ORIGINAL RESEARCH—WOMEN’S SEXUAL HEALTH

Chocolate and Women’s Sexual Health: An Intriguing Correlation

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ABSTRACT

Introduction. Historically chocolate has been reported to exert several effects on human sexuality, mainly acting as an effective aphrodisiac, increasing sexual desire, and improving sexual pleasure.

Aim. The aim of our study was to assess whether there is an association between daily chocolate intake and sexual function in a convenience sample of Northern Italian women.

Methods. A convenience sample of 163 women (mean ± SD age: 35.3 ± 9.2 years; body mass index [BMI]: 22.5 ± 3.5 kg/m²), recruited through advertising, completed an anonymous semistructured interview on recreational habits and questionnaires to assess sexual function (Female Sexual Function Index [FSFI]), sexual distress (Female Sexual Distress Scale), and depression (Beck Depression Inventory and Center for Epidemiological Survey Depression Scale).

Results. Complete data were available for 153/163 (93.8%) women. Participants who reported daily chocolate intake (Group 1: 120 women) were significantly younger than those (Group 2: 33 women) who did not report to eat chocolate (33.9 ± 0.8 years vs. 40.4 ± 1.6 years, respectively) (P = 0.0003), despite a similar BMI. Participants in Group 1 had significantly higher total (P = 0.002) and desire domain (P = 0.01) FSFI scores than participants in Group 2. No differences between the two groups were observed concerning sexual arousal and satisfaction, sexual distress and depression. Our data also confirm that aging has a high statistically significant impact on women’s sexual function.

Conclusions. It is alluring to hypothesize that chocolate can have either a psychological or a biological positive impact on women’s sexuality. In our sample women reporting chocolate consumption have higher FSFI scores than women who do not eat chocolate. However, when data are adjusted for age FSFI scores are similar, regardless of chocolate consumption.


Key Words. Female; Sexuality; Women; Chocolate

Introduction

At no other time has Nature concentrated such a wealth of valuable nourishment into such a small space as in the cocoa bean.

—Alexander von Humboldt (1769–1859), natural scientist

Culinary and ritual preparations as well as several positive claims and potential medical uses from the “beans” of Theobroma cacao can be traced historically and archaeologically [1]. The potential clinical impact of chocolate on overall human health has recently been suggested by several studies speculating, for instance, that dietary flavonoids from plain, dark chocolate may improve cardiovascular health through a direct antioxidant effects or antithrombotic mechanisms [2].
Arguably, chocolate also is considered the food with the greatest impact on mood [3]. It has been suggested that the mood-elevating properties of chocolate reflect its “drug-like” constituents. Indeed, chocolate contains several biologically active constituents (i.e., methylxanthines, biogenic amines, and cannabinoid-like fatty acids), all of which might evoke psychopharmacological and behavioral reactions, as well as psychological sensations, that parallel those of other addictive substances. Moreover, because many palatable foods stimulate endorphin release in the brain, the same mechanism most likely accounts for the improvement of mood observed after chocolate ingestion [3].

Historically, chocolate has been reported to exert several effects on human sexuality, mainly acting as an aphrodisiac, increasing sexual desire, and improving sexual pleasure [1]. However, to the best of our knowledge, there is a lack of studies regarding the potential correlation between chocolate intake and women’s sexual function.

The aim of our study was to assess whether daily chocolate intake affects sexual function in a convenience sample of Northern Italian women.

Subjects and Methods

From June 2003 to January 2004 we advertised our study by posting fliers within our hospital and at a local supermarket in the area. We recruited 163 consecutive women living in Northern Italy and not complaining of any sexual disorder. All participants anonymously completed: (i) a brief self-administered semistructured interview, including specific questions on common recreational habits (i.e., chocolate, coffee or alcohol intake, and cigarette smoking); (ii) the Female Sexual Function Index (FSFI) [4]; (iii) the Female Sexual Distress Scale (FSDS) [5]; (iv) the 21-item Beck Depression Inventory (BDI) [6]; and (v) the Center for Epidemiological Survey Depression Scale (CES-D) [7]. The FSFI is a multidimensional self-report instrument for the assessment of female sexual function that includes 19 items compiled in six domains (desire, arousal, lubrication, orgasm, satisfaction, and pain) [4]. For the purpose of this study we only considered the scores for the desire, arousal, and satisfaction domains. The FSDS is a 12-item instrument to measure sexually related distress in women [5]. We used two validated instruments to assess depression to overcome the limitations of each individual instrument. The scores for each instrument were calculated according to the recommended scoring system [4–7].

Subjects were recruited by advertising, within both our hospital and a local supermarket, with a poster detailing a study specifically aimed at: (i) investigating the overall sexual function in a Northern Italian subset of women, not specifically complaining of any sexual disorders, by means of a set of internationally validated questionnaires; (ii) statistically correlating the overall sexual function of this cohort of women with potential risk factors; and (iii) statistically correlating the overall women’s sexual function with few recreational habits (including cigarette smoking, coffee and chocolate intake). Volunteers did not receive any compensation for participating in this study.

We divided participants into two groups according to their reported daily consumption of chocolate: Group 1 included women answering “Yes” to the question “Do you usually eat some chocolate cube on a daily basis?” and Group 2 included women answering “No” to the same question.

We compared single time point data using a two-tailed Student’s \( t \)-test for paired/unpaired data, a Kruskal–Wallis test for repeated measures analysis, and a chi-squared analysis for the comparison of proportions. The analysis of variance included age and body mass index (BMI) as covariates. We used SAS/STAT (version 8.2) (SAS International, Heidelberg, Germany) to perform all statistical analyses. Data are presented as the mean \( \pm \) SEM. Statistical significance was defined as a \( P \) value of less than 0.05.

The study was conducted in accordance with the principles of research involving human subjects as expressed in the Declaration of Helsinki and was approved by the Ethical Committee of Scientific Institute, University Vita-Salute, San Raffaele, Milan, Italy.

Results

Out of the 163 women who responded to our advertising, 153 (93.8%) completed all questionnaires. Table 1 shows the general characteristics
of study participants. Interestingly, women who reported chocolate intake were significantly younger than those who did not. However, mean BMI was comparable in the two groups. Similar proportions of women reported eating daily chocolate or coffee intake ($\chi^2: 0.004; d.f. = 1, P = 0.95$). A higher proportion of women reported eating chocolate on a daily basis, than cigarette smoking ($\chi^2: 18.93; d.f. = 1, P < 0.001$), wine ($\chi^2: 18.94; d.f. = 1, P < 0.001$), or beer ($\chi^2: 18.95; d.f. = 1, P < 0.001$) consumption.

Table 2 reports the scores of the different psychosexual indexes in the two groups of study participants. Interestingly, both the FSFI total score and the FSFI sexual desire domain score were significantly higher in women reporting chocolate intake compared with women who did not. According to the FSDS score, chocolate intake did not affect overall women's sexual distress. Neither the BDI nor the CES-D inventory showed different mood levels between women eating chocolate every day and women who did not.

Participants were then stratified according to the amount of chocolate cube consumption: 29 participants (24.2%) reported eating 1–2 chocolate cubes daily, 8 (6.7%) reported eating ≥3 chocolate cubes, and 83 women (69.1%) reported eating some chocolate cubes in case of mood deflection. Among women with a daily chocolate consumption of 1–2 or ≥3 cubes, sexual function was similar to that of women with some chocolate consumption only “in case of mood deflection” (Kruskal–Wallis test: $P = 0.48; d.f. = 2$).

Table 3 reports the scores of the different psychosexual indexes in the two groups of study participants after adjustments for both age and BMI. When data are adjusted for age and BMI, the FSFI total scores and the FSFI score for the desire domain are similar in the two groups, that is, regardless of chocolate consumption.

**Table 2** Psychosexual evaluation scores (mean ± SE) among study participants stratified by chocolate consumption

<table>
<thead>
<tr>
<th>FSFI domain</th>
<th>Group 1</th>
<th>Group 2</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSFI desire</td>
<td>4.1 ± 0.1</td>
<td>3.5 ± 0.2</td>
<td>0.01</td>
</tr>
<tr>
<td>FSFI arousal</td>
<td>4.5 ± 0.1</td>
<td>4.1 ± 0.3</td>
<td>0.18</td>
</tr>
<tr>
<td>FSFI satisfaction</td>
<td>4.9 ± 0.1</td>
<td>4.4 ± 0.3</td>
<td>0.09</td>
</tr>
<tr>
<td>FSFI total score</td>
<td>29.3 ± 0.6</td>
<td>26.1 ± 1.7</td>
<td>0.002</td>
</tr>
<tr>
<td>FSDS</td>
<td>8.7 ± 0.8</td>
<td>9.8 ± 1.4</td>
<td>0.50</td>
</tr>
<tr>
<td>BDI</td>
<td>6.9 ± 0.6</td>
<td>6.0 ± 1.0</td>
<td>0.48</td>
</tr>
<tr>
<td>CES-D</td>
<td>17.8 ± 1.0</td>
<td>17.2 ± 1.1</td>
<td>0.76</td>
</tr>
</tbody>
</table>

FSFI = Female Sexual Function Index; FSDS = Female Sexual Distress Scale; BDI = Beck Depression Inventory; CES-D = Center for Epidemiological Survey Depression Scale.

**Discussion**

Our study shows that women who reported eating ≥1 chocolate cubes daily have higher FSFI scores for both sexual desire and overall sexual function than women who did not report eating chocolate. However, when data are adjusted for age and BMI, FSFI scores are similar in women who reported chocolate intake and those who did not. Second, in our cohort of women chocolate consumption seems to be independent of prevalence of sexual distress, depression, and BMI.

To our knowledge, and despite the number of studies examining the correlation between sexual health and well-known risk factors, there has been no such analysis of either dietary habits or lifestyle and sexual function in women. We therefore used principal components analysis to identify patterns of recreational habits and then examined the relationship between the potentially most intriguing patterns (i.e., the intake of ≥1 chocolate cubes) and several parameters of sexual function and mood deflection in a group of women representative of several different sociocultural and educational backgrounds.

Chocolate often is considered the food with the greatest impact on mood [3,8] and it has shown a potential impact on overall human health [2,9]. Addictive behavior is generally associated with drug and alcohol abuse or compulsive sexual activity. It has been suggested that chocolate may evoke similar psychopharmacological and behavioral reactions in susceptible individuals [8]. Chocolate, indeed, is the food most typically associated with craving and addiction—namely, “chocoholism”—together with other energy-dense foods, including salty and savory snacks [10]. Increasing data seem

**Table 3** Psychosexual evaluation scores (mean ± SE) among study participants stratified by chocolate consumption and adjusted for age and BMI

<table>
<thead>
<tr>
<th>FSFI domain</th>
<th>Group 1</th>
<th>Group 2</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSFI desire</td>
<td>4.0 ± 0.1</td>
<td>3.7 ± 0.2</td>
<td>0.10</td>
</tr>
<tr>
<td>FSFI arousal</td>
<td>4.4 ± 0.2</td>
<td>4.3 ± 0.3</td>
<td>0.14</td>
</tr>
<tr>
<td>FSFI satisfaction</td>
<td>4.8 ± 0.1</td>
<td>4.6 ± 0.3</td>
<td>0.68</td>
</tr>
<tr>
<td>FSFI total score</td>
<td>29.0 ± 0.7</td>
<td>26.5 ± 1.3</td>
<td>0.10</td>
</tr>
<tr>
<td>FSDS</td>
<td>8.9 ± 0.8</td>
<td>9.2 ± 1.6</td>
<td>0.90</td>
</tr>
<tr>
<td>BDI</td>
<td>7.0 ± 0.6</td>
<td>5.4 ± 1.2</td>
<td>0.22</td>
</tr>
<tr>
<td>CES-D</td>
<td>17.5 ± 0.9</td>
<td>18.0 ± 1.7</td>
<td>0.80</td>
</tr>
</tbody>
</table>

FSFI = Female Sexual Function Index; FSDS = Female Sexual Distress Scale; BDI = Beck Depression Inventory; CES-D = Center for Epidemiological Survey Depression Scale.
to indicate that the hedonic appeal of chocolate (fat, sugar, texture, and aroma) is likely to be the predominant determinant of such cravings [11,12].

However, sometimes chocolate is used for self-medication in dietary deficiencies (e.g., magnesium) or to balance low concentrations of neurotransmitters regulating mood, food intake, and compulsive behaviors (e.g., serotonin and dopamine) [8].

Gender is a significant factor affecting food choices [13,14]. Compared with men, women prefer sweets, have an increased sensitivity to the taste of sweets, and have a higher craving for sweets [15,16]. Moreover, chocolate cravings often are episodic and fluctuate with hormonal changes just before and during menses, suggesting a hormonal link and confirming the gender-specific nature of chocolate cravings [8,13,14,17,18]. Bruinsma and Taren [8] thus suggested that among women a combination of chocolate’s sensory characteristics, nutrient composition, and psychoactive ingredients, compounded with monthly hormonal fluctuations and mood swings, will ultimately generate chocolate cravings.

It is well known that sexual function is a complex neurovascular phenomenon under psychological and hormonal control [19–21]. Because chocolate has been recognized to have some general psychological effects and because of the assumption of a gender-specific nature of chocolate cravings, it seemed alluring to us to hypothesize that chocolate also might have a potential physiologically positive impact on women’s sexuality.

Chocolate, for instance, contains pharmacologically active substances such as methylxanthines (primarily theobromine, with a lower concentration of caffeine) and lipids chemically and pharmacologically related to anandamide (N-arachidonoylethanolamine), which is a brain lipid that binds to cannabinoid receptors with high affinity and mimics the psychoactive effects of plant-derived cannabinoid drugs [22–24]. Interestingly, di Tomaso et al. [22] showed that cocoa powder and chocolate actually contain three unsaturated N-acylthanolamines that could act as cannabinoid mimics either directly (by activating cannabinoid receptors) or indirectly (by increasing anandamide concentrations). These authors speculated that elevated anandamide concentrations could cooperate with other pharmacological components of chocolate (such as caffeine and theobromine) to produce a transient feeling of well-being. Moreover, Martinez-Gonzalez et al. [25] recently reported that anandamide induced changes in sexual performance in male rats. Interestingly, neuroimaging studies showed that chocolate may have a strong positive valence overlapping considerably with areas where increases in regional blood flow were evoked by cocaine (i.e., subcallosal region, putamen, thalamus, hippocampus, insula, and ventral tegmentum) [26,27]. It has been also demonstrated that the reward value of a food, which is an inherent component of most definitions of food palatability, also results from an increase in central opioid activity [28,29].

Furthermore, chocolate historically has been reported to affect human sexuality [1].

It has been demonstrated that exposure to the odor of chocolate is associated with significant reduction in electroencephalogram theta activity, compared with many other olfactory stimuli [30]. This result was coupled with the knowledge that a reduction in theta levels indicates a reduced level of attention together with less alertness and relaxation, all of which are properties important for good sexual health.

A meal high in carbohydrate increases the rate of tryptophan entrance in the brain, leading to an increased concentration of the mood-modulating neurotransmitter serotonin. An excessive carbohydrate intake by patients with atypical depression potentially may reflect self-medication that temporarily relieves the vegetative symptoms via an increased central serotonergic activity [31,32]. However, in our study we did not observe differences in BDI or CES-D scores in women who did not report chocolate consumption. These unexpected results were in agreement with previous reports in the literature [3,33,34]. Moreover, it has been postulated that, although ingestion of a high-carbohydrate meal can increase the rate of tryptophan, such a mechanism may be important under laboratory conditions, but is unlikely to be of significance after a typical meal [3]. The same authors also suggested that while there have been a series of hypotheses that chocolate’s mood-elevating properties reflect “drug-like” constituents, including anandamines, caffeine, phenylethylamine, and magnesium, the concentrations of these substances are so low as to preclude such influences. They also concluded that because all palatable foods stimulate endorphin release in the brain, this release might be the most likely mechanism to account for the elevation of mood.

Another peculiar finding in our cohort of women was the lack of correlation between choc-
Therefore, aging is confirmed as a significant risk to and regardless of the menopausal status [39,40]. Indeed, has been recently confirmed both relating function with a modification in sexual behaviors, men. A peculiar trend in the reduction of sexual previously and comprehensively debated for the women's sexual function similar to what has been showed that aging had a significant impact on obtaining social approval.

Regarding the need for respondents to anonymously self-assessed with potential distortions related to the need for respondents to obtain social approval.

Finally, the results of the analysis of variance showed that aging had a significant impact on women's sexual function similar to what has been previously and comprehensively debated for the men. A peculiar trend in the reduction of sexual function with a modification in sexual behaviors, indeed, has been recently confirmed both relating to and regardless of the menopausal status [39,40]. Therefore, aging is confirmed as a significant risk factor also for women's sexual dysfunction, as already stated in men [41].

This study has a number of additional limitations. We cannot exclude that unforeseen selection bias due to cultural and socioeconomic status may have affected participation in this study. Furthermore, we cannot exclude that respondents who completed and returned the questionnaires might have been more sexually active per se, that is, have the highest sexual desire profile, and also hold different food-related attitudes than those who did not complete the questionnaires. Therefore, our sample was probably not representative of the Italian female population. However, overall assessment was high, with 93.8% of all study questionnaires completed.

As a fourth limitation, because both health and taste factors are important in the food choice process, dedicated tools for studying these aspects of food choices are required. Therefore, the lack of a questionnaire addressing, for example, the issue of using food as a potential reward could be a bias in analyzing the correlations between chocolate intake and sexuality. According to this observation, most of the “Yes” respondents in our cohort reported eating chocolate in case of mood deflection. However, we did not find any significant correlation between both the questionnaires aimed at evaluating depression and the chocolate intake as an independent variable sustaining the predictivity model.

Conclusions

Notwithstanding their importance, relatively little is understood about the way in which women's recreational eating habits may influence their sexual behavior and lifestyles. It is alluring to hypothesize that chocolate can have either a psychological or a biological positive impact on women's sexuality. In our sample women reporting chocolate consumption have higher FSFI scores than women who do not eat chocolate. However, when data are adjusted for age FSFI scores are similar, regardless of chocolate consumption. Additional studies are needed to further explore this intriguing association.

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Conflict of Interest: None.
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