Effects of oral contraceptives on daily self-ratings of positive and negative affect

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Abstract

Objectives: The relationship between affect and duration of oral contraceptive (OC) use was investigated. Method: Ninety-six women (17 first-time OC users, 34 long-time users, and 45 never-users) completed the Positive and Negative Affect Schedule (PANAS) and the Menstrual Distress Questionnaire (MDQ) daily for 35 days. This study was the first to examine positive affect variability; personal and family psychiatric history; and to compare early-, late-, and never-users of OCs. Results: Triphasic users experienced greater variability in positive affect across the cycle, likely due to the variable hormone levels. Withdrawal of a constant level of hormones (monophasics) during early use was associated with greater variability in positive affect than withdrawal of changing hormonal levels (triphasics). Furthermore, personal and family psychiatric history may mediate an effect of OCs on negative affect variability. Conclusions: OCs and, therefore, hormones can alter day-to-day affect variability. Four variables are associated with this effect: duration of use, OC type, personal psychiatric history, and family psychiatric history. © 2001 Elsevier Science Inc. All rights reserved.

Keywords: Oral contraceptives; Positive affect; Negative affect; Hormones; Mood; Survivor effect

Introduction

Mood change remains a controversial side effect of oral contraceptive (OC) use despite a considerable amount of research. Inconsistent findings have been reported both in earlier research, which tended to focus on the incidence rates of diagnosable mood disorders in OC users versus nonusers (see Slap [1], Cullberg [2], and Long and Kathol [3] for reviews of the better studies), and in more recent research (see Oinonen and Mazmanian [4] for a review), which focuses on group differences in affect across the menstrual cycle (e.g., Refs. [5–17]).

Of the 13 prospective studies involving daily affect ratings, all but one [10] found differences in affect between OC users and nonusers. The direction of the differences and the menstrual cycle phases in which they occurred, however, was not consistent across studies. For negative affect, one study [8] reported that OC users experience less negative affect across the entire menstrual cycle, and another [15] indicated higher negative affect for monophasic OC users than nonusers. Other studies [7,10,13,17] found no differences in negative affect at any phase of the cycle. For positive affect, two studies [8,14] found no differences, but one well-conducted study [7] found that OC users rated themselves higher on positive affect than did nonusers.

Only two reasonably consistent findings emerge from this literature. First, OC users report less affect variability than nonusers [9,13,15,16], which suggests that the hormones in OCs might provide some stabilizing effect on mood. Second, OC users report less negative affect than nonusers during the menstrual phase [8,13,15,16], which could indicate that OCs have an indirect pharmacological effect on mood through the reduction of somatic symptoms during menstruation.
These inconsistent findings might be attributable, at least in part, to a number of methodological factors. First, subjects taking OCs should be defined as either long-time users or first-time users. Studies that do not make this distinction run the risk of underestimating negative mood side effects because of the “survivor effect” [18]. This refers to the fact that individuals who do experience negative effects when taking OCs are likely to discontinue OC use and explore other methods of contraception. Alternatively, such individuals might change pill type (e.g., from monophasic to triphasic preparations). Thus, long-time user groups are likely to be comprised of women who have not experienced negative effects (i.e., survivors), or women who changed pill type because of negative effects (i.e., “switchers”). Second, independent measures of both positive and negative affect should be included, as OCs have been shown to influence both (e.g., Refs. [7,16]). Third, positive and negative affect variability should always be examined. OCs could exert a stabilizing effect on mood (e.g., Refs. [9,13,15,16]), thus, decreasing within-subject variability. Fourth, attention should be paid to individual differences that might serve as vulnerability factors in some women. For example, previous research suggests that a personal history of depression [19,20] and a family history of OC-related depressive symptoms [21] increase one’s risk of exhibiting depressive symptoms when taking OCs. Finally, psychological and indirect pharmacological factors that could affect mood should be assessed to determine what role, if any, they may play. Psychological factors may include expectations of a positive or negative mood change (the placebo effect), or “the symbolic effect of the ‘antibaby pill’” [22] (e.g., an increase in positive affect or a decrease in negative affect due to increased reassurance about protection from pregnancy). An indirect pharmacological effect might be mood change secondary to somatic side effects (e.g., an increase in negative affect occurring because of weight gain).

The present study attempted to examine the relationship between OC use and affect and to determine whether controlling for the above confounds could account for the conflicting findings of previous researchers. The present study is the first to examine positive affect variability and to investigate the survivor effect by directly comparing early-, late-, and never-users of OCs. It is also the first study of affect to examine a number of additional possible moderating variables. These were presence or absence of: self-diagnosed premenstrual syndrome (PMS) history, family history of mental illness, and personal history of mental illness; as well as the interaction between pill type (monophasic vs. triphasic) and duration of use. PMS was included due to the putative relationship between hormones and mood, while family and personal psychiatric history were included as they could reflect possible vulnerability factors to mood change.

Three main hypotheses were suggested by the literature: (a) first-time OC users should experience higher negative affect and lower positive affect than long-time users and never-users; (b) long-time OC users should experience less variability of negative affect and positive affect than never-users and first-time users; and (c) OC users with the presence of a self-diagnosed history of PMS, family history of mental illness, and/or personal history of mental illness should experience more negative affect and less positive affect than never-users and OC users without such a history.

Method

Subjects

One hundred and twenty-nine female university students (20 first-time OC users, 52 long-time users, and 57 never-users) were recruited to participate in this study. The women received either a monetary payment or course credit (introductory psychology student volunteers) for completing the study.

Data were excluded from analysis if the subject: (a) was a long-time user who had taken more than one brand of OC pill (i.e., “switchers”); (b) was a first-time user who had previously taken OCs and was starting again; (c) had previously delivered a child; (d) had a current and/or chronic medical disorder that could affect emotional states (e.g., hypothyroidism); (e) was pregnant; (f) was presently taking a medication that could affect emotional states (e.g., lithium carbonate); (g) did not menstruate during the 35 days of the study; (h) was lactating; or (i) was hysterectomized. In total, 27 women were excluded based on the above criteria. Six women (one first-time user, three long-time users, and two never-users) did not complete the study (4.7%). Reasons for the loss of subjects included: (a) moving out of town during the course of the study (one first-time user); (b) failure to complete the 35 Daily Rating Questionnaires (DRQ) (three long-time users); (c) illness following surgery (one never-user); and (d) failure to complete Stage 3 due to a busy schedule (one never-user).

In total, 96 women (17 first-time OC users, 34 long-time users, and 45 never-users) completed the study and had usable data based on the exclusion criteria. The women ranged in age from 18 to 27 (M = 19.84, S.D. = 1.59) and their years of education ranged from 13 to 19 (M = 14.41, S.D. = 1.01). The majority of the women were single; only 7.3% were married or cohabitating. Of the OC users, 54.9% were taking a medication that could affect emotional states (4.7%). Reasons for the loss of subjects included: (a) moving out of town during the course of the study (one first-time user); (b) failure to complete the 35 Daily Rating Questionnaires (DRQ) (three long-time users); (c) illness following surgery (one never-user); and (d) failure to complete Stage 3 due to a busy schedule (one never-user).

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24 months (M = 36.71, S.D. = 16.76). The never-user group consisted of women who had never taken OCs.

**Measures**

Three self-report instruments were used: an Initial General Information Questionnaire (IGIQ), the DRQ, and a Final General Information Questionnaire (FGIQ).

**Initial General Information Questionnaire**

The IGIQ consisted of seven sections: demographic information, medications and medical conditions, relationship information, personal and family psychiatric history, reproductive history, contraceptive information (including attitudes), and substance use. This questionnaire was developed by the authors specifically for this study. The anxiety and depression subscales from the Symptom-Checklist-90-Revised [23] were also included.

**Daily Rating Questionnaire**

The DRQ contained the Positive and Negative Affect Schedule (PANAS) [24], and the Menstrual Distress Questionnaire (MDQ) Form T [25,26].

The 20-item PANAS is designed to independently measure both positive affect and negative affect. Subjects were instructed to rate each adjective on a five-point scale reflecting the extent to which they have experienced the emotion during the past 24 hours. The scale for each item ranged from 0 (very slightly or not at all) to 4 (extremely). The two scales of the PANAS have been shown to have sound psychometric properties [24].

The MDQ includes 47 items which assess affective, somatic, and behavioural symptoms that might occur during the menstrual cycle. Eight scales are included: pain, water retention, autonomic reactions, concentration, behaviour change, negative affect, arousal, and control. Each symptom within each of these scales is rated on a five-point scale ranging from 0 (none) to 4 (severe). The subject is required to choose the category which best describes their experience for that day. A 48th item is also included to determine if the menstrual flow is occurring. The primary purpose of the MDQ in this study was to monitor somatic symptoms. Markum [27] found the MDQ Form T to have high test—retest reliability for the overall score and high split-half reliabilities. Research by a number of other groups (e.g., Refs. [28–30]) attests to the validity of this questionnaire.

**Final General Information Questionnaire**

The FGIQ included the same seven sections as the IGIQ.

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2 The scoring key for each PANAS item normally ranges from 1 to 5 [24]. When comparing the positive affect or negative affect scores to those of other studies, simply add 10 points to the scale scores reported here.

**Procedure**

The study consisted of three stages. During Stage 1, the women met in mixed groups with the experimenter. They were told that the study was an examination of the psychological and emotional effects of contraception. Subjects read and signed the consent form and then completed the IGIQ. This took approximately 20 minutes. Each subject was then given a package containing instructions and 35 DRQs. The women were told that they would be required to fill out a questionnaire daily for 35 days (Stage 2) and then return to complete a final questionnaire (Stage 3). A date, time, and place were given for Stage 3 of the study.

In Stage 2, the women filled out a DRQ each evening for 35 days beginning the same day that they completed the initial questionnaire. Women in the first-time user group who had not yet started taking OCs filled out the DRQ on the first day of OC use. Each woman also received one phone call from the experimenter near the end of Stage 2 to confirm the final appointment time and to address any questions or concerns which the woman may have had.

Once a woman had completed all 35 DRQs, she returned to the university at the meeting time given during Stage 1 in order to complete Stage 3. They filled out the FGIQ, received a Debriefing Form and then received either payment or course credit for participating. Those women who did not show up for their appointment were rescheduled until they completed the FGIQ or until they withdrew from the study.

**Data reduction and analyses**

The 35 DRQs were numbered based on each woman’s self-reported menstrual cycle. For each woman, Day 1 was the first day of menstruation and the last day used in the analysis was the last day before menstruation (most often between Days 28 and 35). The number of data days used for each woman was dependent on either the length of the woman’s cycle or where her menstrual period fell during the 35 days of the study. For each subject, the menstrual cycle was then partitioned into the four menstrual cycle phases most commonly used by previous researchers: all days of menstrual flow (menstrual phase), the 7 days after menstruation (postmenstrual phase), the remaining days leading up to the 7 days before menstruation (intermenstrual phase), and the 7 days before menstruation (premenstrual phase). Although this method of partitioning the menstrual cycle is not without its criticisms (e.g., Ref. [31]), the majority of studies to date have used this day-count method.

Daily positive affect, negative affect, and four of the MDQ scale scores (pain, water retention, autonomic reactions, and control) were then calculated for each subject. In the rare instances where items were missed, the item’s score was estimated by taking the item’s scores from the preceding and following days and calculating the mean. In total, approximately 225 of the 115,200 items (0.2%) were missed.
From the daily scores, a mean and variability score for the six scales were calculated for each phase for each woman. The variability scores measured the variance of the daily scores within each phase. The above calculations resulted in four mean scores and four variability scores for each woman for positive affect, negative affect, pain, water retention, autonomic reactions, and control (48 scores in total).

The same basic design was used for all analyses: a 3 between (Never-Users, First-Time Users, Long-Time Users) × 4 within (Menstrual Phase, Postmenstrual Phase, Intermenstrual Phase, Premenstrual Phase) mixed multivariate analyses of variance (MANOVA). The dependent variables used in the main analyses were mean positive and negative affect scores, or variability in positive and negative affect scores.

Results

Preliminary analyses

Prior to any analysis, the distributions of mean and variability scores for positive affect, negative affect, pain, water retention, autonomic reactions, and control for each group/phase combination were examined and any univariate outliers were replaced with the (\(M \pm 3 \text{ S.D.}\)) value. The following decisions regarding data analysis were made based on suggestions by Tabachnick and Fidell [32]. First, the unweighted means approach to MANOVA was used to analyse both mean and variability affect scores, with an alpha level of .05. Significant MANOVAs were followed up with univariate ANOVAs using an alpha level of .025 to control for the number of comparisons. Newman–Keuls post hoc comparisons were done on significant effects and interactions with an alpha level of .025. Second, the conservative Pillai’s criterion for evaluating multivariate significance was used in all analyses to compensate for heterogeneity of variance. Finally, the four somatic scales were combined into one to solve the multicollinearity problem. The four scale scores were summed and divided by the number of items to obtain a total somatic symptoms score. Mean and variability somatic scores were calculated for each woman for each phase of the cycle.

The overall mean positive and negative affect rating scores for all women were 13.57 (S.D. = 6.40) and 5.69 (S.D. = 4.90), respectively. These means are very similar to those previously found with male and female university students [33].

Assessing group equivalency

Descriptive statistics for the three groups of women are presented in Table 1. Univariate analyses of variance indicated that the three groups of women were not significantly different in terms of age, years of education, height, weight, frequency of alcohol consumption, amount of alcohol consumption, or frequency of illegal drug use (\(P > .05\)). There were, however, significant relationships between group membership and whether or not one had a romantic partner, \(\chi^2 (2, n = 96) = 16.63, P < .01\), and one’s level of sexual activity during the study, \(\chi^2 (4, n = 95) = 44.07, P < .01\). Since women who take OCs usually do so because they are in a relationship and sexually active, these group differences likely reflect true population differences. Sexual status did not, however, affect positive or negative affect scores (\(P > .05\)). While relationship status did not affect positive affect scores (\(P > .05\)), the women in romantic relationships experienced more negative affect than women not in such relationships \(t(118.96) = 2.74, P < .05\). There was no relationship between relationship status and positive or negative affect variability scores \(Ps > .05\).

Main analyses

Relationship between OC use and positive and negative affect means

Table 2 lists the overall mean scores for positive and negative affect for the three groups of women across the four phases of the menstrual cycle. A 3 (Group) × 4 (Menstrual Cycle Phase) mixed MANOVA was performed on mean daily positive affect scores and mean daily negative affect scores to examine whether first-time OC users differed from long-time users and never-users. There was no group effect for positive or negative affect. Similarly, there was no significant main effect for menstrual cycle phase, or the Group × Menstrual Cycle Phase interaction.

Relationship between OC use and positive and negative affect variability

Mean positive and negative affect variability scores are presented in Table 3. A 3 (Group) × 4 (Menstrual Cycle Phase) mixed MANOVA was performed to assess group
differences in negative and positive affect variability. While there was no significant group effect for positive or negative affect variability scores, there was a significant phase effect \[F(6,558)=3.55, P<.01\], but no Group \(	imes\) Phase interaction. A follow-up 3 (Group) \(	imes\) 4 (Menstrual Cycle Phase) mixed ANOVA performed on negative affect variability scores did not reveal an effect for group, phase, or for their interaction. The identical ANOVA performed on positive affect variability scores revealed a significant main effect for phase of the menstrual cycle \[F(3,279)=5.54, P<.01\]. The main effects for group and the Group \(	imes\) Phase interaction were not significant.

Newman–Keuls post hoc tests revealed that the women experienced significantly less variability in positive affect during the menstrual phase than during the postmenstrual phase \(q(279) = 6.28, P<.01\); the intermenstrual phase \(q(279) = 10.18, P<.01\); and the premenstrual phase, \(q(279) = 9.84, P<.01\). In other words, less positive affect variability was observed during menstruation than during any other phase of the cycle.

Despite the absence of any group differences in affect as measured by the PANAS, a large proportion of the first-time and long-time OC users indicated retrospectively that they believed that OCs had affected their mood “slightly negatively” (40.8%). Furthermore, a significantly greater proportion of first-time users (64.7%) than long-time users (28.1%) indicated that they believed that OCs had affected their mood “slightly negatively” (\(z = 2.47, P<.05\)).

**Exploration of pill type**

The following analyses were undertaken in order to explore whether a failure to distinguish between OC type (monophasic vs. triphasic) in the main analyses could be obfuscating any main effects. Four separate 2 (First-Time Users, Long-Time Users) \(	imes\) 2 (Monophasic Users, Triphasic Users) \(	imes\) 4 (Menstrual Cycle Phases) mixed ANOVAs were conducted on mean positive affect, mean negative affect, mean positive affect variability, and mean negative affect variability. For positive affect variability, both the OC Type \(	imes\) Phase interaction and the Pill-User Group \(	imes\) OC Type \(	imes\) Menstrual Cycle Phase interactions were significant \[Fs(3,141) = 4.55 and 3.56, Ps<.01 and .025\], respectively (see Table 4 for the mean scores).

Separate ANOVAs for the two OC types found a phase effect for the triphasic OC users \[F(3,63) = 4.86, P<.01\], and a Pill-User Group \(	imes\) Menstrual Cycle Phase interaction for the monophasic OC users \[F(3,78) = 5.09, P<.01\]. Post hoc analysis of these findings revealed that the triphasic OC users experienced more positive affect variability during the intermenstrual phase than the menstrual phase \(q(78) = 16.19, P<.025\), while no phase effect was found for the monophasic users (see Fig. 1). Separate examination of the first-time and long-time users revealed a phase effect for the long-time users \[F(3,96) = 5.31, P<.01\], and an OC Type \(	imes\) Menstrual Cycle Phase interaction for the first-time users \[F(3,45) = 6.48, P<.01\].

Examination of the menstrual phase revealed that: (a) first-time users had higher positive affect variability than the long-time users \[F(1,50) = 8.42, P<.01\]; (b) monophasic OC users had significantly higher positive affect variability than the triphasic users \[F(1,50) = 7.18, P<.025\]; and (c) there was a Pill-User Group \(	imes\) OC Type interaction \[F(1,50) = 6.15, P<.025\] (see Fig. 2). First-time OC users taking monophasic preparations experienced significantly more positive affect variability than long-time users.

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**Table 2**

Mean negative and positive affect scores for the three groups across the four phases of the menstrual cycle

<table>
<thead>
<tr>
<th>Group</th>
<th>Positive affect</th>
<th>Negative affect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phase 1</td>
<td>Phase 2</td>
</tr>
<tr>
<td>Never-users</td>
<td>13.56</td>
<td>13.54</td>
</tr>
<tr>
<td></td>
<td>(7.72)</td>
<td>(7.15)</td>
</tr>
<tr>
<td>First-time users</td>
<td>14.23</td>
<td>14.91</td>
</tr>
<tr>
<td></td>
<td>(7.10)</td>
<td>(7.40)</td>
</tr>
<tr>
<td>Long-time users</td>
<td>12.42</td>
<td>12.38</td>
</tr>
<tr>
<td></td>
<td>(7.60)</td>
<td>(6.10)</td>
</tr>
<tr>
<td>Phase means</td>
<td>13.28</td>
<td>13.37</td>
</tr>
<tr>
<td></td>
<td>(7.52)</td>
<td>(6.83)</td>
</tr>
</tbody>
</table>

Phase 1 = menstrual; Phase 2 = postmenstrual; Phase 3 = intermenstrual; Phase 4 = premenstrual.
variability during the menstrual phase than long-time monophasic users \(q(50) = 24.38, P < .01\), first-time triphasic users \(q(50) = 23.38, P < .01\), and long-time triphasic users \(q(50) = 25.29, P < .01\).

Premenstrual Syndrome

Self-diagnosis of PMS (yes, no, or unsure) was explored in two 2 (Never-User, Long-Time User) \times 3 (No PMS, PMS, Unsure of PMS) \times 4 (Menstrual Cycle Phase) mixed MANOVAs. The first-time user group was excluded since only one woman fell into the PMS cell. No significant main effects or interactions were obtained for the mean affect scores. However, analysis of the mean variability scores found a main effect for phase \(F(6,432) = 5.36, P < .001\). ANOVAs revealed a significant phase effect for both positive affect variability \(F(3,216) = 8.44, P < .001\), and negative affect variability \(F(3,216) = 4.49, P < .025\).

Family history of mental illness

The results of two 3 (Group) \times 2 (Presence, Absence of Family History) \times 4 (Menstrual Cycle Phase) mixed MANOVAs indicated that the Pill Group \times Family History variable interaction was not significant nor were any of the other main effect or interaction tests. The variability MANOVA found only a main effect for menstrual cycle phase \(F(6,540) = 3.31, P < .01\). The follow-up ANOVAs revealed a significant effect of phase for positive affect variability \(F(3,270) = 4.66, P < .01\) and a significant Group \times Family History \times Phase interaction for negative affect variability \(F(6,270) = 2.81, P < .025\). A positive affect variability phase effect, similar to that reported in the main analyses, was found as well as two new differences for negative affect variability: (a) a significant phase effect for women with a family history of mental illness \(F(3,117) = 3.77, P < .025\).

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Mean positive affect variability scores as a function of OC type group, pill-use group, and phase of the menstrual cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Phase 1</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>First-time users</td>
<td></td>
</tr>
<tr>
<td>Monophasic (n = 7)</td>
<td>36.44 (31.14)</td>
</tr>
<tr>
<td>Triphasic (n = 10)</td>
<td>13.06 (14.70)</td>
</tr>
<tr>
<td>Long-time users</td>
<td></td>
</tr>
<tr>
<td>Monophasic (n = 34)</td>
<td>12.06 (9.47)</td>
</tr>
<tr>
<td>Triphasic (n = 21)</td>
<td>11.15 (8.89)</td>
</tr>
<tr>
<td>Phase means</td>
<td>15.37 (16.81)</td>
</tr>
</tbody>
</table>

Phase 1 = menstrual; Phase 2 = postmenstrual; Phase 3 = intermenstrual; Phase 4 = premenstrual.

Fig. 1. Mean positive affect variability scores across the menstrual cycle as a function of OC type. While the menstrual and intermenstrual phases differed significantly for the triphasic users, there were no significant between-phase differences for the monophasic users. Vertical lines depict standard errors of the mean.

Fig. 2. Mean positive affect variability scores during the menstrual phase as a function of pill-use group and the OC type. The first-time monophasic users had significantly higher positive affect variability than the other three groups. Vertical lines depict standard errors of the mean.
and (b) a significant phase effect for the long-term user group \[F(3,96) = 3.37, P < .025\].

**Personal history of mental illness**

The only significant finding from two 3 (Group) \(\times\) 2 (Presence, Absence of Personal History) \(\times\) 4 (Menstrual Cycle Phase) mixed MANOVA was a main effect for the personal history of mental illness variable \[F(2,89) = 3.58, P < .05\]. There were no significant main effects or interactions for the mean positive affect scores but a significant main effect for the personal history variable for the negative affect scores \[F(1,90) = 7.22, P < .025\], was revealed. The women with a suspected or diagnosed history of mental illness experienced more negative affect than women without a suspected or diagnosed history of mental illness.

The mean variability scores for the variances MANOVA revealed only a significant main effect or phase \[F(6,540) = 2.57, P < .05\]. A Group \(\times\) Personal History of Mental Illness \(\times\) Phase interaction was revealed for negative affect variability scores \[F(6,270) = 2.86, P < .025\]. Further analyses identified: (a) a phase effect for women without a personal history of mental illness \[F(3,207) = 3.26, P < .025\]; (b) a phase effect for the long-time user group \[F(3,96) = 6.31, P < .01\]; and (c) a Personal History \(\times\) Phase interaction for the long-term user group \[F(3,96) = 4.11, P < .01\].

**Analysis of somatic subscales**

A 3 (Group) \(\times\) 4 (Menstrual Cycle Phase) mixed ANOVA was performed on mean somatic scores and on mean somatic variability scores. While there was no main effect for group for the mean scores, there was a significant phase effect \[F(3,279) = 15.92, P < .001\]; but no Group \(\times\) Phase interaction. The women experienced significantly more somatic symptoms during the menstrual phase than the other three phases \[qs(279) = 0.14, 0.14, 0.07, Ps < .01\]; and significantly more somatic symptoms in the premenstrual phase than the postmenstrual and intermenstral phases \[qs(279) = 0.07, 0.07, Ps < .01\]. The phase effect is illustrated in Fig. 3. The analysis of the somatic variability scores found results similar to those listed above: no group effect; a phase effect \[F(3,279) = 4.17, P < .01\]; and no Group \(\times\) Phase interaction. Women experienced more variability in somatic symptoms during the premenstrual and menstrual phases than they did during the postmenstrual phase \[qs(279) = 0.16 and 0.13, Ps < .01 and .025\], respectively (similar to the effect presented in Fig. 3).

**Fig. 3.** Mean total somatic symptom scores for all women across the menstrual cycle. The women reported significantly more somatic symptoms during the menstrual phase than during the other three phases and during the premenstrual phase. Vertical lines depict standard errors of the mean.

**Discussion**

**No group differences in affect**

No differences in positive or negative affect were found between the three groups of women over the entire menstrual cycle or at any specific phase of the cycle. For positive affect, the lack of group differences between never-users and OC users is consistent with two studies [8,14], yet inconsistent with one other [7]. For negative affect, the above findings were in line with some studies [7,10,13,17] but not with others [8,16]. While previous studies have investigated either early, middle, or long-time use of OCs, the present study was the first to compare a group of first-time and long-time users. It is noteworthy that while we did not find group differences in the daily psychometric ratings of affect, when women in our study reported retrospectively on the effect of OCs on their mood, the first-time users indicated experiencing significantly more negative effects than the long-time user group. Therefore, in first-time users, retrospective measures appear more likely than prospective measures to indicate increases in negative affect.

One could argue that although our sample size is one of the largest in this area of research to date, a larger sample may be required to provide enough statistical power to detect group differences. This argument can be countered simply by looking at the means and the \(F\) values in our analyses. For positive affect, the means were not even in the predicted direction. However, for negative affect, all \(F\) values were less than one, which suggest that simply increasing the sample size will not lead to significant differences. Therefore, this argument does not seem to pose a great threat to the validity of the present findings.

The results suggest three conclusions. First, it is difficult in the face of these findings to sustain the view that taking OCs leads to a common decrease or increase in positive or negative affect for all women. If some women do experience positive or negative affect change as a result of OC use, a
third mediating or moderating variable must play a role. Second, the results do not suggest that the hormones in OCs lead to different psychoneuroendocrine actions on affect/mood during “early” or “late” use of OCs. Finally, daily ratings did not provide support for the role of the “survivor effect” as an artifactual confound. Our failure to find differences in affect between first-time and long-time users is not consistent with the hypothesis that many women tend to discontinue OC use due to negative mood side effects. Therefore, one cannot argue that the failure of previous researchers to find differences between groups of OC users and nonusers was due to a biased sample resulting from women with negative mood effects having already self-selected out of the OC user population.

No group differences in affect variability

None of the three groups differed in their experience of positive or negative affect variability. No previous studies have compared positive affect variability in OC users and nonusers. McFarlane et al. [11] came the closest to examining positive affect variability by assessing “mood stability.” They did not find any group differences. For negative affect variability, the present findings were not in line with previous studies comparing OC users and nonusers [9,13,15,16], as these studies found that OC users had more stable levels of negative affect either across the menstrual cycle or within certain phases.

Two implications arise from this finding. The first is simply that all women who take OCs may not experience a uniform increase or decrease in the stability of day-to-day positive or negative affect compared to never-users. Secondly, women just starting on OCs may not differ from long-time users as a whole on their mood lability or stability across the cycle or within certain phases. These findings are surprising in light of previous support for the OC mood-stabilizing hypothesis.

Pill type: monophasic and triphasic preparations

While triphasic OC users experienced more positive affect variability in the intermenstrual phase than in the menstrual phase, there were no significant phase differences for the monophasic users. This finding is similar to the results of two studies [34,35] that indicated greater mood stability in monophasic than triphasic OC users, and could be interpreted in three possible ways: (a) a methodological artifact due to unequal days in the menstrual cycle phases; (b) an indirect pharmacological effect on mood stability; or (c) a direct pharmacological effect on mood stability.

It seems plausible that in a sample with high between-subject and within-subject variabilities, cycle phases which contain more days (the intermenstrual phase) would have larger variances than phases which contain less days (the menstrual phase) since the longer phases contain more scores. Therefore, the above finding could be an artifact of the length of the phase. This interpretation is supported by significant correlations between the number of days in the menstrual and intermenstrual phases and the positive affect variability scores for these phases [rs = .23 and .25, Ps < .05].

However, four lines of evidence suggest that differences in phase length cannot entirely account for the finding. First, while the above correlations are significant, they are small and account for little variance (5.8%). Second, visual inspection of mean positive affect variability scores for the three groups also indicates that the first-time users’ menstrual and intermenstrual phase scores were almost identical in spite of the differences in the length of the phases. Third, the women in this study experienced more somatic symptom variability during the menstrual phase than the postmenstrual phase (which contains more days). Finally, it can be argued that if the number of days in the phase accounted entirely for this finding, then there would have been similar phase differences for the monophasic users here, and for both of these groups of women on negative affect variability. These differences were not found, which suggests that differences in phase length cannot entirely account for the positive affect stability differences between monophasic and triphasic users.

The likelihood that phase differences in positive affect variability for the triphasic users could be the result of different somatic side effects from the monophasic and triphasic preparations is low. A comparison of monophasic and triphasic users on both total mean somatic scores and total mean variability somatic scores across the phases of the cycle did not reveal any group effects or interactions. Since an OC type by menstrual cycle phase interaction was found for positive affect variability, the women’s overall experience of somatic symptoms cannot entirely explain the positive affect variability group differences. However, this does not rule out individual somatic symptoms as contributing to positive affect variability differences between the two pill types.

The final interpretation of the differences is a pharmacological effect of the OCs on positive affect variability. More variable hormonal levels across the cycle may be associated with greater variability in positive affect across the cycle. While monophasic OCs contain consistent levels of estrogen and progestin across the 21 days, the triphasic OCs change the levels of progestin (and sometimes estrogen) three times during the 21 days. The simple act of switching dosages may increase positive affect variability across the cycle. However, for triphasic users, the progestin dosage is usually one-half to two times higher during the intermenstrual phase than the menstrual phase. Thus, increased positive affect variability may be related to increased progestin. If our finding is replicated, a practical application might be that triphasic OC users complaining of “mood lability” may experience more positive affect stability on a monophasic preparation.

The comparison of monophasic and triphasic users resulted in a second finding. The first-time monophasic users experienced more positive affect variability than first-time triphasic users, long-time monophasic users, and long-time
Neither triphasic users during the menstrual phase. No previous studies have compared first-time and long-time users of OCs in general or with further separation by the type of pill.

Before any conclusions could be drawn about the above finding, it was necessary to ensure equivalency of the groups on five variables: personal history of mental illness, family history of mental illness, mean and variability of somatic symptoms during the menstrual phase, number of cycles of OC use, and proportion of specific OC types taken. No group differences were found.

Keeping in mind the smaller samples used in this analysis, the finding suggests that the early use of monophasic OCs is associated with higher variability in positive affect during the menstrual phase than the early use of triphasic. This increased variability disappears after at least 2 years of taking OCs, suggesting that the increased variability may reflect a greater withdrawal effect during the pill-free week for the monophasic than triphasic users. The monophasic women take a constant hormone dosage for 21 days which is then suddenly withdrawn while the triphasic users have had gradual changes in the dosage throughout the cycle. Perhaps adjustments occur over time to adapt to this sudden withdrawal of exogenous hormones. The underlying implication is that both differences in duration of OC use and OC type are associated with differences in positive affect variability. Furthermore, while the main analyses suggest that the survivor effect is not a valid explanation for the failure of “late use” studies to find differences between OC users and nonusers, the above findings suggest that for studies using certain groups of women, the survivor effect may be a real confound. High variability in positive affect during the menstrual phase may cause first-time monophasic users to discontinue OC use.

**PMS history**

Whether or not a woman believed that she experienced PMS did not differentiate never-users and long-time users on positive or negative affect or affect variability scores. This analysis was done as two previous studies [19,36] indicated that “premenstrual depression” and “premenstrual weepiness” increased the risk of OC-related depression. However, no studies have used daily ratings of affect to compare long-time and never-users based on their PMS history.

The most likely explanation for the lack of group differences in affect is that no such differences exist. However, two possible threats to the validity of this conclusion must be mentioned. First, this analysis had low statistical power as the number of women in each cell of the design ranged from only 6 to 18. Second, while the measure of PMS had reliability, it seemed to be lacking in validity. That is, there was no indication from the affect phase means that those women who answered “yes” to the PMS question experienced more negative affect in the premenstrual phase or greater intermenstrual to premenstrual increases in negative affect than those who answered “no.” In light of the power and validity issues, PMS history cannot be completely excluded as a possible mediating or moderating variable in any effect of OC on affect.

**Family mental illness history**

The addition of a suspected or diagnosed family history of mental illness variable did not reveal any differences in general positive or negative affect or affect variability. No other studies on positive or negative affect have investigated family history as a moderating variable. Some studies even excluded women who had a positive family history of mental illness (e.g., Ref. [14]). The only study to investigate the possible genetic influence of OC-related changes in affect was a large-scale twin study which concluded that OC-related depression (and “irritability” to a lesser extent) was clearly influenced by genetic factors and not by individual-specific environmental factors [21].

Since the present analysis was exploratory, it seems important to mention that although post hoc tests did not find differences between means, a significant weak interaction between the family history variable, menstrual cycle phase, and pill-use group was found for negative affect variability. Considering the small n’s in each cell, and the fact that this was the only variable to produce significant (although weak) group differences for negative affect variability, family history of mental illness merits further exploration.

**Personal mental illness history**

First-time, long-time, or never-users of OCs with a suspected or diagnosed personal history of mental illness do not seem to have different experiences of negative or positive affect or affect stability. No previous studies have explored this relationship and it is not uncommon for studies to have excluded women with a history of mental illness (e.g., Refs. [14,37]). However, some early studies examining diagnosable mood disorders, as opposed to affect, found that the relationship between OCs and depressive mood change was most strongly found in women who already had a predisposition to be depressed (e.g., Refs. [19,20]).

As with the family history variable, a weak interaction between personal history, pill-use group, and menstrual cycle phase was found for negative affect variability. This interaction is again only being mentioned as it deserves further consideration, since this study was the first to explore it. Although the number of women per cell in the analysis ranges from 5 to 34, the reliability of the personal history categorization seems quite good. There was, however, no external measure of validity for the categorization. Nevertheless, this exploratory examination of personal mental illness history suggests that the inclusion of this variable in further research examining the relationship between OCs and affect may be warranted.
Positive affect variability phase effect

Significant differences in positive affect variability were found between the phases of the menstrual cycle. The women’s ratings of positive affect were more stable during the menstrual phase than during the other three phases. This study was the first to examine positive affect variability across the menstrual cycle. As was noted in the section on monophasic and triphasic preparation comparisons, this phase effect could be interpreted in one or more of the following ways: (a) a methodological artifact of the number of days in the menstrual cycle phases; (b) a secondary effect of somatic symptoms on positive affect variability; or (c) a psychoneuroendocrine difference between phases of the cycle.

As outlined earlier, the number of days in each menstrual cycle phase cannot account for all of the variation in the positive affect variability scores across phases. With regard to somatic symptoms during the menstrual phase, there was no relationship between positive affect variability and the experience of somatic symptoms ($r = -.05, P > .05$). However, there was a positive correlation between positive affect variability and somatic symptom variability ($r = .25, P < .05$). These two coefficients suggest that neither the experience of somatic symptoms nor somatic variability can account for the phase effect. An internal psychoneuroendocrine mechanism may cause women to experience more stability of positive affect while they are menstruating. Since both progesterone and estrogen levels are low during this period for both OC users and nonusers, perhaps these hormones regulate positive affect variability (e.g., higher levels lead to higher variability).

Somatic symptom phase effect

The intensity of somatic symptoms was the same for women in all three groups. The women did, however, experience more intense somatic symptoms during the menstrual phase, followed by the premenstrual phase. More physical symptoms were experienced during these two phases than either of the other two. The lack of group differences is not consistent with previous studies (e.g., Refs. [35,38]). However, the phase effects are similar to those reported by others [8,10,14,16,17], which suggests that this is a reliable finding.

While there were no group differences in somatic symptom variability, there was a phase effect for the women as a whole. Compared to the postmenstrual phase, there was greater day-to-day variability of somatic symptoms in the premenstrual and menstrual phases. As this was the first study to specifically examine somatic symptom variability, no comparisons with other findings are possible. The phase effect findings seem straightforward and likely reflect the increases in “pain” and “water retention,” which women commonly report experiencing in the days leading up to and during menstruation. Failure to find group differences in somatic symptoms, especially between first-time users and the other groups, could again be a function of the large between-subject variation. Since physical side effects are common in the early use of OCs, it seems suspect that no group differences were found.

Future research

Future research should explore how OC type (monophasics and triphasics), family mental illness history, and personal mental illness history combine with duration of OC use or nonuse to differentially affect positive and negative affect variability across the menstrual cycle phases. In particular, the monophasic/triphasic preparation user differences need to be replicated. An excellent experiment would involve a 2 (OC Type) x 2 (Duration of OC Use) x 4 (Triphasic OC Cycle Phase) design with the inclusion of users of monophasic and triphasic preparations who differ only by the dosage of the progesterone across the triphasic cycle. The critical dependent variable would be positive affect variability. Future studies could also include samples more characteristic of the general population, as well as more reliable and valid measures of PMS, family mental illness history, and personal mental illness history, as these variables may play a moderating role in any effects of OCs on positive or negative affect or affect variability. The effects of OCs on circadian, as opposed to daily, variability in affect should also be investigated. Finally, as we have discussed elsewhere [4], many OC-related somatic side effects (e.g., breakthrough bleeding, weight gain) could also influence affect. Measures of such side effects should, therefore, be included in any research that investigates the relationship between OC use and affect or mood.

Summary

The present study did not find any group differences in positive or negative affect or affect variability between first-time, long-time, and never-users of OCs in a sample of relatively young, healthy, and intelligent women. Based on these findings, the “survivor effect” may not have played as great a role in previous research as has been suggested. However, differences in positive affect variability between monophasic and triphasic first-time and long-time OC users suggest that the survivor effect may be a confound in previous studies if early monophasic users discontinued OC use due to increases in positive affect variability. The exploratory comparison of monophasic and triphasic users found that the variable hormone levels of triphasic OCs were associated with greater variability in positive affect across the cycle. Triphasic users experienced more variability in positive affect between menstrual cycle phases than did monophasic users. Furthermore, during the menstrual phase, the monophasic first-time users experienced more positive affect variability than the other three groups. This suggests that the sudden withdrawal of a constant level of
hormones (e.g., monophasic OCs) leads to greater variability in positive affect than does the sudden withdrawal of changing hormonal levels (e.g., triphasic OCs). Finally, while consideration of PMS history did not reveal group differences in affect, consideration of family and personal mental illness history indicated that these variables may interact with OC group and menstrual cycle phase in terms of their effects on negative affect variability. These findings suggest a role for hormones in the regulation of day-to-day affect variability.

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