$ ,  $P = 0.18$ . A linear regression was also conducted on the East Asian women alone to assess whether these variables and heritage and mainstream acculturation predicted VPA percent increase. The overall model was not statistically significant,  $R^2 = 0.69$ ,  $F(12,9) = 1.66$ ,  $P = 0.23$ .

### **Discussion**

#### *Self-Identified Ethnic Group (East Asian vs. Euro-Canadian) and Sexuality*

Among the full sample of East Asian and Euro-Canadian participants, we found no differences between the two groups on the proportion who were currently in a relationship or were currently sexually active. While information pertaining to sexual history was not assessed, Euro-Canadian women were more likely to have engaged in a wide range of sexual activities with their current partner, including touching with clothing removed, touching a partner's genitals, being the recipient of oral sex, and penile-vaginal intercourse—the exception for this trend being that Euro-Canadian and East Asian women were equally likely to have engaged in hugging, kissing, or holding hands with a current partner, and to have performed oral sex on their partner. This is consistent with prior research that has found individuals of Asian ancestry to be much less likely to have engaged in most sexual activities than those of European descent [15,62–64]. Furthermore, with the exception of arousal, we found no significant differences between the two groups on most self-report measures of sexual response (i.e., sexual desire, lubrication, orgasm, satisfaction, and genital pain), a finding that is contrary to expectations and to previous research [9,15,19]. Our observation that East Asian women held less sexual knowledge than Euro-Canadian women replicates the findings of others [14,15,18]. East Asian and Euro-Canadian women did not differ on measures of depression, anxiety, or fear of negative evaluation, thus, any differences in sex-related variables could not be attributed to these psychological factors.

#### *Ethnicity and Psychophysiological Sexual Arousal*

There was no significant difference in VPA between the East Asian and Euro-Canadian women, although there was an overall increase in VPA seen in both groups with exposure to the erotic stimuli. Prior research has frequently presented compelling evidence for ethnic differences on a number of nonsexual measures of physiological arousal, including blood pressure, heart rate, skin conductance, and respiration rate. There has been no clear pattern in which direction these differences lie, and they may have varied depending on the measure employed, age, gender, and/or ethnicity of the participant (see [22,28,31,65]). However, other studies have observed a lack of ethnic differences on a number of physiological measures [23,26,32,66,67]. In light of the fact that results of prior research often vary depending on many factors and that ethnic differences in physiological measures in men may have limited generalizability for women, our null findings, while they are not in keeping with our hypothesis—that East Asian women would show an altered VPA response compared to Euro-Canadians—are not entirely inconsistent with the existing data.

The literature addressing ethnic differences in measures of physiological arousal has also noted that these measures are often influenced by social context and belief systems, as well as factors such as ethnicity of the researcher, or meaning ascribed to a particular situation. Unfamiliarity and novelty of a situation might increase uncertainty, which in turn could increase physiological reactivity [68]. This influence may have affected the current sample of women with the unfamiliarity of the laboratory environment, and vaginal photoplethysmography undoubtedly being a novel experience for most women. Sexual conservatism is another factor that might influence physiological arousal, and this has been linked to VPA [37]. Women of East Asian descent have higher levels of sexual conservatism, including greater sex guilt [39,40], perception of oneself as low in sexual arousability, and lacking sexual experience [15–18] and it follows that they might have shown an increase in VPA compared with Euro-Canadian women. In the present study however, both ethnic groups reported comparable rates of current sexual activity and self-reported sexual response. While this study did not measure sexual conservatism or guilt directly, these findings suggest that our sample of East Asian women were not more sexually conservative than the comparison Euro-Canadian group, and that participation in psychophysiological

sexual arousal testing would not be expected to elicit the heightened physiological reactivity.

Higher heritage acculturation has been linked to higher sexual conservatism, lower sexual knowledge, and lower sexual arousal in East Asian women when compared with their Caucasian counterparts (e.g., [15]). East Asian women in the current sample reported lower heritage acculturation scores than those observed in previous research [16,17,40], and thus, it is a possibility that East Asian women in this sample were too “westernized” to allow for an adequate test of the hypotheses. However, East Asian women in the current study reported lower levels of sexual knowledge and sexual arousal when compared with Euro-Canadian women, as has been observed in previous research [14–17], suggesting that despite lower heritage acculturation scores on the VIA, they were sufficiently different from the Euro-Canadian sample to allow comparisons between the two groups. In light of the present finding that there were no ethnic group differences in genital or subjective sexual arousal, it is not entirely surprising that among East Asian women only, heritage and mainstream acculturation similarly did not correlate with either self-report sexual arousal, or VPA. Our null findings cannot be attributed to lack of power given that the main effects of stimuli were associated with moderate to strong effect sizes and the *F* values for the interaction of group and stimuli were very low.

#### *Genital-Subjective Arousal Correlations*

It is often the case that studies employing psychophysiological and subjective measures fail to find concordance between these two indices of sexual arousal in sexually healthy young women [48]. When showing women woman-made erotic films vs. man-made erotic films, Laan et al. [69] concluded that “the increase in subjective sexual arousal related to the woman-made films seems to be elicited by specific film content and the meaning it conveys, and not by a specific contribution of increased peripheral (genital) feedback.” This proposal is supported not only in studies examining nonsexual physiological arousal (e.g., [32,34,35]), but also by the finding that women who scored higher on measures of sexual conservatism or sex guilt experienced increased physiological sexual arousal while watching erotic films [70]—perhaps because of increased discomfort while watching erotic films because of greater negative connotation assigned to those films—but to report less subjective sexual arousal. We there-

fore predicted that our East Asian sample might assign more negative meaning to watching erotic films than their more sexually liberal Caucasian counterparts. Despite our predictions, we found no difference in subjective sexual arousal between East Asian and Euro-Canadian women, nor did we find a correlation between physiological and subjective sexual arousal for East Asian women alone, Euro-Canadian women alone, or the full sample. It is possible that the East Asian women who took part in this study did not assign any difference in meaning to the erotic films than their Euro-Canadian counterparts, and thus both groups showed similar nonsignificant patterns in the correlation between their subjective and genital sexual arousal.

The present study itself consisted of two phases—an analysis comparing those women who did vs. did not elect to participate in physiological sexual arousal testing revealed Euro-Canadian women participating in the present study addressing physiological sexual arousal were not substantially different from Euro-Canadian women who did not continue on after completing questionnaires. East Asian participants, however, may have been more sexually liberal than their nonvolunteer counterparts and this may have contributed to their willingness to participate in a study on physiological sexual arousal that involved direct contact of the genitals with a probe. The possibility of selection bias cannot be overstated; however, it is often inherent in sexuality research and is exceedingly difficult to avoid. Previous research has attempted to understand the potential biases associated with volunteering for different levels of sexuality research by inviting participants to take part in a relatively innocuous study involving questionnaires only [70–74]. These studies revealed that among those willing to complete questionnaires on sexuality, there were significant differences between those who were and were not willing to participate in subsequent, more invasive, phases on aspects of sexuality. For example, that those agreeing to participate in an additional study involving genital plethysmography exhibited significantly lower levels of sex guilt and higher sexual experience than those who declined—a finding that is consistent with previous research [72,75,76]. Further, Wolchick [73,74] found that women electing to participate in vaginal photoplethysmography had less sexual anxiety, fewer objections to pornography, and a history of more sexual partners than those who declined.

Notably, there is no way of knowing whether volunteers for a questionnaire study on sexuality differ from the larger population from which they were drawn. It may be the case that more sexually liberal individuals are more likely than less sexually liberal individuals to participate in a questionnaire study of sexuality, and thus to continue on to a psychophysiological portion of the study. However, it is important to note that selection bias seems to be more extreme in studies involving measures of direct genital arousal than for those requiring only self-report [71–74], and while East Asian women who participated in the present study did differ on measures of acculturation from those who did not, there were no differences between participants and nonparticipants on direct self-report measures of sexuality. Further, those studies producing data on sexuality among East Asian and Euro-Canadian women would have also encountered the same challenges of questionnaire selection bias, and nevertheless revealed significant differences on a number of measures between ethnic groups (e.g., [9,14,15,18,19]). Thus, while this study addressed two groups of women who did not mirror what had been found in previous self-report research, we did not observe any volunteer bias in those who continued on to the physiological arousal testing, and do not view the unexpected equivalence of these groups on sexual behaviors and response at baseline to be a confounding factor that should influence their VPA response.

### Conclusion

While ethnicity has been previously linked to higher sexual conservatism, lower sexual knowledge, and lower self-report sexual arousal in East Asian women, the current findings suggest that these conclusions do not extend to physiological sexual responding. The present study also suggests that East Asian women and Euro-Canadian women who show similar ratings of sexual behaviors and self-report sexual arousal do not differ in physiological sexual arousal induced by an erotic film, nor is there any correlation between genital and subjective arousal for all women, East Asian women alone, or Euro-Canadian women alone. It is reasonable to conclude therefore that previously demonstrated ethno-cultural differences in self-report measures of sexual attitudes and functioning are not a by-product of underlying differences in physiological arousability. This has implications for treatment outcome studies that employ sexual psychophysiology as a targeted endpoint [44,77]; it

suggests that ethnic group is not necessarily a confounding factor when interpreting treatment effects on VPA.

### Acknowledgments

Funding for this study came from a UBC Hampton Research Grant awarded to LA Brotto.

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*Conflict of Interest:* LA Brotto is a member of the Sexual and Gender Identity Disorders workgroup for DSM-5.

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