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Self-reported crying during the menstrual cycle:
Sign of discomfort and emotional turmoil or erroneous beliefs?

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Abstract

Crying is generally associated with distress and discomfort and is also part of the premenstrual syndrome in women. Therefore the present studies focused on crying fluctuations during the menstrual cycle. First, a retrospective cross-cultural study among women from 33 different countries (N= 2447) was conducted. Crying proneness reportedly increased before menstruation, with remarkable cross-cultural differences. Women using oral contraceptives (OC) largely reported the same pattern of results as women not using OC. In a second study, 82 Dutch students kept a crying and mood diary for two consecutive menstrual cycles. During no phase of the menstrual cycle, actual crying episodes nor crying proneness was increased, although significant changes in mood were reported. Given the large cross-cultural differences on the one hand, and the remarkable correspondence between the self-reports of those using OC and those who do not use OC on the other hand, it is concluded that the role of female sex hormone fluctuations in crying has to be questioned. Rather, it seems more likely that fluctuations in self-reported crying are based on implicit theories on the relation between menstrual cycle, mood, and crying

Introduction

Crying, the shedding of tears in response to an emotional stimulus, is a typical and uniquely human emotional expression. It may best be considered as a biopsychosocial phenomenon, with as main function to express and communicate psychological distress or physiological discomfort (like sadness and pain). The association with distress/discomfort, on the one hand, and the apparent important role of biological, psychological and sociocultural factors makes crying an interesting behavior to study in relation to menstrual cycle variations. Even though it is questionable whether mood varies with menstrual cycle^{2,3}, having a menstrual period is not a positive experience either. Most women consider it to be a hassle and cramps and discomforts are frequently reported⁴.

In addition, tearfulness is one of the symptoms of pre-menstrual syndrome (PMS), together with other emotional (e.g., depression, anxiety, nervous tension), cognitive/functional (difficulty concentrating, insomnia, marital discord, and increased personal conflicts), and somatic (breast swelling, abdominal cramping, aches, and muscle spasms) symptoms⁵. However, PMS is a fuzzy concept and no exact lines can be drawn between those afflicted and those who are not. Nevertheless, in addition to being a PMS-like symptom in itself, increased tearfulness and crying may likely result from the pain and cramps, emotional lability, fatigue, and increased interpersonal conflicts.

Crying is also an interesting variable to study in relation to the menstrual cycle since some episodes in women's lives, in particular those associated with large fluctuations in female sex hormones, appear to be connected with changes in crying frequency. Examples are the maternity blues with increased crying and tearfulness as basic features, and the for the menopause characteristic 'dry eyes' syndrome⁶⁻⁸. In addition, recent data suggest a role for disturbances in serotonergic neurotransmission and/ or immune-serotonin interactions¹¹. This justifies research into the specific relation between crying and menstrual cycle.

Although there is ample indication that suggests menstrual cycle variations in crying, empirical support is rather slim. Only a handful of studies have paid explicit attention to crying variations across the menstrual cycle. In a classic study¹⁰ among 839 women, retrospective reports of crying increased 5-fold during the premenstrual and menstrual phases. In a more recent study¹² among registered nurses, 36% explicitly reported to experience depression and crying just before or at the start of their menstrual period. Frey and coworkers⁶ examined the number and length of crying episodes of 85 healthy women, who were not on birth control pills. Their data revealed three consistent peaks in crying behavior: four to six days before the menstruation, three to five days after the onset of the menstrual periods, and thirteen to sixteen days after the onset of menstruation (around ovulation).

Unfortunately, none of these studies controlled for the confounding effects of beliefs. Longitudinal studies in which women were not aware of being in a study on menstrual cycle effects, have shown that women are less likely to report decreased mood during the typical PMS days¹³⁻¹⁷. The same might be true for crying. However, it seems likely that self-reports of behavioral events like crying are less prone to memory bias than the reports of experienced mood states. Crying could possibly be used as a more reliable indicator of distress in menstrual cycle research.

The present studies focus on the association of crying to different menstrual cycle phases. Specifically, we expect to find increases in self reported crying during the premenstrual phase, when decreases in mood are most likely to occur and during the menstrual cycle when physical discomfort might result in increased crying. In Study 1, we report retrospective data collected in the context of the large world-wide International Study on Adult Crying (ISAC)¹⁸⁻¹⁹. The study of cross-cultural differences can significantly contribute to our understanding of menstrual cycle effects of crying. The second study was designed to overcome the limitations inherent to the retrospective design of the first study by collecting crying data during two consecutive menstrual cycles among Dutch women.

Study 1

Methods

Participants

The sample consisted of women between 16 to 28 years of age ($M = 20.9$; $SD = 2.5$), participating in the International Study on Adult Crying (ISAC)¹⁸⁻¹⁹. Country samples were included when the number of women in the mentioned age range was at least 30. The respondents used in this study were 2447 young, mainly students, residing in 33 different countries (see Table 1). The samples were recruited by local collaborators. In some cases, students participated to meet course requirements, in other countries the respondents mainly consisted of volunteers. Oral Contraceptives (OC) were used by 571 women ($N=1503$ non-users, $N= 373$ missing data). All participants indicated to have experienced crying episodes as an adult.

Measures and procedures

As part of a larger crying questionnaire, women were asked whether their crying tendency varied with the phase of their menstrual cycle (yes/no). If so, women were asked to mark the days of a typical menstrual cycle they *felt* they cried more easily. This typical menstrual cycle was divided up into the following days: premenstrual days 14-1, menstrual days 1-6, and postmenstrual days 1-14 (see figure 1).

In order to make this data suitable for analyses, menstrual cycle phases were defined. In accordance with previous studies²⁰⁻²² on mood changes during the menstrual cycle, menstrual cycle phases consisted of the days which would theoretically coincide with estrogen or progesterone changes. The *Menstruation phase* coincided with menstruation days 1-5, *Follicular* or *Postmenstrual phase* was defined as postmenstrual days 1-5, *Ovulation phase* as premenstrual days 14-10,

and *Luteal* or *Premenstrual phase* as premenstrual days 5-1 (see Figure 1).

Menstrual cycle effects were determined by averaging the scores over these specific days.

Results

Of the total sample, 41.8% (N=1022) reported that their crying tendency was dependent on the phase of the menstrual cycle by indicating at least one day with increased crying tendency (no data were available of 221 women (9.0%)). More women using OCs (55.0%) compared to those not using birth control pills (45.0%) reported such an association (Pearson $\chi^2 = 18.78$, $p < .001$). Large cross-cultural variations were found, with less than 25% of the country samples reporting this relation in Bulgaria, Ghana, Nepal, Nigeria, Romania and Peru. In Australia, Brazil, Chile, Spain, Sweden and Turkey more than 65% reported a relation between crying and their menstrual cycle (see Table 1). All further analyses were restricted to those women who reported an association.

Menstrual cycle variations in crying

Variations in the likelihood of crying across the four different phases were investigated using ANOVA with repeated measurements, with crying proneness in each of the four menstrual phase as the within-subject factor and OC use as the between-subject factor. Because of the fact that OC-use was relatively high in Western countries, like Australia and Sweden but low in non-Western countries, like Ghana and Nepal, country of origin might possibly confound the effect of OC-use. Therefore, country was entered as a between subject factor in the ANOVA analysis.

The within subject factor *cycle phase* was significant ($F_{(2.4,2136)} = 314.4$, $p < .001$; Degrees of freedom after Huynh-Feldt correction). Participants indicated to cry more easily during the premenstrual than during the menstrual phase ($F_{(1,908)} = 20.7$, $p < .001$). Crying proneness was increased in the menstrual and premenstrual phases compared to the postmenstrual and ovulation phase (i.e., contrast menstrual phase versus postmenstrual phase ($F_{(1,908)} = 143.9$, $p < .001$). The latter two phases did not differ mutually.

The effect of the between-subject factor *OC use*, was not significant nor were the interaction effects significant. This indicated that the OC group was not more prone to cry or differed in crying proneness over phases, compared to the non-OC group.

The between-subject factor *Country* was significant ($F_{(32,908)} = 3.54, p < .001$). In addition, the interaction between country and phase was significant ($F_{(75.3,2136)} = 2.83; p < .001$; Degrees of freedom after Huynh-Feldt correction), which was recurrent in the contrast between premenstrual and menstrual phase ($F_{(32,908)} = 1.83, p < .01$), and between menstrual and postmenstrual phase ($F_{(32,908)} = 2.12, p < .001$). There was no interaction effect when comparing the menstrual phase to the ovulation phase. Thus, the variation in crying during the menstrual cycle differed between countries mainly over three phases.

Cross cultural differences in menstrual cycle variations of crying

Similar ANOVA analyses were run for each of the 33 countries separately, comparing only the premenstrual, menstrual and postmenstrual phases. In 27 countries the general effect of phase was significant at the 5% level, which was mainly recurrent in the contrasts between the menstrual phase on the one hand and the postmenstrual phase on the other. Most countries showed higher crying proneness in the premenstrual phase than in the menstrual phase, which contrast was significant for Australia, Austria, Greece, Hungary, Iceland, India, New Zealand, Sweden, Turkey and USA. Eight countries showed higher menstrual than premenstrual crying proneness (Ghana, Indonesia, Italy, Malaysia, Nepal, Nigeria, Peru, and Poland), although the difference was only significant in Peru. No significant differences in the tendency to cry during the menstrual cycle were found in Kenya and Nepal.

Discussion

The objective of this study was to examine the role of culture on variations in self-reports of crying tendency during the menstrual cycle. The results reveal that self-reported crying proneness is elevated during the premenstrual phase, lower (but still high) during the menstrual phase and low during the post-menstrual phase.

We found that women from non-Western countries were less inclined to report an association between crying and the menstrual cycle, disclaiming a major role for biological factors. Similar results have been reported by Janiger, Riggenburg and Kersh²³, who found large cross-cultural variations in the type of perimenstrual symptoms experienced by women. For example, only 6% of their Japanese participants and as many as 56% of Turkish women reported crying in the week before menstruation. In addition, Hasin, Dennerstein and Gotts²⁴ reported remarkable differences in the kind of symptoms reported by Australian immigrants from different cultural backgrounds. Whereas Turkish, Greek and Vietnamese women complained mainly of somatic symptoms, the majority of Australian and Italian women's complaints were of psychological or behavioral symptoms.

At first sight OC users seem to report higher crying proneness than non-users. However, in some, especially non-Western countries where reported associations were lower, OC use was rare or not reported on. Consequently, any effect of OC use on crying could have been confounded by the effect of culture. After controlling for this possible confounding effect, no differences in the relationship between menstrual cycle and crying proneness were found between OC users and non-users. Since OCs dampen the fluctuations in female sex hormones, this finding further challenges a major role of these hormones in crying behavior.

In contrast, our findings emphasize the role of sociocultural factors in the association of crying to the menstrual cycle. Unfortunately, it is difficult, based on the present data, to establish which specific cultural factors are most important. Most plausible seems to be the role of implicit theories of menstrual experiences²⁵. Participants might have reported their

beliefs or implicit theories about such an association, rather than actual experiences. It is a generally accepted belief, at least in Westernized countries fed by the popular media and women magazines²⁶ that the days immediately preceding menstruation are associated with mood swings and irritability²⁷⁻²⁹. Therefore, women might retrospectively report increased crying tendencies in accordance with these implicit theories, irrespective of how they really feel during that time. Alternatively, it could be argued that they remember their crying during these specific days better, because they can ascribe it to their periods.

Given the well-known inherent weaknesses of retrospective studies, we felt the need for a concurrent study, in which we not only studied crying proneness (which requires a subjective assessment of the likelihood of crying and is possibly influenced by implicit beliefs about mood evaluations), but also actual crying episodes. In addition, we collected relevant information concerning mood and the specific antecedents of crying episodes, in order to obtain some data on reasons for crying during the different phases of the menstrual cycle.

Study 2

Methods

Participants

Subjects were 91 students majoring in psychology at Tilburg University in The Netherlands. Nine students were left out of the analyses because of the following reasons: (i) more than 40 days in between menstrual periods ($N = 6$); (ii) less than 14 days in between menstrual periods ($N = 2$); (iii) no more than 1 menstrual period reported ($N = 1$). The final sample consisted of 82 students in the age range of 18 to 23 ($M = 19.5$; $sd = 1.44$). Sixty-five students reported using OC, whereas 16 did not use OC ($N = 1$ missing).

Measures and Procedures

Starting at the first day of menstruation of period 1 and ending with the first day of menstruation of period 3, participants kept a mood and crying diary for two consecutive menstrual periods. Daily mood was rated on a 7-point scale for the following mood states: nervous, cheerful, bad-tempered, relaxed, restless, tense, sad, anxious, emotionally stable, and irritable. Crying proneness was also rated daily on a 7-point scale. In addition, participants recorded crying episodes and the reason for crying. A crying episode was defined as the experience of at least tearfulness, due to emotional reasons. These reasons were categorized into eight categories (conflict, loss, personal inadequacy, witnessing suffering of others, positive experiences, physical condition, psychological condition, and other reasons) ^{cf. 21}.

In accordance with the methodology applied in Study 1 and unless otherwise mentioned, measures were determined by calculating the mean over the five days from both cycles that were assumed to coincide with estrogen or progesterone changes. The menstruation phase consisted of days 1-5 (day 1 is the first day of menstrual flow), follicular or post-menstrual phase of days 6-10, ovulation phase of days -16 to -12, and luteal or premenstrual phase of days -5 to -1.

Results

Figure 2 shows the variation in averaged crying proneness and crying frequency over the four menstrual phases. In each phase of the menstrual cycle about three quarters of the women reported 1 or more crying episodes over 2 cycles (67.1% in the Premenstrual phase, 74.7% in the Menstrual phase, 75.3% in the Post Menstrual phase, and 71.2% in the Ovulation Phase), but the number of crying episodes was relatively low (0.18 in menstruation, 0.14 in follicular, 0.15 in ovulation and 0.15 in luteal phase).

Menstrual cycle variations in crying

Variations in crying and mood over time were tested with a repeated measurements ANOVA, with phase as the within-subject factor and use of OC as the between-subject factor. Significant within-subject differences were found for bad-tempered ($F_{(3,207)} = 4.12$, $p < .05$), emotionally stable ($F_{(3,210)} = 3.21$, $p < .05$), tense ($F_{(3,204)} = 2.61$, $p < .05$), irritable ($F_{(3,204)} = 9.63$, $p < .05$), relaxed ($F_{(3,216)} = 3.10$, $p < .05$), and restless ($F_{(3,210)} = 2.86$, $p < .05$). Student-Newman-Keuls post-hoc tests showed that mood is significantly decreased during the menstrual phase.

Significant between-subject differences were found only for actual crying episodes ($F_{(1,63)} = 7.73$, $p < .05$). The OC group cried more frequently ($M = 7.0$ crying days summed over the four phases of both cycles; $sd = 4.39$) than the non-OC group ($M = 4.1$; $sd = 3.45$). None of the interaction effects were significant.

Mood and crying

We further examined the relationship between actual crying and mood by comparing mood on crying versus no-crying days. The T-test results were significant for all mood indicators, showing that mood was significantly lower during crying days.

Reasons for crying

Finally, we analyzed the self-reported reason for all crying episodes reported. In total, 591 episodes were reported. Comparison of OC and non-OC users yielded some differences. Non-OC users cried relatively more often because of positive experiences and because of personal inadequacy, whereas pill users relatively often mentioned physical state as an explanation (see Table 2).

Discussion

In Study 1 it was found that women from Western countries retrospectively report increased crying tendencies on the days before menstrual flow and during the first days of menstruation. However, findings could be flawed because of the retrospective nature of the self-reports. Furthermore, no mood, pain or events data was collected preventing a conclusion about the possible mediating role of any of these factors, in explaining the self-reported increase in crying around menses. This concurrent study therefore was designed to validate the observations of the first one. The present study failed to reveal any systematic variations in crying across the menstrual cycle, even though some mood indicators did show a fluctuation. However, reported actual crying episodes per phase were rare, which makes it hard to draw any valid conclusions based on only 85 women.

If an increase in crying would be the result of changes in levels of hormones, women who take OC should report less variation in mood and crying since the fluctuations in sex hormone levels across the menstrual cycle are dampened by the use of birth control pills. However, our data suggest that the OC group cried more often throughout the entire menstrual cycle and that crying did not vary with menstrual cycle in either the OC or the non-OC group. It is not clear from the present study why women who use OC cry more frequently. Since women in both groups were currently single, conflicts with partners cannot account for the increased crying among OC users. The analysis of the self-reported attributions for crying revealed that non-OC users cried relatively more often because of feeling inadequate and because of positive feelings. One may wonder whether using OC at this age is associated with personality factors, as has been reported for other life style variables like smoking and alcohol consumption²⁹ or that OC use influences emotionality in (some) women. This may imply that OC use and crying actually are spuriously correlated, with personality as the third variable. Future research should specifically focus on this possible connection.

Conclusions

Crying was expected to vary across the menstrual cycle with variations in mood, in direct response to physical symptoms including pain and discomfort associated with the menstrual cycle, or by changes in female sex hormones or in neurotransmitter activity that lower the threshold to shed tears. In addition, the menstrual cycle may cause pain or influence the way women deal with their partners (e.g., not being available for sex) and others in the social environment, increasing the likelihood of conflicts, which in turn may invoke crying.

However, given the large cross-cultural differences on the one hand, and the lack of differences between OC-users and those who do not use OC on the other, it is concluded that self-reported variations in crying during the menstrual cycle, predominantly reflect implicit theories concerning the relationship between menstrual cycle and crying. Despite the assumed greater reliability of self-reports on conspicuous behaviors as compared to psychological states including mood and feelings, self-reports of crying proneness apparently were not immune to the bias of the belief that women's mood is decreased a couple of days before menstrual flow. It has to be established if the same is true for reports of actual crying episodes.

It is interesting to note that crying proneness reportedly was elevated *during* the menstrual phase in non-Western countries. Menses is associated with physical discomforts explaining the association with crying. It is not clear why no association was found in Western countries. This might be due to better access to medications that reduce physical discomfort in Western countries. These results further raises the question whether women who suffer from dysmenorrhea, a condition associated with increased cramping pain during menstrual flow, are more likely to cry during the menstrual cycle.

Future studies on crying could benefit by focusing on specific subgroups of women, like women with dysmenorrhea or Premenstrual Dysphoric Syndrome. In addition, a more fine-grained analysis of the antecedents of crying in the different phases of the menstrual cycle may yield valuable information. In addition, there is a need for studies that focus

explicitly on the role of sociocultural factors in the association of crying to the menstrual cycle, especially cultural variations in attitudes towards menstruation. The Menstrual Attitude Questionnaire³¹, has been shown to be valuable in interpreting such cultural differences³². Furthermore, the effect of oral contraceptives on mood and crying deserves further exploration. OC users may experience less variability in mood which could influence crying³³. Furthermore, different OC's may vary in their ability to dampen hormonal fluctuations during the menstrual cycle. Therefore one needs to be careful by pooling data of women using different OC's. Moreover, the current study did not use blood draws to determine menstrual phase, but rather used menstrual diary data which is not a very precise method. Finally, our data strongly suggest the importance and need of longitudinal study designs when focusing on menstrual cycle differences in crying.

Nonetheless, the present study not only has yielded valuable information about the different ideas of women of a different sociocultural background about the relationship between crying and menstrual cycle, it also learns researchers and clinicians to be sensitive to complaints as biopsychosocial phenomena, i.e. as resulting from a complex interplay between biological, psychological and socio-cultural factors.

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Figure 1: Percentages of women retrospectively reporting increased crying proneness on each day of a typical menstrual cycle, with determination of the menstrual phases.

Figure 2: Mean scores on crying frequency and crying proneness for each menstrual cycle phase, taken from a diary study.

Table 1. Country characteristics

Country	N	OC users N (%)	Women reporting association between crying and cycle N (%)	Country	N	OC users N (%)	Women reporting association between crying and cycle N(%)
Australia	174	44 (27.2)	117 (67.2)	Kenya	71	3 (4.2)	43 (60.6)
Austria	48	20 (41.7)	19 (39.6)	Lithuania	135	0 (0)	44 (33.1)
Belgium	125	38 (61.3)	30 (47.6)	Malaysia	48	1 (2.6)	14 (31.8)
Brazil	178	76 (49.4)	80 (79.2)	Nepal	45	2 (12.5)	6 (14.3)
Bulgaria	32	1 (3.6)	7 (25.0)	Netherlands	75	59 (80.8)	46 (62.2)
Chile	52	11 (22.9)	35 (67.3)	New Zealand	41	18 (48.6)	20 (54.1)
China	92	0 (0)	13 (27.1)	Nigeria	36	1 (2.9)	9 (25.7)
Finland	31	17 (54.8)	18 (58.1)	Peru	48	1 (2.1)	7 (14.6)
Germany	45	21 (47.7)	19 (42.2)	Poland	56	1 (2.0)	18 (32.1)
Ghana	40	0 (0)	9 (23.1)	Portugal	59	18 (33.3)	19 (32.2)
Greece	76	9 (15.8)	36 (48.6)	Romania	90	10 (12.3)	18 (21.4)
Hungary	35	3 (10.3)	17 (48.6)	Spain	50	9 (18.0)	33 (66.0)
Iceland	154	84 (54.5)	62 (40.3)	Sweden	30	17 (63.0)	20 (69.0)
India	85	2 (2.9)	27 (33.3)	Switzerland	59	25 (43.1)	28 (47.5)
Indonesia	105	2 (2.9)	41 (39.0)	Turkey	50	0 (0)	34 (68.0)
Israel	48	32 (66.7)	17 (35.4)	United States	156	29 (19.3)	90 (58.8)
Italy	78	17 (23.6)	26 (34.2)	<i>total</i>	<i>2447</i>	<i>571 (23.3)</i>	<i>1022 (41.8)</i>

Table 2. Reasons for all (591) reported crying episodes

	Group using Oral Contraceptives (N = 65) episodes (%)	Group not using Oral Contraceptives (N = 16) episodes (%)
total episodes reported	518	73
Conflict	91 (17.6)	11 (15.1)
Loss	65 (12.5)	7 (9.6)
Personal inadequacy	56 (10.8)	14 (19.2)
Witnessing suffering of others	62 (12.0)	12 (16.4)
Positive experiences	29 (5.6)	9 (12.3)
Physical condition	35 (6.8)	2 (2.7)
Psychological condition	61 (11.8)	10 (13.7)
Other reasons	109 (22.9)	8 (10.9)

Current knowledge on this subject

To date little is known about crying during the menstrual cycle. In particular prospective data are lacking and no comparisons were made among cultures. In addition, until now it was not clear whether there were systematic variations in the antecedents of crying during the different phases of the cycle.

What this study adds

The present study reports on a unique set of cross-cultural data. In addition, in the prospective study, we not only focused on crying frequency, but we also examined the specific reasons for crying.