Association of Physical and Behavioral Characteristics with Menstrual Cycle Patterns in Women Age 29–31 Years

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We examined the association between menstrual cycle characteristics (cycle length, variability, and bleeding length) and physical and behavioral attributes in 766 women age 29–31 years. Menstrual cycle data were prospectively recorded as part of the Menstruation and Reproductive History Study of college women in Minnesota, begun by Alan Treloar in 1934. Data on lifetime height, weight, physical activity, alcohol and caffeine consumption, and smoking history were collected in 1990 using a self-administered questionnaire. Cycle variability, as measured by the standard deviation of the cycle length, was increased, and menstrual cycles ≥42 days in length were more common among women in the lowest quartile of Quetelet index [odds ratio (OR) for long cycle = 1.6; 95% confidence interval (CI) = 0.82–3.0] and among the most physically active (OR = 1.7; 95% CI = 0.93–3.1). Long menstrual cycles were less common (OR = 0.40; 95% CI = 0.22–0.73) among women who drank alcohol than among nondrinkers. Variable or long menstrual cycles may reflect anovulation and relatively low levels of estrogen exposure. We would expect, based on our data, reduced estrogen exposure among lean women, physically active women, and those who do not consume alcohol. These findings suggest an explanation for the reported associations between these factors and breast cancer risk. (Epidemiology 1996;7:624–628)

Keywords: menstrual cycles, bleeding, smoking, weight, height, alcohol drinking, physical activity, caffeine.

The ovarian steroids (estrogen and progesterone) are important factors influencing the development of many diseases. Exogenous estrogens have been associated with an increased risk of some diseases (for example, estrogen replacement therapy and endometrial cancer[1]) and with a decreased risk of others (for example, oral contraceptives and ovarian cancer, estrogen replacement therapy and osteoporosis or cardiovascular disease[2-4]). The role of endogenous hormones is less clear, perhaps in part because it is difficult to characterize differences between women in hormones that inherently vary by time of the cycle as well as by age.

Menstrual cycle characteristics such as cycle length or variability or bleeding duration may be influenced by a variety of endogenous and exogenous factors affecting the pituitary-hypothalamus-ovarian axis.[5] Anthropometric and behavioral factors that affect the risk of certain diseases may do so through their effects on hormone levels or metabolism. Examples of these factors include body mass, exercise, smoking, and alcohol consumption.[6-8] Only a few population-based epidemiologic studies have examined the relation between these factors and menstrual cycle length or variability[9,10] or bleeding patterns,[11-13] although clinical studies indicate that extreme situations, such as eating disorders and strenuous exercise, can lead to anovulation and amenorrhea.[14,15]

We analyzed menstrual patterns from 766 women who had recorded menstrual diary data during ages 29, 30, and 31 years as part of the Menstruation and Reproductive History Study begun in 1934 by Alan Treloar.[16] A recent follow-up of these women collected data on weight, height, physical activity, alcohol and caffeine consumption, and smoking habits at specific ages.[17] We used these data to assess the relations between these factors and the prospectively recorded menstrual cycle characteristics.

Methods

Participants in the Menstruation and Reproductive History Study recorded beginning and ending dates of bleeding periods on calendar cards that were collected annually along with a questionnaire that obtained information about pregnancies, hormone use, surgery, and other medical conditions.[16] Between 1934 and 1939, 1,807 women under age 25 years (mostly college stu-

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dents from Minnesota) enrolled in this study, and 1,134 of these women contributed 5 or more years of menstrual data. This group of 1,134 women represents the study cohort. In 1989, a follow-up study of the cohort was begun. Information necessary for tracing (that is, name, date of birth, and last known address) was available for 997 of the women, and 943 of these (94.6%) were successfully located by 1991. Tracing procedures have been described previously.[18] A self-administered questionnaire was completed by 874 respondents, of whom 158 were proxies (most often a daughter or husband).

We analyzed the menstrual cycle patterns between ages 29 and 31 years, because this interval is relatively unaffected by menarche or menopause-related influences on cycle length or variability,[16] and it corresponds to the age interval represented by much of the questionnaire data. We chose six *a priori* as the minimum number of cycles needed to calculate summary statistics; we excluded 52 women who did not have at least six cycles with bleeding start and stop dates during the 3-year period (because of hormone use, pregnancy, or other breaks in recording). We excluded an additional 56 women who had stopped recording menstrual cycle information before age 29 years, leaving 766 women in the sample for analysis.

We eliminated 75 cycles shorter than 15 days because of our concern about the plausibility of a menstrual cycle of this length. These represented less than 0.5% of all menses recorded during ages 29–31 years and were not disproportionately associated with a small group of women. We also eliminated the first postpregnancy cycle, because this first cycle is more likely than later cycles to be anovulatory.[19] The menstrual records included information on "single" and "sustained" hormone treatments for menstrual disorders. During ages 29–31 years, 1% and 11% of the women recorded one or more single or sustained hormone treatment, respectively. The sustained codes were often recorded for an entire calendar year rather than with specific start and stop dates. Because of uncertainty about the type and timing of these medications, we eliminated data from the 3 months following a recorded single hormone treatment and from the 12 months following a sustained hormone treatment counted from the end of the year in which the sustained treatment was recorded.

The mean age of respondents to the questionnaire was 73 years (range = 63–81 years). The questionnaire data included current height and weight at age 30 years [which we used to calculate the body mass or Quetelet index (kg per m^2)], physical activity during ages 23–34 years (two questions concerning participation in vigorous sports such as jogging, swimming, tennis, dancing, and heavy physical activity at work, with response categories of less than once per week, once per week, or every day), and usual consumption (cups per week) of caffeine-containing coffee, tea, and soft drinks, and beer, wine, and liquor between ages 20 and 40 years. We calculated alcohol consumption (13.2 gm per can or bottle of beer, 10.9 gm per glass of wine, and 15.1 gm per drink of liquor[20]) and caffeine consumption per day (99 mg per cup of coffee, 35 mg per cup of tea, and 45 mg per soft drink[21]) from these data. Smoking history was obtained for each age starting at age 10 years. Reproductive history included the date and outcome of each pregnancy and was used to supplement information from the prospectively recorded data.

TABLE 1. Menstrual Cycle Characteristics of 766 Women Who Prospectively Recorded Data from at Least Six Menstrual Cycles between Ages 29 and 31 Years

Characteristic (per Woman*)	Mean or Percentage	SD	Range
Mean cycle length (days)			
All subjects	28.9	4.14	22.6–97.3
12 subjects excluded†	28.6	2.73	22.6–42.2
Standard deviation of cycle length (days)			
All subjects	3.4	3.62	0.42–66.3
19 subjects excluded†	3.0	1.87	0.42–11.9
Mean bleeding duration (days)			
All subjects	5.3	0.97	1.6–11.3
16 subjects excluded†	5.2	0.89	1.6–7.8
Percentage with frequency of cycles of length (days)*			
15–22	2.3		
23–25	17.7		
26–28	42.6		
29–31	23.4		
32–34	8.0		
35–41	4.3		
42–180	1.7		
Percentage with at least one cycle‡			
≤22 days	10.2		
≥42 days	9.7		
Percentage with at least one bleeding duration‡			
≤3 days	11.2		
≥8 days	12.5		

* Analysis of all available cycles (N = 20,581).
† Based on DFFIT regression diagnostics procedure.
‡ Analysis of six randomly selected cycles per woman (N = 4,596).

We calculated cycle length as the number of days from the start of one bleeding period through the day before the start of the next recorded menses. We calculated bleeding duration as the number of days from the start of one menstrual bleeding period through the last day of bleeding before an indication of the end of menses was recorded.

We used the mean cycle length, cycle standard deviation (SD), and bleeding duration as dependent variables in linear regression models. We assessed the normality assumption for the linear regression procedures using a variety of residual plots and regression diagnostic procedures.[22] To examine the effects of observations with large residuals on parameter estimates, we excluded up to 3% of the observations with the most extreme values as detected using the difference in fit (DFFIT) procedure. Most of the residual outliers were in the upper tail of the distribution of the dependent variable (>3 SD above the mean), and we excluded them from the analysis (Table 1). The natural log transformation of the dependent variables did not alter the associations we observed; therefore, these results are not presented.

We also analyzed the occurrence of long cycles (defined as ≥42 days, corresponding to the upper 2% of the

TABLE 2. Personal Characteristics and Menstrual Cycle Length and Variability among Women Age 29–31 Years*

		Mean Menstrual Cycle Length‡,§		Standard Deviation of Cycle Length‡,‖		At Least One Cycle ≥42 Days¶	
Characteristic†	Number	Slope	Standard Error (Slope)	Slope	Standard Error (Slope)	Odds Ratio	95% CI
Quetelet index (kg/m²)							
14.0–19.9	160	0.647	0.275	0.557	0.190	1.58	0.82–3.03
23.0–37.8	172	−0.080	0.270	0.188	0.186	1.18	0.60–2.30
Height (per 10 cm)	733	−0.072	0.180	0.049	0.124	1.12	0.72–1.75
Daily physical activity (vigorous sports or at work)	141	0.277	0.268	0.404	0.186	1.69	0.93–3.06
Drank alcohol							
1–29 gm/day	459	−0.289	0.246	−0.348	0.170	0.41	0.23–0.75
≥30 gm/day	38	−0.149	0.526	−0.869	0.365	0.27	0.06–1.27
Smoked at age 29, 30, and 31 (all years)	247	0.381	0.246	0.187	0.169	1.14	0.61–2.15
Caffeine (coffee-cup equivalents/day)** ≥3	226	−0.079	0.236	−0.195	0.164	1.23	0.69–2.19

* Adjusted for all variables in table, and parity up to age 31 years (0, 1–2, ≥3 live- or stillbirths).
† Reference groups: for Quetelet index, 20.0–22.9 (N = 373); physical activity, < every day (N = 592); alcohol, none (N = 222); smoking, none during ages 29, 30, or 31 years (N = 481); caffeine, <3 coffee-cup equivalents per day (N = 482). Missing values: Quetelet index, N = 61; height, N = 33; physical activity, N = 33; alcohol, N = 47; smoking, N = 5; caffeine, N = 58. An additional 33 women who smoked for 1 or 2 years were excluded from the smoking analysis.
‡ Linear regression, slope estimate (beta) corresponds to the mean increase or decrease in mean cycle length (in days) with a (per unit) change in the covariate.
§ 12 outliers excluded. Total N in adjusted analysis = 625.
‖ 19 outliers excluded. Total N in adjusted analysis = 619.
¶ Logistic regression, using six randomly selected cycles per woman. Total N in adjusted analysis = 637.
** Coffee-cup equivalents = 99 mg caffeine.

distribution), short cycle days (15–22 days, the lower 2% of the distribution), and long and short bleeding durations (≥8 days and ≤2 days, the upper 4% and lower 2%, respectively) using logistic regression. For these analyses, we randomly selected six cycles per woman. In this way, we avoid overrepresenting data from women who reported the most cycles, since the number of cycles may affect the probability that a cycle of a given length may occur (that is, the more cycles a woman records, the more likely it is that one will be long or short) and may also vary nonrandomly among the women in our sample.

We treated Quetelet index and height as continuous variables unless there was evidence, from stratified analyses, of a nonlinear relation with the outcome variable. In this case, we used two dummy variables representing the highest and lowest quartiles, with the reference group the middle two quartiles of the distribution. We examined parity through age 31 years (1, ≥2 stillbirths or livebirths *vs* 0) and all of the physical and behavioral variables as potential confounders. For most variables, adjusted effect estimates were similar to estimates from the crude analyses. We also repeated the analyses limiting the sample to the self-respondents. Results were similar, so we present the analyses that included both self- and proxy-respondents.

Results

In Table 1, characteristics of the cycles included in this analysis are given. As was described by Harlow and Zeger,[23] this distribution included a long upper tail portion. The number of cycles per woman ranged from 6 to 47 (mean = 27.0).

The mean (and SD) of Quetelet index at age 30 years, height, and caffeine consumption were 21.7 (SD = 2.45) kg per m², 162.0 (SD = 6.23) cm, and 248 (SD = 187.8) mg per day, respectively. Nineteen per cent of respondents reported some form of heavy physical activity (vigorous sports or at work) every day, 31% did not consume any alcoholic beverages, and 34% smoked cigarettes during ages 29–31 years.

We observed only small (≤0.5 day) differences in mean cycle length between groups (Table 2), but cycles were longest for women in the lowest quartile of body mass. Cycle variability was increased among leaner women and women who reported the highest level of physical activity and was reduced among women who drank alcohol. In the randomly selected sample of six cycles per woman, long menstrual cycles (≥42 days) were negatively associated with alcohol consumption [odds ratio (OR) = 0.40 for any *vs* no alcohol; 95% confidence interval (CI) = 0.22–0.73] and somewhat associated with low Quetelet index (OR = 1.6) and daily physical activity (OR = 1.7). There was little association between any of the examined factors and the occurrence of short (15–22 days) menstrual cycles (data not shown).

Bleeding duration was shorter by 0.24 day among women who reported daily physical activity (Table 3). There was also evidence of a linear association with body mass (longer bleeding among leaner women) and

TABLE 3. Personal Characteristics and Mean Bleeding Duration among Women Age 29–31 Years*

		Adjusted Analysis‡	
Characteristic†	Number	Slope	Standard Error (Slope)
Quetelet index (per kg/m²)	705	−0.044	0.015
Height (per 10 cm)	733	0.163	0.059
Physical activity (vigorous sports or at work) (every day)	141	−0.239	0.087
Alcohol (gm/day)			
1–29	459	0.118	0.079
≥30	38	−0.053	0.173
Smoked at ages 29, 30, and 31 years (yes)	247	0.114	0.079
Caffeine (≥3 coffee-cup equivalents/day§)	228	0.021	0.076

* Linear regression analysis, adjusted for other variables in the table, and parity up to age 31 years (0, 1–2, ≥3 live- or stillbirths).
† Reference groups: for physical activity, < every day (N = 592); alcohol, none (N = 222); smoking, none during ages 29, 30, or 31 years (N = 481); caffeine, <3 coffee-cup equivalents per day (N = 482). Missing values: Quetelet index, N = 61; height, N = 33; physical activity, N = 33; alcohol, N = 47; smoking, N = 5; caffeine, N = 58. An additional 33 women who smoked for 1 or 2 years were excluded from the smoking analysis.
‡ Slope estimate (beta) corresponds to the mean increase or decrease in days of bleeding associated with a (per unit) change in the covariates. 16 outliers excluded. Total N for adjusted analysis = 621.
§ Coffee-cup equivalents = 99 mg caffeine.

with height (longer bleeding among taller women). The association with body mass was strongest among smokers: bleeding duration was approximately 0.3 day longer among the leanest (lowest quartile of Quetelet index) smokers compared with heavier nonsmokers. Analysis of the occurrence of long and short bleeding durations produced associations that were similar to those observed in these linear regression analyses (data not shown).

Discussion

In this analysis of prospectively recorded menstrual cycle data from women age 29–31 years, several characteristics were associated with increased cycle variability (measured by the standard deviation of cycle length or by the frequency of cycles ≥42 days in length). Thinner women were more likely to experience more variable and long (≥42 days) menstrual cycles, but we saw no association among women in the highest quartile of body mass. In contrast, Harlow and Matanoski[9] reported a higher frequency of long cycles (≥43 days) in women above the 90th percentile of relative weight in a prospective study of 166 women age 17–19 years. Our data indicate that daily physical activity was associated with increased cycle variability and with the occurrence of long menstrual cycles (≥42 days); similar results were also reported by Harlow and Matanoski.[9] Women who reported that they consumed alcohol had less variable cycle lengths and a lower occurrence of long menstrual cycles in our data. Some previous studies have reported adverse reproductive effects, including anovulation and amenorrhea in association with alcohol abuse.[24] Little has been reported concerning the more moderate level of alcohol consumption seen within the general population.

In our study, lean body mass, particularly among smokers, and taller stature were associated with increased bleeding duration, and physical activity was associated with a shorter bleeding duration. These findings support data from previously reported prospective[11,14] and retrospective[10,25] studies. Relatively little is known about the endocrinologic or other factors affecting bleeding duration,[5] although prostaglandin production has been associated with dysmenorrhea and dysfunctional uterine bleeding.[26]

The major strength of this study is the availability of prospectively recorded menstrual cycle data in a large cohort of women. Oral contraceptives were not available until these women were over age 40 years, and the use of other exogenous hormones within this cohort was low. A specific definition of menstrual bleeding was not provided, so some variability in recording between women is likely.

We compared the results from different analyses to assess the impact of specific decisions we had made (for example, eliminating one *vs* four postpregnancy cycles, choosing the mean *vs* the median as a summary measure, using six randomly selected cycles for the analysis of long and short cycle lengths, including and excluding proxy-respondents). The similarity of results from these analyses makes us believe that our results are fairly robust to the effects of these decisions.

The physical and behavioral data used in this analysis were recorded retrospectively (by women age 63 years and over), and some recall inaccuracy can be expected, particularly among proxy-respondents.[27-29] Although the smoking data were based on a year-by-year assessment, the physical activity, alcohol, and caffeine measures were based on broad age categories (23–34 years for physical activity, and 20–40 years for alcohol and caffeine). Further misclassification was introduced by our use of the woman's reported current height, rather than recalled height, since height loss may occur in older women.[3] It is unlikely that the errors introduced in these assessments would be related to specific menstrual cycle characteristics, so on average these sources of nondifferential misclassification would attenuate the associations we observed.

We have, as noted above, only one measure of alcohol consumption, physical activity, and body mass, and the smoking data are available by year but not by cycle. Thus, although we have multiple observations of cycles occurring during the 3-year period, the covariate data do not vary by cycle, so we did not use a repeated measures analysis for these data. This alternative analytical strategy would be preferred with more extensive covariate data.

This cohort of white women was primarily of northern European ancestry and had attended college in the

1930s. This homogeneity reduces the extent to which uncontrolled confounding by factors associated with socioeconomic status could be influencing our results.

Variable or long menstrual cycles may reflect anovulation and would thus be associated with relatively low levels of estrogen exposure. Lean body mass and early-adult exercise, both of which were associated with long or variable cycles in our data, have been suggested to decrease postmenopausal breast cancer risk.[30,31] Alcohol consumption has been associated with an increased risk of breast cancer,[32] and in our data, women who drank alcohol would be expected to have relatively high estrogen exposure, since cycle variability and occurrence of long menstrual cycles were reduced in this group. The relation between menstrual cycle patterns and endogenous hormone exposure may provide further indirect evidence into the pathogenesis of hormonally related disease.

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References

1. Grady D, Gebretsadik T, Kerlikowske K, Ernster V, Petitti D. Hormone replacement therapy and endometrial cancer risk: a meta-analysis. Obstet Gynecol 1995;85:304–313.
2. Whittemore AS, Harris R, Itnyre J. Characteristics relating to ovarian cancer risk: collaborative analysis of 12 US case-control studies. II. Invasive epithelial cancer in white women. Am J Epidemiol 1992;136:1184–1203.
3. Cummings SR, Kelsey JL, Nevitt MC, O'Dowd KJ. Epidemiology of osteoporosis and osteoporotic fractures. Epidemiol Rev 1985;7:178–208.
4. Stampfer MJ, Willett WC, Colditz GA, Rosner B, Speizer FE, Hennekens CH. A prospective study of postmenopausal estrogen therapy and coronary heart disease. N Engl J Med 1985;313:1044–1049.
5. Harlow SD, Ephross SA. Epidemiology of menstruation and its relevance to women's health. Epidemiol Rev 1995;17:265–286.
6. Hankinson SE, Willett WC, Manson JE, Hunter DJ, Colditz GA, Stampfer MJ, Longcope C, Speizer FE. Alcohol, height, and adiposity in relation to estrogen and prolactin levels in postmenopausal women. J Natl Cancer Inst 1995;87:1297–1302.
7. Ellison PT, Lager C. Moderate recreational running is associated with lowered salivary progesterone profiles in women. Am J Obstet Gynecol 1986;154:1000–1003.
8. Baron JA, La Vecchia C, Levi F. The antiestrogenic effect of cigarette smoking in women. Am J Obstet Gynecol 1990;162:502–514.
9. Harlow SD, Matanoski GM. The association between weight, physical activity, and stress and variation in the length of the menstrual cycle. Am J Epidemiol 1991;133:38–49.
10. Brown S, Vessey M, Stratton I. The influence of method of contraception and cigarette smoking on menstrual patterns. Br J Obstet Gynaecol 1988; 95:905–910.
11. Harlow SD, Campbell BC. Host factors that influence the duration of menstrual bleeding. Epidemiology 1994;5:352–355.
12. Belsey EM, Peregoudovv S. Determinants of menstrual bleeding patterns among women using natural and hormonal methods of contraception. I. Regional variations. Contraception 1988;38:227–242.
13. Belsey EM, d'Arcangues C, Carlson N. Determinants of menstrual bleeding patterns among women using natural and hormonal methods of contraception. II. The influence of individual characteristics. Contraception 1988;38: 243–257.
14. Bullen BA, Skrinar GS, Beitins ZA, Von Mering G, Turnbull BA, MacArthur JW. Induction of menstrual disorders by strenuous exercise in untrained women. N Engl J Med 1985;312:1349–1353.
15. Johnson J, Whitaker AH. Adolescent smoking, weight changes, and binge-purge behavior: associations with secondary amenorrhea. Am J Public Health 1992;82:47–54.
16. Treloar AE, Boynton RE, Behn BG, Brown BW. Variation of the human menstrual cycle through reproductive life. Int J Fertil 1967;12:77–126.
17. Whelan EA, Sandler DP, Root JL, Smith KR, Weinberg CR. Menstrual cycle patterns and risk of breast cancer. Am J Epidemiol 1994;140:1081–1090.
18. Root J, Smith, KR, Whelan EA, Sandler D, Voda AM. Tracing women over half a century: strategies to locate subjects lost to follow-up in a longitudinal health study. Res Aging 1994;16:375–388.
19. Gray RH, Campbell OM, Zacur HA, Labbok MH, MacRae SL. Postpartum return of ovarian activity in nonbreastfeeding women monitored by urinary assays. J Clin Endocrinol Metab 1987;64:645–650.
20. Willett WC, Stampfer MJ, Colditz GA, Rosner BA, Hennekens CH, Speizer FE. Moderate alcohol consumption and the risk of breast cancer. N Engl J Med 1987;316:1174–1180.
21. Pennington JAT, Church HN. Bowes and Church's Food Values of Portions Commonly Used. Philadelphia: JP Lippincott, 1985;223–224.
22. Belsley DA, Kuh E, Welsch RE. Regression Diagnostics: Identifying Influential Data and Sources of Collinearity. New York: John Wiley and Sons, 1980.
23. Harlow SD, Zeger SL. An application of longitudinal methods to the analysis of menstrual diary data. J Clin Epidemiol 1991;44:1015–1025.
24. Mello NK. Effects of alcohol abuse on reproductive function in women. Recent Dev Alcohol 1988;6:253–276.
25. Kirchengast S. Intercorrelations between menstrual cycle patterns and body dimensions in Austrian women. J Biosoc Sci 1994;26:207–216.
26. Cameron IT, Leask R, Kelly RW, Baird DT. Endometrial prostaglandins in women with abnormal menstrual bleeding. Prostaglandins Leukot Med 1987;29:249–257.
27. Perry GS, Byers TE, Mokdad AH, Serdula MK, Williamson DF. The validity of self-reports of past body weights by U.S. adults. Epidemiology 1995;6:61–66.
28. Lee MM, Whittemore AS, Lung DL. Reliability of recalled physical activity, cigarette smoking, and alcohol consumption. Ann Epidemiol 1992;2:705–714.
29. Nelson LM, Longstreth WT Jr, Koepsell TD, Checkoway H, van Belle G. Completeness and accuracy of interview data from proxy respondents: demographic, medical and life-style factors. Epidemiology 1994;5:204–217.
30. Tornberg SA, Carstensen JM. Relationship between Quetelet's index and cancer of breast and female genital tract in 47,000 women followed for 25 years. Br J Cancer 1994;69:358–361.
31. Mittendorf R, Longnecker MP, Newcomb PA, Dietz AT, Greenberg ER, Bogdan GF, Clapp RW, Willett WC. Strenuous physical activity in young adulthood and risk of breast cancer (United States). Cancer Causes Control 1995;6:347–353.
32. Longnecker MP. Alcoholic beverage consumption in relation to risk of breast cancer: meta-analysis and review. Cancer Causes Control 1994; 5:73–82.