Ethnic Differences in the Duration and Amount of Menstrual Bleeding during the Postmenarcheal Period

Siobán D. Harlow and Ben Campbell

In 1989, 125 African-American and 123 European-American girls aged 12–14 years living in Durham, North Carolina, were enrolled in a 2-year study in which they maintained a menstrual calendar, recording the date and amount of menstrual bleeding. Weight, exercise, and stress during the previous week were recorded at the start of the menstrual cycle. Ethnicity was the strongest determinant of the duration of menstrual bleeding and of the probability of heavy bleeding. The mean duration of bleeding was 5.1 days for African-American girls and 5.6 days for European-American girls. Low body mass index, high stress, and dieting also influenced bleed duration, but the effects of low body mass index and stress were modified by ethnicity. European-American girls were less likely to have an episode of heavy bleeding (odds ratio = 0.48) than were African-American girls, while high stress increased the risk of having a heavy bleeding episode (odds ratio = 1.51). Further investigation of potential ethnic differences in menstrual bleeding characteristics and of the role of stress in provoking heavy bleeding is warranted.


Compared with other aspects of the menstrual cycle, population variation in the duration and amount of menstrual bleeding has received little attention (1–6), despite the fact that abnormal bleeding is a major cause of gynecologic morbidity (6, 7) and a leading indicator for hysterectomy, the most common nonobstetric major surgery for women in the United States (8). Data on patterns of hysterectomy in the United States suggest that significant ethnic differences may exist in the incidence of menstrual dysfunction. Although the total hysterectomy rate is only slightly higher for African-American (61.7/10,000) compared with European-American (56.5/10,000) women (9), the mean age at hysterectomy is significantly earlier (mean age, 42.0 years versus 46.1 years, respectively) (10). Moreover, African-American women are twice as likely to have a diagnosis of fibroids as the indication for hysterectomy (7, 9, 10). Nonetheless, large gaps exist in our knowledge about basic population differences in the duration and amount of menstrual bleeding.

Data from multicenter contraceptive trials have revealed striking regional differences in the duration of menstrual bleeding in both adolescent girls and adult women. For example, Mexican and Latin-American women bleed for a mean of 4.5 days compared with a mean of 5.9 days for European women (2, 4, 5). These data indicate the existence of substantial variation between populations, at least on a global scale. However, none of the multicenter studies of regional differences include African women, and in the United States, longitudinal menstrual diary studies have not examined ethnic differences in bleeding patterns (6). The role that host and environmental factors may play in explaining these regional differences in bleeding duration is largely unknown (2, 3).

A few studies have suggested that duration of menstrual bleeding may be influenced by age, altitude, history of exposure to diethylstilbestrol, and weight (1, 3, 6, 11). Recently, factors known to influence ovarian function and menstrual cycle length, including low weight-for-height, dieting, and exercise, were found to affect the duration of bleeding within a sample of college women (1). However, since the sample was relatively small and consisted predominantly of European-American women, the generalizability of these findings to other populations is unclear. As is true for menstrual cycle length, bleed duration and bleed amount...
in adolescence may be important risk factors for the occurrence of menstrual dysfunction later in reproductive life. This paper examines the relation between duration and amount of menstrual bleeding and weight, exercise, and stress in a population-based sample of postmenarcheal African-American and European-American girls.

MATERIALS AND METHODS

In 1989, 125 African-American and 123 European-American girls living in North Carolina were enrolled in a 2-year study of adolescent behavior and development. This paper is based upon menstrual diary data collected as one component of that study. In the parent study, respondents completed an extensive self-administered questionnaire at each of five semiannual interviews. Anthropometric measures were taken, and an 18-ml blood sample was collected at the time of the semiannual interview. In addition to a menstrual diary, a behavioral checklist and saliva sample were obtained monthly throughout the 2-year data collection period.

A local county school district provided enrollment lists of all girls in grades 7 and 8 that included information on ethnicity. A random sample of African-American and European-American girls was drawn after the list was stratified by ethnicity. Girls were contacted sequentially, evaluated for eligibility, and, if eligible, asked to participate. To be eligible, girls had to have reached menarche. Informed consent was obtained first from the parent and then from the girl herself according to guidelines of the Institutional Review Board of the University of North Carolina at Chapel Hill. As expected, given differences in age at menarche, fewer African-American girls (6.3 percent) than European-American girls (12.4 percent) were premenarcheal and thus ineligible to participate. For the eligible girls, 22 percent of parents refused permission to contact their daughters, with no difference in willingness to give permission observed by ethnicity. For the girls we had permission to contact, 88 percent of the African Americans and 74.9 percent of the European Americans agreed to participate. Thus, the final recruitment rate for eligible African Americans was 69.8 percent, and that for European Americans was 58.2 percent. The mean age of participants and eligible nonparticipants did not differ.

Girls completed a two-part, self-administered questionnaire at the time of enrollment that provided demographic data, including self-reported ethnicity, as well as information about age at menarche, contraceptive use, pregnancy status, and self-reported height and weight. At the time of this visit, height and weight measurements were also taken. Follow-up visits occurred semiannually at 6, 12, 18, and 24 months, at which time information on contraceptive use and pregnancy was gathered. Interviewers received standardized training for all components of the study, including instructions on how to train participants to use the menstrual diary.

The girls maintained a weekly menstrual diary in which they marked with an X each day that they experienced bleeding. They also indicated whether the bleeding was only a few drops for which no protection was needed, light, moderate, or heavy by recording a number from one to four, respectively. Amount of bleeding was self-defined by the participant. Girls were instructed to telephone the study office when their periods started. On the second day of each menstrual period, girls completed a nine-item questionnaire that included information on their current weight; whether they had lost weight, gained weight, or dieted in the previous week (yes/no); and whether or not they had participated in any of 22 different athletic activities, such as running, tennis, or aerobics and, if so, for how many hours. Cohen's four-item perceived stress scale was also included (12). The time frame of reference for each variable was the previous week. A caseworker visited each girl's home once a month and collected the previous month's menstrual diaries.

Menstrual data

Definitions recommended by the World Health Organization were used to summarize the bleeding data (13). Menstrual cycle length was calculated by counting the number of days from the first day of one bleeding episode up to and including the day before the next bleeding episode. Length of a bleeding episode was calculated by counting the number of days from the start of a bleeding episode up to and including the day before the start of a bleeding-free interval. A bleeding-free interval was defined as no bleeding for at least 3 days. A bleeding episode could not consist of a single day of spotting.

Two outcome variables were used to describe menstrual bleeding, bleed duration and heavy bleeding (yes/no). Bleed duration was defined by the length of the bleeding episode. A bleeding episode was considered heavy if the median amount of bleeding reported during the episode was characterized as heavy. The bleed amount reported each day was assigned to an ordinal scale from one (spotting) to four (heavy). An episode of heavy bleeding was then defined as an episode for which the median daily bleed amount was four.

To be eligible for this analysis, a girl had to contribute at least three menstrual cycles. Seven girls never returned a month of menstrual diaries, one girl was pregnant from the time of enrollment until she...
dropped out, and 10 girls contributed fewer than three eligible cycles. Of these 18 girls, 14 (11.2 percent) African-American girls did not contribute any eligible data compared with four (3.3 percent) European-American girls (\( p = 0.016 \)).

For the remaining 230 girls included in this analysis, the menstrual record was censored when a girl dropped out of the study, when she became pregnant and continued the pregnancy, when she started birth control pills and continued using contraception throughout the study period, or at the end of the 2-year study period. Seventy-five girls (32.6 percent) were censored prior to the end of the study, 45 (19.6 percent) because they withdrew, 25 (10.9 percent) because they started using hormonal contraception, and 5 (2.2 percent) because of pregnancy. African-American girls were more likely to be censored before the end of the study and more likely to be censored because they started using birth control pills (\( p < 0.001 \)).

All data until the time of censoring are used in this analysis. Menstrual characteristics, including cycle length and variability and bleed length, did not differ between girls who dropped out and those who completed the study. Girls who were censored because they went on the pill tended to have a shorter cycle length (1.7 days mean difference in median cycle length, \( p = 0.06 \)) during their eligible cycles than did those who completed the study. Bleed duration was also shorter in girls who began taking the pill (0.4 days mean difference in median bleed length, \( p = 0.02 \)).

Diaries for all cycles longer than 42 days were examined to ensure that long cycles were not a result of missing data. If one diary week was missing and no bleed had been reported within 14 days of the missing week or if multiple weeks were missing, the time interval from the previous to the subsequent observed bleed was coded as missing data. For girls who started and stopped taking birth control pills, the time interval while they were on the pill was also coded as missing data. The records of girls who became pregnant were coded as missing from the date of the last menstrual period until the date of birth or miscarriage plus 6 weeks (14). Twenty-three girls had missing data at some point during the study period.

**Covariates**

Ethnicity was determined by self-report response to the question “Are you Black, White/Caucasian, Asian, Hispanic, American Indian/Alaskan Native, Pacific Islander, Other?” All girls defined their ethnicity as either black or white/Caucasian. We measured perceived stress in the previous week by using Cohen’s four-item Perceived Stress Scale (12). This scale is designed to be a global measure of the extent to which situations in one’s life are appraised as stressful. The items tap the degree to which respondents find their lives unpredictable, uncontrollable, and overloaded. The four-item version has been found to be reliable (alpha = 0.72) and is correlated with life event scores, depressive and physical symptomatology, and social anxiety. Each item is scored from 0 to 4, and then the four-item scores are summed. Dieting to lose weight is considered to be a marker of cognitive dietary restraint, which previously has been found to influence menstrual function (1, 15) and was measured by asking the single question, “Did you diet to lose weight in the past week (yes/no)?” In addition to summing the number of reported physical activities, total moderate-to-very hard leisure energy expenditure in the previous week was calculated by summing the products of the metabolic MET rating of each activity and the hours spent doing that activity (16). (A MET is a unit of measurement of heat production by the body).

Four weight-related measures were considered in this analysis. Weight (kg)/height (m)^2 was used as an index of body mass (BMI), with measured height at baseline and monthly self-reported weight used to calculate BMI each month. Correlation between measured weight and self-reported weight at the baseline examination was 0.9. Low and high weight-for-height, defined as the 20th and 80th percentiles for this population, were 18.7 and 24.9, respectively. All changes of weight that exceeded 10 pounds (4.54 kg) were reviewed for potential errors, and three girls who had four or more unreliable weight observations were excluded from risk factor analyses. Three variables were used to measure weight fluctuation: self-reported loss of weight in the previous week (yes/no), self-reported gain of weight in the previous week (yes/no), and self-reported change in weight of more than 5 pounds (2.27 kg) during the previous menstrual cycle, calculated by taking the difference of the previous and current weight measurements.

**Analysis**

Bleed length and bleed amount is presumed to reflect the characteristics of the preceding ovarian cycle. This analysis evaluates acute effects, addressing how differences in risk factor values at the physiologic onset of the menstrual cycle affect bleed duration and amount at the end of that cycle. Thus, the covariate values at the start of the menstrual cycle were used to predict characteristics of the bleed at the end of that cycle. Since we have multiple observations of bleed characteristics for each girl, variance estimates obtained from standard regression procedures are inac-
curate. Therefore, linear and logistic regressions with robust variance estimation (17), which accounts for the correlation between observations from the same individual, were used to model the effects of covariates on expected bleed length and the probability of a heavy bleed, respectively. A generalized estimating equation approach (17) was employed using the SAS IML macro GEE and assuming exchangeable correlation (i.e., that the dependence between two observations within the individual are the same no matter how far apart in time they occur). This approach adjusts the variance estimates of regression coefficients for the correlation between observations and does not require an equal number of observations per subject. It models the average response in the population (e.g., expected bleed length or probability of a heavy bleed) for a given covariate value. The beta coefficients are interpreted as one would in a standard regression analysis.

On the basis of an approach we have described previously to define the approximate Gaussian portion of a menstrual cycle length distribution, we excluded cycles shorter than 13 days (n = 30) or longer than 45 days (n = 295) since very short cycles are unlikely to be menstrual cycles and very long cycles represent a distinctly different ovarian process (18). Median cycle length in this population was 29 days. Bleed durations of over 16 days (n = 4) were also excluded because they were clear outliers.

In the unadjusted analyses, the effect of each covariate on expected bleed length and on the probability of a heavy bleed was determined by introducing each covariate separately into linear and logistic regression models, respectively. Adjusted regression models were then built by forward stepwise regression, introducing covariates with the largest coefficients into the model first. All possible interactions were evaluated individually. Ethnicity modified the effect of several covariates. For each covariate for which ethnicity was an effect modifier, dummy variables were constructed to model that covariate separately for each ethnic group. We present the unadjusted results for these covariates stratified by ethnicity. Given the limited range of bleed duration (1–3), the potential for change in bleed length is relatively small, with the strongest risk factors altering bleed duration by about one quarter to one half a day. In this study, we consider shifts in expected bleed duration of a tenth of a day or more to represent meaningful differences.

RESULTS

At the time of enrollment, girls ranged in age from 12 to 14 years, and by the end of the study they were 14–16 years old. The mean age at menarche was 11.7 years (range, 8–14 years), and during the course of the study period gynecologic age ranged from zero to 6 years. The mean age at menarche was 0.4 years younger for African-American girls compared with European-American girls (table 1). Girls contributed a median of 21 cycles (range, 3–32 cycles) and 22 bleeding episodes for a total of 4,690 bleeds. Eighty-five percent of the study participants reported 12 or more cycles. Bleed length ranged from 1 to 34 days (median, 5 days) with 96.5 percent of the bleeds between 3 and 8 days. Fifteen girls (6.5 percent) reported ever having a bleed longer than 10 days. The median reported bleed amount was a few drops or light in 32.3 percent, moderate in 57.9 percent, and heavy in 9.8 percent of the episodes. Heavy episodes were reported at some time by 103 (44.8 percent) of the girls, including 55 of 111 (49.5 percent) African-American and 48 of 119 (40.3 percent) European-American girls.

BMI ranged from 14.8 to 44.6 (median, 21.6), with African Americans being significantly heavier than European Americans (table 1). The median change in weight from cycle to cycle was zero pounds, with a change greater than 5 pounds (2.27 kg) reported in 10.7 percent of observed cycles. Dieting to lose weight was reported during 12.0 percent of bleeding episodes. Perceived stress scores ranged from zero to 16, with a median observed score of five and a score of nine at the 90th percentile. The number of activities reported ranged from zero to 15 (median, two), with seven or fewer activities being reported in 99 percent of menstrual cycles. No exercise was reported during 23.0 percent of episodes, and the median number of hours per week of exercise reported was four. The median total leisure METs score was 20, which represents 2 hours of very hard activity or 5 hours of moderate activity. The 95th percentile for METs scores was 120 or 12 hours of very hard activity. European Americans reported doing more activities with a higher median energy expenditure than did African Americans (table 1).

When the effect of each covariate on duration of menstrual bleeding was examined, ethnicity had the largest impact (table 2). The mean duration for African-American girls was 5 days. European-American girls, on average, bled six-tenths of a day longer. The effects of body mass and perceived stress on bleed duration were modified by ethnicity; therefore, the ethnicity-specific effects of these covariates are presented. Low and high body mass decreased average bleed length in African-American girls by three-tenths and two-tenths of a day, respectively, whereas in European-American girls, low body mass increased bleed length by a quarter of a day and high body mass had no impact on bleed duration. Being at
TABLE 1. Menstrual characteristics, weight, activity, and stress levels of study participants at baseline and during the 2-year study period for 111 African-American and 119 European-American girls aged 13–15 years, Durham, North Carolina, 1989–1991

<table>
<thead>
<tr>
<th></th>
<th>African American</th>
<th>Population</th>
<th>European American</th>
<th>Population</th>
<th>p value</th>
</tr>
</thead>
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<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>Mean</td>
<td>Range</td>
<td>No.</td>
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<tr>
<td>Age at baseline</td>
<td>111</td>
<td>13.4</td>
<td>12–14</td>
<td>119</td>
<td>13.3</td>
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<td>Age at menarche</td>
<td>111</td>
<td>11.5</td>
<td>8–14</td>
<td>119</td>
<td>11.9</td>
</tr>
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<td>Gynecologic age at baseline</td>
<td>111</td>
<td>23.7</td>
<td>0–57</td>
<td>119</td>
<td>17.1</td>
</tr>
<tr>
<td>(months)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median menstrual cycle length*</td>
<td>111</td>
<td>29.8</td>
<td>21–85</td>
<td>119</td>
<td>30.4</td>
</tr>
<tr>
<td>Weight*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Body mass index</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Baseline</td>
<td>111</td>
<td>22.7</td>
<td>16.0–36.7</td>
<td>119</td>
<td>20.8</td>
</tr>
<tr>
<td>Median</td>
<td>109</td>
<td>23.6</td>
<td>15.8–40.7</td>
<td>116</td>
<td>21.4</td>
</tr>
<tr>
<td>Ever reported</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lose weight</td>
<td>111</td>
<td>75.7</td>
<td></td>
<td>118</td>
<td>82.2</td>
</tr>
<tr>
<td>Gain weight</td>
<td>111</td>
<td>76.6</td>
<td></td>
<td>117</td>
<td>85.5</td>
</tr>
<tr>
<td>Weight change &gt;5 pounds (2.27 kg)</td>
<td>111</td>
<td>72.1</td>
<td></td>
<td>119</td>
<td>63.0</td>
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<tr>
<td>Dieted</td>
<td>111</td>
<td>46.0</td>
<td></td>
<td>119</td>
<td>55.5</td>
</tr>
<tr>
<td>Scale in home</td>
<td>110</td>
<td>40.9</td>
<td></td>
<td>117</td>
<td>76.1</td>
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<tr>
<td>Activity</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Median no. of activities*</td>
<td>111</td>
<td>1.5</td>
<td>0–7</td>
<td>119</td>
<td>2.5</td>
</tr>
<tr>
<td>Median total leisure METS*,†</td>
<td>111</td>
<td>16.1</td>
<td>0–112</td>
<td>119</td>
<td>35.8</td>
</tr>
<tr>
<td>Stress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median perceived stress score*</td>
<td>111</td>
<td>4.9</td>
<td>0–10</td>
<td>119</td>
<td>4.8</td>
</tr>
</tbody>
</table>

* The value for each girl is the median of all of her observed values across the study period.
† A MET is a unit of measurement of heat production by the body.

On average, an African-American girl with low body mass could be expected to bleed 4.88 days, two-tenths of a day less than other African-American girls. In contrast, a European-American girl with low body mass would be expected to bleed 5.75 days, or a tenth of a day more than her European-American counterparts. On the other hand, high levels of perceived stress tended to increase bleed duration in African-American girls by about a tenth of a day but to decrease bleed duration in European-American girls by 0.16 days. Dieting to lose weight shortened expected bleed length by 0.14 days in all girls.

The crude associations between ethnicity and other covariates and the probability of having very heavy bleeding are presented in table 4. As was true for bleed duration, the strongest predictor of heavy bleeding was ethnicity. Although European-American girls tended to have longer bleeds, they were much less likely to have a heavy bleeding episode than were African-American girls. High levels of perceived stress were associated with a 50 percent increase in the odds of having heavy bleeding. Girls with low body mass and those who reported dieting to lose weight appeared
slightly less likely to have a heavy bleeding episode, although the confidence intervals include one. Results of the multiple logistic regression on the probability of having a heavy bleeding episode (table 5) suggest that only ethnicity and stress, and in European-American girls dieting to lose weight, have a meaningful impact on the probability of heavy bleeding. The magnitudes of the impact of ethnicity and stress were similar in the adjusted and the unadjusted models, while dieting to lose weight decreased the odds of a heavy bleed by about 60 percent in European-American girls in the adjusted model.

**DISCUSSION**

This study found large ethnic differences in the duration of menstrual bleeding and in the probability of heavy bleeding during the early postmenarcheal period. More specifically, among postmenarcheal girls aged 13–16 years, European Americans reported bleeding about half a day longer than African-Americans girls and had a decreased probability of reporting an episode of heavy bleeding. In addition, these data confirm earlier findings that low weight and dieting can have an impact on bleed duration and provide new evidence that high levels of perceived stress may be associated with heavy bleeding.
TABLE 3. Multiple linear regression on bleed length (in days) using robust variance estimation (final model) for 3,413 bleeding episodes in 105 African-American and 115 European-American girls aged 12–16 years, Durham, North Carolina, 1989–1991

<table>
<thead>
<tr>
<th></th>
<th>Bleed duration (days)</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>African Americans (intercept)</td>
<td>5.08</td>
<td></td>
</tr>
<tr>
<td>European Americans</td>
<td>0.56</td>
<td>0.30 to 0.83</td>
</tr>
<tr>
<td>Low body mass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African Americans</td>
<td>-0.20</td>
<td>-0.45 to 0.06</td>
</tr>
<tr>
<td>European Americans</td>
<td>0.11</td>
<td>-0.19 to 0.40</td>
</tr>
<tr>
<td>High perceived stress by ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African Americans</td>
<td>0.11</td>
<td>-0.003 to 0.22</td>
</tr>
<tr>
<td>European Americans</td>
<td>-0.16</td>
<td>-0.31 to -0.007</td>
</tr>
<tr>
<td>Diet to lose weight</td>
<td>-0.14</td>
<td>-0.27 to 0.004</td>
</tr>
<tr>
<td>Gynecologic age (months)</td>
<td>-0.0021</td>
<td>-1.29 to 1.23</td>
</tr>
</tbody>
</table>

What the difference in bleed duration between the two ethnic groups may represent is less clear. Menstrual bleeding is the result of many different components, including uterine size and structure, steroid hormone production, uterine sex steroid receptors, and prostaglandin production and sensitivity. Differences in any one of these factors could be an important host factor related to ethnic differences in bleeding. The most obvious ethnic difference, timing of pubertal maturation (19) or gynecologic age, does not appear to explain differences in these data in duration of bleeding or the probability of heavy bleeding. Women exposed prenatally to diethylstilbestrol, which is known to affect the size of the uterus, have been found to have shorter and lighter bleeds than do nonexposed women (11). It has also been suggested that variability in bleeding patterns may reflect difference in the ratio of prostaglandins $PGE_2$ and $PGF_2$ (20, 21).

The possibility of systematic reporting differences between the two groups cannot be completely ruled out. Individual misclassification of bleed amount is known to occur; however, Hallberg et al. (22) reported that mean blood loss for women who report heavy bleeding is greater than mean loss for those who report light or moderate bleeding. To date, no other risk factor has been associated with systematic differences in reporting of bleed amount. Misclassification of bleed duration is less likely. Instructions for the use of menstrual calendars were standardized; thus differential measurement error is unlikely to explain this finding.

In the United States, African-American girls have been reported to have an earlier age at menarche than do European-American girls (19). The findings that African-American women are twice as likely as European-American women (10) to have a diagnosis of fibroids as the reason for hysterectomy and that African-American women also appear to have an ear-
lier age at menopause (23) suggest that differences in uterine and ovarian function may also exist at the end of reproductive life. Thus, the finding of an apparent ethnic difference in uterine function soon after menarche warrants further investigation and suggests the possibility that risk factors for menstrual dysfunction may be identifiable early in reproductive life.

The impact of dieting and, for European Americans, of low weight on bleeding duration is consistent with findings in an earlier study among predominantly European-American, college-age women (1). The observation that low BMI in African-American girls decreased rather than increased bleed duration may be related to differences in body composition, including fat and lean weight, or to differences in weight distribution. Alternatively, given differences in the social meaning of weight between the two ethnic groups (24), including differential influences on sexual behavior in this data set (Halpern CT, et al., University of North Carolina, unpublished manuscript), cognitive processes may also have an impact on biologic aspects of menstrual functioning. Finally, it is also possible that measurement error has influenced this finding. Although self-reported weight is generally considered a valid measure in epidemiologic studies (25), three-quarters of European Americans had a scale in their home compared with fewer than half of the African-American girls. In addition, heavier girls were more likely to have missing data on weight. Future studies may need to provide for more frequent measurement of weight or to ensure the availability of scales to study participants to distinguish potential ethnic differences in the impact of weight on menstrual bleeding.

Unlike in earlier results (1), exercise does not show a significant impact on bleed duration. However, exercise had only a small effect in the previous study of college women, and girls in this study are younger and come from a less-selected population. Thus, differences in physical activity patterns of the two samples may be sufficient to account for the discrepancy in results.

The finding that high levels of perceived stress appear to influence both bleed duration and the probability of heavy bleeding is new. Other than ethnicity, and dieting in European-American girls, the only risk factor associated with bleed amount was high levels of perceived stress at the onset of the menstrual cycle. Stress is known to influence ovarian function and menstrual cycle length (6). The role of stress in triggering heavier bleeding generally, and menorrhagia specifically, warrants further research (26), although the possibility that difficult menstruation may itself act as a stressor must also be considered. The ethnic difference in the impact of perceived stress on bleed duration suggests that more information about contextual differences in stressors and about physiologic adaptation to stressors is needed. A recent study of factors associated with age at menopause found that stress lowered age at menopause in African-American, but not in European-American, women (23).

Generalizability of these findings is clearly limited by the narrow age range of the sample. Although these data are consistent with data from women aged 17–19 years (1), both studies focused on adolescents, and research on older women should be undertaken. In addition, no hormonal data were available to evaluate potential differences in the probability of ovulation or in levels of hormone production. Although participation rates by the girls themselves were quite high and little dropout occurred, the fact that only 70 percent of eligible African-American and 58 percent of eligible European-American girls were recruited raises the possibility of selection bias. However, for selection bias to have occurred, participation would also have to be associated with menstrual bleeding. The one study that examined factors associated with the participation of teenagers in menstrual diary studies found no association between menstrual characteristics and willingness to participate (27,28). Furthermore, neither age at menarche nor time since menarche, the menstrual parameters that seem most likely to affect a girl’s decision to participate in a study of adolescent development, influenced duration or amount of bleeding in this study.

In conclusion, the strength of the ethnic difference in bleed duration and the probability of heavy bleeding observed in this study are noteworthy. Further investigation of potential differences in characteristics of bleeding among various ethnic groups may help to elucidate reasons for differences in risk of menstrual and uterine abnormalities in older women (10). The finding that both BMI and stress had different impacts in European-American and African-American girls also suggests the need for more attention to the cross-cultural meaning of biologic and social risk factors in future studies.

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