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The Menstrual Cycle and Sexual Behavior: Relationship to Eating, Exercise, Sleep and Health Patterns

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Abstract

Patterns of eating, exercise, sleep and health were investigated across 180 menstrual cycles of 89 women who engaged in sex with a male (n = 45; cycles = 85), a female (n = 21; cycles = 37) or abstained from sex (n = 33; cycles = 58) from January 2005 to December 2007 (10 contributed to 2 groups). Cycles were divided into 5 phases based on their luteinizing hormone surges. Daily questionnaires and saliva for IgA and cortisol analyses were obtained. Women indicated that they ate more ($p < .008$) and did not sleep as well ($p = .02$) during their luteal and premenstrual phases. Participants were less likely to experience food cravings and did not satisfy their cravings when they were ovulatory ($p < .001$). Additionally, a greater proportion of lesbians skipped breakfast ($p = .01$) and exercised less than heterosexuals ($p = .05$). Sexually active women had lower cortisol and IgA levels than abstinent women ($p = .02$). Our study discovered, and confirmed, systematic differences in eating, sleeping and health patterns across women's menstrual cycles.

Keywords

lesbian; IgA; cortisol; alcohol; food cravings and abstinence

Substantial research has been conducted on changes in women's sexuality across their menstrual cycles (Bullivant et al., 2004), but considerably fewer studies have been conducted on how other behaviors such as eating, exercise, sleep and health vary across the cycle. Additionally, little is known about how women who engage in sex with other women across a menstrual cycle might differ in their health patterns from women who abstain from or engage in sex with men.

Fessler (2003) theorized that women ate less and exercised more at ovulation because their behavior was directed towards mating at this time. In contrast, he argued that women increased their feeding behavior during their luteal phases when implantation was likely. His review of the literature supported his theory. Independent research also found that women ate more (Bryant et al., 2006) and reported more food cravings, especially for chocolate (Michener et al., 1999) and carbohydrates (Cohen et al., 1987) during the luteal phase of their cycles, although the chocolate craving may have a cultural origin (Zellner et al., 2004). Sternfeld et al. (2002) found that moderate levels of physical activity were positively correlated with cycle length. However, most research on exercise and the menstrual cycle has been conducted on women athletes (Goodman & Warren, 2005) and is therefore difficult to generalize to other women.

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As far as we know, comparable research into eating and exercise has not been conducted on lesbians across their menstrual cycles. Some studies of lesbian health behavior have reported that lesbians have a higher body mass index (BMI) (Case et al., 2004) and higher frequencies of obesity (Boehmer et al., 2007) and substance abuse (Ridner et al., 2006) than heterosexuals. Other studies have found the opposite (Heffernan, 1998) or mixed results (Heffernan, 1996).

Objectification and stigmatization theories have been used to explain the reported differences between lesbian and heterosexual obesity and substance abuse rates. Objectification theory (Kozee & Tylka, 2006) posits that lesbians are less concerned about the cultural norms of appearance than heterosexuals and therefore not as concerned about their eating behavior while stigmatization theory (Skidmore et al., 2007) posits that lesbian's increased weight and substance abuse result from the stress of identifying with a stigmatized social group.

In a review of the literature on sleep and the menstrual cycle, Baker and Driver (2007) reported that women complained more about sleep disturbances in their premenstrual and menstrual phases. Previously Driver and Baker (1998) reported that healthy women had more stage 2 sleep, higher spindle frequency activity and less rapid-eye movement sleep in their luteal phases than at other times during the cycle, but much of the work on sleep and the menstrual cycle has yielded inconsistent results (Parry et al., 2006). Preliminary work comparing sleep in lesbians and heterosexuals found that lesbians had shorter sleep durations than heterosexuals (Rahman & Silber, 2000).

Research on health and the menstrual cycle has focused primarily on premenstrual disorder (Winer & Rapkin, 2006) or eating disorders (Di Carlo et al., 2002; Edler et al, 2007) with few studies examining frequent illnesses such as colds and influenzas across the menstrual cycle (Brown et al., 1997). Estrogen's effects on the immune system tend to be positive (Cutolo et al., 1995), and progesterone's effects tend to be negative (Li et al., 1993); therefore, one might expect differences in frequent health problems across the cycle. It is unclear whether lesbians differ from heterosexuals in frequent health problems that are unrelated to eating and substance abuse.

Many of the studies comparing lesbians and heterosexuals are limited due to their reliance on mass surveys, different methods of classifying sexual orientation, lack of empirical data to assess exercise and fitness, and large age-data sets (Heffernan, 1996). Mixed results could also be attributed to different sampling strategies (Yancey et al., 2003; Heffernan, 1996).

Another limitation of previous research is the variety of ways menstrual phases are defined. Researchers have used as few as two to as many as 6 phases to examine the menstrual cycle (Cohen et al., 1987; Fessler, 2003) resulting in a lack of uniformity, consistency and duration. In this study we remedied the problem by only examining women with documented surges in luteinizing hormone (LH) to establish strictly defined menstrual cycle phases.

The goal of this study was to provide an overall health profile across women's menstrual cycles with verifiable LH surges and by sexual behavior. We report on the sleeping, eating, exercise and health patterns, including immunoglobulin A (IgA) and cortisol measurements across the menstrual cycle. Using participants who engaged in sex with other women or men or who abstained from sex allowed us to examine whether choice of sexual partner affected health patterns. Several theoretical approaches informed our research including: (1) Fessler 's theory (2003) which predicts that women display consummatory and mating behavior differentially across the menstrual cycle; (2) objectification theory (Kozee & Tylka, 2006) which predicts that lesbians are less concerned about their body images than heterosexuals and (3) stigmatization theory (Skidmore et al., 2007) which predicts that lesbians should be more stressed than heterosexuals.

Methods

Participants

The protocols for this project were approved by the institutional review board at the University of Hawaii. The study was conducted from January 2005 to December 2007 and was part of a larger project on the menstrual cycle. Eligibility criteria included: (1) regular menstrual cycles ranging from 25 to 35 days; (2) age between 18 and 40 years; (3) body mass index (BMI) between 18 and 40.2; (4) no history of autoimmune disease or use of medications that could affect the participants' reproductive hormones; and (5) no use of intrauterine devices or hormonal forms of birth control, pregnancy or lactation in the previous 6 months. Therefore, all of the participants had natural menstrual cycles and were using either barrier methods and/or coitus interruptus as their primary forms of birth control. None of the participants reported the use of diaphragms, foams or jellies.

Participants were recruited from the University of Hawaii at Hilo primarily through classroom visits and campus fliers. Potential participants attended an information session during which they filled out eligibility forms and signed informed consent forms. Between 70 and 80% of the women met the eligibility criteria, and the participation rate among the eligible women was 95%. We recruited 153 participants for the entire project of whom 89% (136) completed at least one menstrual cycle. For this paper, we present data on 89 participants because we excluded 38 women who used hormonal forms of birth control and 9 who did not have detectable LH surges during the study. The 9 participants without LH surges were distributed evenly across the three groups (9% in the lesbian, 10% in the heterosexual and 6% in the abstinent group).

We had two strict criteria for including a participant's cycle data: (1) the cycle had to have a detectable LH surge, and (2) if the participant engaged in sexual behavior, it had to be exclusively with males or females during the cycle (data from 5 cycles were excluded because the participant engaged in sex with both males and females during the cycle).

Participants' cycles were divided into three groups. The first group included women who engaged in sex exclusively with other women (lesbian group), the second group included women who engaged in sex exclusively with men (heterosexual group), and the third group included women who abstained from sex (abstinent group) during a particular menstrual cycle. Women contributed from one to three cycles to a sexual behavior group (Table 1). The proportion of participants contributing 1, 2 or 3 cycles did not significantly differ across the groups (Chi-square(3) = 1.37;p = .85). Of the 89 participants, 9 contributed data to the abstinent and heterosexual groups, and one to the lesbian and heterosexual groups. In all, we examined 180 cycles, 58 for the abstinent group, 85 for the heterosexual group and 37 for the lesbian group.

Procedure

On the day of enrollment in the study, height and weight measurements were obtained from each participant to calculate the BMI (wt in kg/(ht in m)^2). Percent body fat was also measured through bioelectrical impedance analysis (BIA). Participants began the study on Day 1 of their first menstrual bleed after enrollment. Each participant was partnered with a researcher who contacted them every 1 to 2 weeks to ensure that protocols were followed and to pick up completed questionnaires and saliva samples regularly.

Participants were asked to complete daily questionnaires that obtained data on their eating behavior (a three-point scale in which 1 = less than usual, 2 = about the same as usual, 3 = more than usual, so each participant could act as her own control), whether they ate breakfast, lunch and dinner, number of sweets/salty cravings (each day participants checked whether they

had experienced a craving for chocolate, sweet, salty and fast food) and whether they satisfied their cravings (participants indicated what they had eaten to satisfy a particular craving), and intake of spices with immunological properties (checked a list of 6 types of spices) and phytoestrogens (nuts/tofu)), alcohol use (5-point scale from 0 to 5 or more drinks), minutes and quality of sleep (same scale as the amount of food), exercise activities (pedometer reading and whether they exercised), and number of symptoms and health problems experienced in the previous 24 hour period (headache, muscle pain, dizziness, skin rash, cold sore, cold or influenza, fever, chills, a genital herpes flare, painful or bloody urination, yeast infection or vaginal irritation/itching). These health problems were chosen because they were the most frequently reported problems in a pilot study (Brown et al, 1997). Participants filled out the questionnaire every day of a cycle but only data from 15 questionnaires (3 days X 5 phases; see below) were used in the analyses. We did not use standardized tests.

Daily saliva samples were collected and used to analyze IgA and cortisol levels via an enzyme-linked immunosorbent assay (ELISA). Participants collected saliva samples in the evening to minimize the influence of transient daily stressors. Saliva was collected through the drool method after the participants thoroughly rinsed their mouths, but before they brushed their teeth to eliminate blood contaminants. All saliva samples were frozen. ELISA assays were conducted using the kits and methodology obtained from Salimetrics LLC. All of a participant's saliva samples were assayed on the same day, and each was double plated. Results from the ELISA analyses were included only if the coefficient of variation between the two samples was 15.2 or below. If a participant had data for 4 of the 5 phases, the relevant cell means were used as missing values. If a participant had fewer than 4 complete phases, data for IgA and cortisol were not analyzed for that cycle.

The LH surge was determined using Assure Ovulation Predictor kits (the 9 day version, Contraception Technology, San Diego, CA) establishing ovulation. The cycle then was divided into 5 phases based on the day of the LH surge and time of menstrual bleeding. The menstrual phase consisted of the first day of menstruation (Day 1) and the subsequent 2 days, the follicular phase of days 5, 6 and 7, the ovulatory phase of the day of the LH surge and the subsequent 2 days, the luteal phase of days 7, 8 and 9 after the LH surge and the premenstrual phase of the 3 days prior to the next menstrual flow. Data were averaged across the 3 days defining a phase for all analyses.

Statistical Analyses

All data were analyzed using SPSS (VERSION 15). Univariate analysis of variance (ANOVA) was used to examine group differences in age, percent body fat, BMI and cycle length across the 3 sexual behavior groups. Repeated measures ANOVA designs [Participants(Ppts)/Groups (3 sexual behavior groups) X Phases (5 phases of the menstrual cycle)] were used to examine the following dependent variables: the quality and duration of the prior night's sleep, pedometer readings, self-reported exercise, whether the participant ate breakfast, lunch and dinner, self-perceived amount of food eaten, food cravings including the type of craving and whether the participant satisfied the cravings, alcohol intake, intake of spices and phytoestrogens, number of reported health symptoms, salivary IgA and cortisol levels. For the sexual behavior group effects, analysis of covariance was used in the Ppts/Groups X Phases design with age, BMI and number of cycles a participant contributed as covariates. The criteria for including potential confounding variables (age, % body fat, BMI, cycle length) in multivariable analyses was a significant group difference at the $p < .05$ level. Because the covariates relations to outcomes were linear, and we expected curvilinear phase effects, we did not use analysis of covariance in examining either the phase effects or the sexual behavior group X phase interactions. The only dependent variable that was highly skewed was salivary IgA, and it was log transformed prior to the analyses. The standard errors for the analyses were similar indicating that the

homogeneity of variance assumption was consistently met. All of the statistically significant differences that we report were also significant in multivariate analyses. The probabilities for the phase and interaction effects were corrected using the Greenhouse-Geisser correction which corrects for failing to meet the sphericity assumption, homogeneity of covariance. This is a conservative correction (Quinn & Keough, 1991).

Because the participants began data collection on the first day of menstruation after recruitment, potential confounding existed between the day of cycle and the day of the study for the first cycle. We analyzed the data for all dependent variables using a Ppts/Group (1^{st} (n = 58; $50_{\text{for cortisol}}$), 2^{nd} (n = 63; $50_{\text{for cortisol}}$) or 3^{rd} (n=59; $40_{\text{for cortisol}}$) menstrual cycle after recruitment) X Phase ANOVA. We found three cycle X phase interactions for minutes of sleep, number of health symptoms and cortisol levels. However, neither minutes of sleep nor cortisol levels varied across the phases, so the potential confounding did not affect those analyses. The number of health symptoms did have a phase effect so we analyzed these data using only cycles 2 and 3.

Results

Demographics

Women in the lesbian and heterosexual groups were significantly older than women in the abstinent group. Additionally, women in the lesbian group had significantly higher BMIs than women in the heterosexual and abstinent groups (Table 1). The groups did not differ in terms of their percent body fat or menstrual cycle lengths.

Menstrual Cycle Phase Associations

Women in all groups perceived themselves as eating more food in their luteal and premenstrual phases than in their menstrual, follicular and ovulatory phases (Table 2). This perceived difference did not translate into the number of reported meals. Women were just as likely to report eating breakfast, lunch and dinner across all phases. The actual amount of food eaten is unknown. The number of reported food cravings was curvilinear (quadratic trend analysis: $F(1,177) = 22.1$; $p < .001$ and cubic trend analysis: $F(1,177) = 22.1$; $p < .001$) with significantly higher cravings in the menstrual phase of the cycle. Food cravings significantly declined in the follicular and ovulatory phases and then significantly rose again in the luteal and remained high in the premenstrual phase. When we examined particular food cravings, we found that women reported significantly increased cravings for sweets and chocolate during their menstrual phase and significantly decreased cravings for sweets and chocolate during their ovulatory phase. Additionally, the participants were significantly more likely to satisfy their cravings for sweets and chocolate during their menstrual phase and significantly less likely to satisfy these cravings during their ovulatory phase. Cravings for salty/fast food did not significantly vary across the phases. Interestingly, participants reported eating significantly more nuts and tofu in their menstrual phases (Table 2).

Women reported sleeping better in their menstrual, follicular and ovulatory phases than in their premenstrual phase. Use of spices, pedometer readings, exercise, the number of reported health symptoms, IgA levels and cortisol levels did not differ significantly across the phases.

Associations with Sexual Behavior

Lesbians perceived themselves as eating less food than heterosexuals, but the overall group difference did not reach statistical significance. When we examined whether the participants reported eating breakfast, lunch and dinner, we found that a significantly lower proportion of lesbians ate breakfast than abstinent women but eating lunch and dinner did not differ among

the groups (Table 3). Cravings for sweets, chocolate, salty and fast foods were the same across the groups and were satisfied to the same extent.

Lesbians engaged in daily exercise significantly less often than the heterosexuals (Table 3). Both lesbians and heterosexuals had significantly lower levels of IgA and cortisol than the abstinent women, but they reported health problems at the same rate as abstinent women. The group associations for the sleep variables did not significantly differ (Table 3).

No main effect was observed across the groups for alcohol consumption (Table 3) but a possible sexual behavior group X menstrual phase interaction was observed ($F(8,708) = 1.98$; $p < .05$). Lesbians increased, while the heterosexuals decreased, their alcohol consumption across the phases. Abstinent women consumed alcohol in consistent amounts across the menstrual cycle. Both lesbians and abstinent women drank significantly more than the heterosexual participants during their ovulatory and premenstrual phases (Table 4). Also a sexual behavior group X menstrual phase interaction was observed for nuts and tofu consumption. The heterosexual group ate fewer nuts and tofu during the menstrual phase than the other two groups but the groups did not differ during the other four phases. None of the other sexual behavior group X menstrual phase interactions reached statistical significance.

Discussion

Like Fessler's (2003) report of a periovulatory decrease in food intake, we found that women perceived that they ate less than usual prior to ovulating than in their luteal phase. We also found that women reported a decreased number of food cravings during ovulation with cravings peaking in their luteal through menstrual phases. When we examined specific food cravings, we found that women were less likely to crave and eat sweets and chocolate during their ovulatory phase than at other times of their cycle. The increase in food cravings, especially for carbohydrates, during the luteal phase corresponds to an increase in energy costs associated with building up the endometrium for possible implantation (Strassmann, 1996). Unlike Fessler (2003), we did not find phase differences in pedometer readings or in the exercise patterns of our participants. In fact, both of these variables were incredibly stable across the phases of the menstrual cycle. In a companion study (Brown & Morrison, 2008), we reported increased sexual activity at mid-cycle in these participants, similar to the increases found in other research on sexual behavior and the menstrual cycle (Bullivant et al., 2004). Therefore, our data provide limited support for Fessler's theory that the drop in preovulatory eating behavior is an adaptive shift in which women move from consummatory behaviors to mating behavior.

We found additional evidence that women's behavior was associated with their menstrual phases and perhaps the hormonal differences across those phases. First, similar to other researchers we found that the women reported decreased quality of sleep during their luteal phases. This replicated the findings reported by Baker and Driver (2007) and probably represents a natural rhythm in healthy women. Additionally, women increased their consumption of tofu and nuts, foods high in phytoestrogens (Gonzalez & Salas-Salvado, 2006; Thompson et al., 2007), during their menstrual phase, a time when both progesterone and estrogen levels are at their lowest levels. This was a preliminary finding that should be replicated. Contrary to our predictions, however, we found women reported similar levels of health problems, use of spices with immunological properties and IgA levels across their menstrual cycles.

Despite attempting to control for BMIs in the current study, the lesbian participants had higher BMIs than heterosexual and the abstinent women. Many studies have found higher BMIs in lesbians (Boehmer et al., 2007; Case et al., 2004), which may be associated with “stress” eating. We found that both lesbians and heterosexuals had lower cortisol and IgA levels than abstinent

women, but their cortisol and IgA levels did not differ from each other, indicating that lesbians in the current study were not more stressed, either mentally or physically, than heterosexual women. Therefore, it is unlikely that the lesbian's increased BMIs resulted from “stress” eating as predicted by stigmatization theory.

A smaller proportion of lesbians engaged in daily exercise than the heterosexuals. Also a lower proportion of lesbians ate breakfast than the abstinent women. Eating breakfast has an inverse relationship to BMI (Timlin et al., 2008), so not eating breakfast is associated with increased BMI. The BMI differences that we found could be explained by the facts that the lesbians, in this particular study, engaged in less healthy eating habits and did not exercise as much as the heterosexuals or abstinent women. Other research found that lesbians reported being unsure about what constitutes healthy eating (Bowen et al., 2006) and that they reported lesbian-specific barriers to getting regular exercise (Brittain et al., 2006). Our results also support objectification theory in that lesbians may be less concerned about their body images than heterosexuals and therefore pay less attention to eating and exercise.

Lesbians did not differ in their overall alcohol consumption from the other groups but did drink more than the heterosexuals during certain phases of their cycles. This latter difference might explain some of the mixed results published on substance abuse and lesbians as noted in Heffernan (1998), especially if data were collected during particular phases of the cycle. It was, however, a preliminary finding deserving of further research.

Finally, we want to emphasize that lesbians had more similarities to heterosexual and abstinent women than differences in our study. Our findings must be treated with caution because: (1) we used a convenience sample that may have resulted in selection and/or participation bias, both of which could affect the generalizability of the results; (2) we had a small sample size, especially in the lesbian group; and (3) because we performed multiple statistical tests, some of our differences might be due to chance variation. Nonetheless, we found, for the most part, that lesbians were similar to other women in their eating, sleeping and health patterns and that these patterns varied across the phases of the menstrual cycle.

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Table 1

Characteristics of the Study Groups and Number of Cycles each Participant Contributed to the Study.

Variable	Lesbian	Heterosexual	Abstinent	F (2,177)	P
Age, Mean(S.D.)	28.0^{A} (6.93)	26.1 ^{A} (5.83)	24.2 (4.53)	5.04	.007
% body fat Mean(S.D.)	31.2 (8.55)	28.0 (7.32)	29.8 (6.53)	2.78	.06
BMI Mean(S.D.)	26.3^{HA} (6.38)	23.7 (3.95)	24.3 (3.20)	4.48	.01
Cycle length Mean(S.D.)	29 (418)	29 (4.08)	28 (4.22)	.84	.43
No. contributed 1 cycle	10	17	14	NA	NA
No. contributed 2 cycles	6	16	13	NA	NA
No. contributed 3 cycles	5	12	6	NA	NA

A and H indicate that the superscripted group significantly differed from the abstinent or heterosexual, respectively, in post-hoc analyses.

Table 2

Menstrual Cycle Phase in Relation to Eating, Activity, Sleep and Health. Means and standard errors (in parentheses), and the degrees of freedom for the F-ratios are provided.

	Phase of Menstrual Cycle						
Variable	**M**	**F**	**O**	**L**	**P**	**F**	**P**
[1] Amount of Food	1.87[L] (.04)	1.82[L,P] (.04)	1.86[L] (.04)	1.97 (.03)	1.93 (.03)	3.61 (4,708)	.008
[2] Breakfast	.74 (.02)	.72 (.03)	.70 (.03)	.75 (.02)	.75 (.02)	1.1 (4,708)	.35
[2] Lunch	.90 (.02)	.89 (.02)	.90 (.02)	.89 (.02)	.88 (.02)	.48 (4,708)	.74
[2] Dinner	.94 (.01)	.95 (.01)	.92 (.02)	.93 (.01)	.93 (.01)	.64 (4,708)	.63
[3] # of Cravings	.70[F,O,P] (.05)	.46[L,P] (.04)	.39[L,P] (.04)	.61 (.04)	.58 (.05)	12.44 (4,708)	<.001
[2] Cravings for sweet/chocolate	.39[F,O,L,P] (.03)	.26 (.02)	.21[M,F,L,P] (.02)	.30 (.02)	.30 (.03)	9.53 (4,708)	<.001
[2] Satisfy sweet/chocolate	.32[F,O,L,P] (.03)	.22 (.02)	.17[M,F,L,P] (.02)	.24 (.02)	.24 (.02)	6.95 (4,708)	<.001
[3] Spices	.91 (.07)	.90 (.06)	.85 (.07)	.90 (.07)	.89 (.06)	.25 (4,708)	.90
[1] Nuts/Tofu	.52[F,O,P] (.04)	.42 (.04)	.40 (.04)	.44 (.04)	.42 (.04)	2.67 (4,708)	.03*
Pedometer (# of steps)	7651 (362.95)	7601 (288.61)	7788 (338.77)	7605 (244.92)	7583 (291.02)	.15 (4,680)	.94
[2] Exercise	.38 (.03)	.37 (.03)	.35 (.03)	.34 (.03)	.31 (.03)	1.79 (4,708)	.13
Minutes of Sleep	475 (5.77)	471 (5.42)	471 (5.35)	473 (5.25)	472 (5.54)	.14 (4,708)	.97
[1] Quality of Sleep	2.01[P] (.04)	2.01[P] (.03)	2.00[P] (.03)	1.96 (.03)	1.90 (.04)	2.87 (4,708)	.02*
[1] [o]Health	.44 (.05)	.38 (.05)	.36 (.05)	.35 (.05)	.40 (.05)	.94 (4,480)	.44
IgA (log amount)	1.4 (.03)	1.4 (.03)	1.39 (.03)	1.41 (.03)	1.43 (.03)	.74 (4,648)	.55
Cortisol (amount)	.11 (.02)	.13 (.02)	.15 (.02)	.12 (.02)	.14 (.02)	1.06 (4,548)	.36

M,F,O,L and P indicate that the superscripted phase significantly differed from the menstrual, follicular, ovulatory, luteal or premenstrual phase, respectively, in post-hoc analyses.

[1]Variable had 3 levels (1 = less than usual, 2 = about the same as usual, 3 = more than usual) and nuts/tofu has 3 levels (0=none consumed, 1 = nuts or tofu consumed, 3 = both nuts and tofu consumed)

[2]Variable had two levels (0=absence, 1=presence)

[3]# of cravings and spices (range 0 to 5); Health symptoms (range 0 to 4)

*with more conservative tests this effect would not reach statistical significance

Table 3

Relation of Sexual Orientation to Eating, Activity, Sleep and Health. Means and standard errors (in parentheses) and the degrees of freedom for the F-ratios are provided.

Variable	Lesbian	Heterosexual	Abstention	F	P
[1] Amount of Food	1.82 (.05)	1.93 (.03)	1.92 (.04)	2.02 (2,174)	.14
[2] Breakfast	.67[A] (.04)	.73 (.02)	.81 (.03)	4.18 (2,174)	.02*
[2] Lunch	.88 (.02)	.88 (.01)	.90 (.02)	.67 (2,174)	.51
[2] Dinner	.94 (.01)	.93 (.01)	.94 (.02)	.22 (2,174)	.80
[3] # of Cravings	.63 (.06)	.50 (.04)	.50 (.05)	1.95 (2,174)	.15
[2] Cravings for sweet/chocolate	.34 (.04)	.26 (.02)	.27 (.03)	1.76 (2,174)	.18
[2] Satisfy sweet/chocolate	.83 (.06)	.74 (.04)	.68 (.05)	2.13 (2,174)	.12
Alcohol see Table 4	.50 (.07)	.40 (.05)	.50 (.06)	1.16 (2,174)	.32
[3] Spices	.96 (.11)	.92 (.07)	.76 (.08)	1.39 (2,174)	.25
[1] Nuts/Tofu	.49 (.06)	.45 (.04)	.39 (.05)	.82 (2,174)	.44
Pedometer (# of steps)	6772 (496.64)	7912 (329.01)	8109 (400.19)	2.40 (2,167)	.09
[2] Exercise	.29[H] (.04)	.42 (.03)	.35 (.03)	3.07 (2,174)	.05*
Minutes of Sleep	475 (8.39)	480 (5.42)	464 (6.60)	1.80 (2,174)	.17
[1] Quality of Sleep	2.03 (.05)	1.94 (.03)	1.98 (.04)	.91 (2,174)	.40
[3] Health	.49 (.07)	.47 (.05)	.41 (.06)	.50 (2,174)	.61
IgA (log amount)	1.33[A] (.05)	1.38[A] (.03)	1.5 (.04)	4.46 (2,159)	.01*
Cortisol (amount)	.07[A] (.03)	.12 [A] (.02)	.19 (.02)	4.34 (2,134)	.02*

A,H and L indicate that the superscripted group significantly differed from the abstinent, heterosexual or lesbian group, respectively, in post-hoc analyses.

[1]Variable had 3 levels (1 = less than usual, 2 = about the same as usual, 3 = more than usual) and nuts/tofu has 3 levels (0=none consumed, 1 = nuts or tofu consumed, 3 = both nuts and tofu consumed)

[2]Variable had two levels (0=absence, 1=presence)

[3]# of cravings and spices (range 0 to 5); Health symptoms (range 0 to 4)

*with more conservative tests this effect would not reach statistical significance

Table 4

Sexual Orientation Groups X Menstrual Phase Interaction for Alcohol. Means and standard errors (in parentheses) are provided. Alcohol was coded using a 5-point scale from 0 to 5 or more drinks.

Phase	Lesbian	Heterosexual	Abstention	F (2,177)	P
M Phase	.40 (.09)	.49 (.07)	.52 (.09)	.38	.69
O Phase	.56 [H] (.12)	.27 (.05)	.53 [H] (.10)	3.81	.02*
P Phase	.62 [H] (.10)	.33 (.06)	.56 [H] (.10)	3.65	.03*

H indicates that the superscripted group significantly differed from the heterosexual groups in post-hoc analyses.

* with more conservative tests this effect would not reach statistical significance