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Incidence of anovulatory menstrual cycles among dysmenorrheic and non-dismenorrheic women: Effects on symptomatology and mood

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The incidence of spontaneous anovulatory (SA) menstrual cycles among dysmenorrheic and non-dysmenorrheic women and their effects on symptomatology and mood were examined in 52 university students distributed into two groups (18 dysmenorrheic women and 34 non-dysmenorrheic women) according to the presence or absence of symptoms of primary dysmenorrhea. Women were tested in menstrual, ovulatory and premenstrual phases. In order to estimate the proportion of ovulatory and SA cycles the basal body temperature (BBT) method was used. Results indicated that the percentage of SA cycles found in dysmenorrheic women does not confirm that primary dysmenorrhea only occurs in ovulatory cycles. In addition, the ovulatory cycles did not present greater symptomatology than the anovulatory cycles in self-rating of negative affect. In fact, menstrual symptomatology was not associated with ovulatory cycles. These data confirm that primary dysmenorrhea does not only depend on the endocrine factors which regulate the menstrual cycle but also on other factors such as social or psychological ones.

Incidencia de ciclos menstruales anovulatorios entre mujeres dismenorreicas y no dismenorreicas: efectos sobre sintomatología y humor. La incidencia de ciclos menstruales anovulatorios espontáneos (SA) entre las mujeres dismenorreicas y no dismenorreicas y sus efectos sobre sintomatología y humor fueron examinados en 52 estudiantes universitarias distribuidas en dos grupos (18 dismenorreicas y 34 no-dismenorreicas) de acuerdo a la presencia o ausencia de síntomas de dismenorrea primaria. Las mujeres fueron evaluadas en las fases menstrual, ovulatoria y premenstrual. Para estimar la proporción de ciclos ovulatorios y SA se utilizó el método de la temperatura basal corporal (BBT). Los resultados indicaron que el porcentaje de ciclos SA encontrados en mujeres dismenorreicas no confirma que la dismenorrea primaria solo ocurra en ciclos ovulatorios. Además, los ciclos ovulatorios no presentaron mayor sintomatología que los ciclos anovulatorios en las medidas de autoinforme de afecto negativo. De hecho, la sintomatología menstrual no estuvo asociada con ciclos ovulatorios. Estos datos confirman que la dismenorrea primaria no solo depende de los factores endocrinos que regulan el ciclo menstrual, sino también de otros factores sociales o psicológicos.

Primary dysmenorrhea is the most common gynaecological affection in the adolescent population (French, 2005; Harel, 2002) and different studies have reported prevalence rates ranging from 25% up to 90% of females in the samples studied (Larroy, Crespo, & Meseguer, 2001; Polat et al., 2009).

This affection is very common during the teenage years after the menarche and less often in women after the age of 20-25 years (Freeman, Rickels, & Sondheimer, 1993). Other authors affirm that dysmenorrhea is more prevalent during mid and late adolescence with the establishment of normal ovulatory cycles (Harel, 2002).

This dysfunction brings with it a group of physical symptoms including menstrual pain, nausea, vomiting, cramps, diarrhea, headache and syncope, which appear to be associated with menstruation and do not have an identifiable organic or pathological cause (French, 2008; O'Connell, Davis, & Westhoff, 2006).

In addition, dysmenorrhea may also be associated with emotional changes. Studies employing retrospective questionnaires have found that dysmenorrheic (D) women report cyclical changes in psychological symptoms such as irritability, difficulty concentrating, crying spells, anxiety and depression (Alonso & Coe, 2001; Granot et al., 2001; Groër, Carr, & Younger, 1993).

Among the proposed explanations for the appearance of these symptoms, the most widely accepted one postulates a hormonal cause. Some studies have found that during anovulatory cycles induced by oral contraceptives (OCs), menstrual symptomatology diminishes (Clayton, 2008; Harel, 2002; Vercellini et al., 2003) and the use of oral contraceptives to alleviate dysmenorrhea has been advocated (Davis, Westhoff, O'Connell, & Gallagher, 2005; Harel, 2002). In particular, a low-dose combination oral contraceptive seems to be highly effective in relieving pain in primary dysmenorrhea (Hendrix & Alexander, 2002; Legro et

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al., 2008). This effect could be explained by the fact that OCs suppress ovulation and reduce menstrual fluid prostaglandin (PG) activity levels (Chan & Hill, 1978; Dawood, 1985). The use of nonsteroidal anti-inflammatory drugs (NSAIDS) is considered to be an alternative intervention, and the action mechanism seems to be a direct inhibition of PG production (Polat et al., 2009; Proctor & Farquhar, 2003).

Some authors conclude that the synthesis of PG and symptoms of dysmenorrhea only occurs during ovulatory cycles, when the corpus luteum secretes progesterone. In the anovulatory cycles induced by OCs, where the estrogen and progesterone levels are constant, primary dysmenorrhea does not occur (Coupey & Ahlstrom, 1989). But daily ratings studies on OCs do not give such consistent results. Some authors have found that OCs have little impact on the pattern or incidence of menstrual cycle symptoms and they suggest that menstrual and premenstrual changes are not dependent on the sequelae to ovulation (Ross, Coleman, & Stojanovska, 2003). In addition, other research which also employed daily ratings did not find any group differences in positive or negative affect between first-time users of OCs, long-term users, and those who have never used them; and it is considered that other variables such as personal and family psychiatric history may mediate an effect of OCs on negative affect variability (Oinonen & Mazmanian, 2001).

The presence of a high proportion of SA cycles among adolescent and young women is well known (Metcalf & Mackenzie, 1980). However, the possible relationship between SA cycles and a decrease in the incidence of dysmenorrhea has not been explored.

There are different methods of identifying ovulation with a variable degree of sensitivity, specificity and accuracy (Guermandi et al., 2001). The use of the BBT procedure enables the estimation of the hormonal phase and the identification of the anovulatory cycles (Moghissi, 1980). But the recording of BBT may be affected by many factors other than hormonal changes, and the accuracy of the BBT method in identifying the day of ovulation may be limited (Bauman, 1981; Dunlop, Allen, & Frank, 2001; McCarthy & Rockette, 1986). However, the BBT graph may be consistent and useful when it is used to retrospectively analyze the complete graph. Under these conditions, the BBT chart method agrees in a high percentage of cases with methods such as ultrasonography (Guermandi et al., 2001) or urinary LH surge and vaginal ultrasound (Smith et al., 1998). In these cases, BBT may be the preferred method because of its clear advantages regarding economic costs and ease of use. Also, the biphasic BBT chart may provide additional useful information, which are not found in other methods, such as duration of the menses, length of the cycle, length of the follicular and luteal phases, or the pattern of ovulation timing. The method of the «smoothed curve» (SMC) that was described by McCarthy and Rockette (1983), results in 97% biphasic curves, and tends to erase the day-to-day variability of the BBT graph. These authors add that the SMC technique appears to be ideal for applications such as research.

Although induced anovulatory cycles by OCs are not directly comparable with SA cycles, this information could be of relevance to support the hormonal hypothesis about primary dysmenorrhea. According to this postulate, non-dysmenorrheic (ND) women should show a higher proportion of SA cycles, than D women. Therefore, making use of the SMC method, our study tests this hypothesis and also reports the effect of SA cycles on symptoms and mood changes of adolescent females.

Method

Participants

According to the information reported in a general questionnaire, an initial sample of 166 female undergraduate university students met the inclusion criteria and volunteered to participate in the study. All of them were unmarried, nulliparous and reported regular menstrual cycles (± 3 days of variation) during the last three menstruations, and no history of gynaecological disorders. None had taken OC or any medication that affects the neuroendocrine system. Following Plante and Denney (1984) all women with scores in the upper and lower quartiles in the six items (cramps, pain spasms, heat, aspirin, weak dizziness, nausea and dull aching) included in the menstrual pain factor of the Menstrual Symptom Questionnaire (MSQ) of Stephenson, Denney and Aberger (1983) and who reported painful menstruations during the last three months and had also taken any antiinflammatory, analgesic or ansiolitic drug or practised physical exercise in order to relieve the pain, were designated the dysmenorrheic and non-dysmenorrheic subgroups. Thus, the final sample was of 52 women divided in two experimental groups: D (N= 18; $\bar{X}$ age= 19.17; SD= 0.71) and ND (N= 34; $\bar{X}$ age= 19.27; SD= 1.35). All subjects gave written informed consent to participate in the study.

Instruments

In order to determine the menstrual cycle phases, participants were tested in three cycle phases: menstrual (1-4 days), midcycle phase (12-16 days after cycle onset, representing the ovulatory phase) and premenstrual phase (24-28 days). Cycle phase was established using two estimation procedures: Firstly, in order to predict the moment in which the subject should be cited, all the cycles were converted to a standard 28 day cycle, taking as reference points the day of onset of the last menstruation and the real length of the studied cycle (Rossi & Rossi, 1980). Secondly, to confirm the previous estimation and to estimate the ovulation point, BBT was recorded daily during two complete menstrual cycles. Sublingual temperature was taken before getting up. The retrospective SMC method was used to determine the presumed day of ovulation (McCarthy & Rockette, 1983, 1986). The SMC is obtained by replacing the BBT data for a given day with the average from the day before, the target day and the next day (triplets). The thermal shift is located where the SMC transects the average of all temperatures, of at least 0.17°C (3°F), and all points on the curve remain above this average. In order to consider a BBT chart as biphasic, we have required at least seven points in the postovulatory phase. The ovulation point is identified as the day before the rise in temperature. The SMC method was used to calculate the proportion of ovulatory and SA cycles as well as the distribution of menstrual cycle phases.

Participants completed the following questionnaires in all three sessions: The six items (cramps, pain spasms, heat, aspirin, weak dizziness, nausea and dull aching) included in the menstrual pain factor of MSQ; Beck Depression Inventory - BDI (Beck, Ward, Mendelson, Mock, & Erbaug, 1978); State-Trait Anxiety Inventory - STAI (Spielberger, Denney, & Aberger, 1970); Menstrual Distress Questionnaire - MDQ (Moos, 1985); Profile of Mood States - POMS (McNair, Lorr, & Droppleman, 1971) and the Eysenck Personality Questionnaire - EPQ-R (Eysenck & Eysenck, 1997).

Procedure

Participants were given an oral thermometer and a temperature chart and were instructed on how to use them to register their BBT. Measures of symptoms were taken longitudinally. Each subject attended the laboratory in her menstrual, ovulatory and premenstrual phases for control of the BBT chart and to complete questionnaires. Participants were not informed about the real aim of the experiment so as to minimize the social expectations about menstruation. Experimental sessions took place from 9.00 to 14.00 hours, Monday to Friday, in the Psychophysiology Laboratory at the University facilities. All data were collected by two women experimenters. The protocol of the study was approved by the Bioethical Committee of the University.

Data analysis

The analyses of the POMS, MDQ, BDI, EPQ and STAI questionnaires was carried out by means of two 2×2×3 mixed analysis of variance (ANOVA), with «group» (D and ND women) or «cycle» (ovulatory/SA cycles) as independent factors and «phase» (premenstrual/menstrual/ovulatory) as a repeated-measures factor. Physical characteristics and menstrual variables were compared across groups by means of T-tests for independent samples to check for possible differences. The SPSS-W (11.0) statistical package was used for all analyses.

Results

Menstrual and anthropometric variables

There were no significant differences between groups regarding age, weight, height, duration of menstrual flow and age of the menarche (see table 1 and 2). Incidence of SA cycles was 26.9%. ND women presented a higher frequency of SA cycles (32.35%) than D women (16.67%), but this difference was not enough to reach significance (χ^2= 1.47; p= 0.22).

Self-report measures

All self-report measures showed changes related to cycle phase with significantly less symptomatology levels during the ovulatory phase (STAI-S: F (2, 96)= 6.06, P= 0.003; MDQ: F (2,96)= 7.671, P= 0.001; and POMS: F (2,96)= 6.061, P= 0.003). However, groups did not show general differences regarding menstrual related symptomatology according to the MDQ, POMS and STAI-S questionnaires. The only exception appeared in the water retention subscale of the MDQ, where the D group scored higher ($\bar{X}$= 7.82 SD= 0.44) than the ND group ($\bar{X}$= 6.45 SD= 0.32) (F (1, 48)= 6.404, P= 0.015).

Some differences did arise when comparing specific phases between groups. Significant «Phase × Group» interactions

Table 1
Means, standard deviations and probability for the menstrual and anthropometric variables of the sample

Physical characteristics	Min	Max	Mean	SD	p
Age	17	23	19.23	1.16	0.06
Weight	47.00	85.00	56.95	6.95	0.15
Height	1.54	1.80	1.65	0.06	0.47
Duration of menstrual flow	3	9	4.96	1.06	0.55
Duration of cycle	24	35	30.28	3.31	0.69
Menarche	10	16	11.88	1.33	0.12

Table 2
Means, standard deviations for age and menstrual variables in non-dysmenorrheic and dysmenorrheic women

Variables	Minimum	Maximum	Mean	SD
		Non dysmenorrheic		
Age	17	23	19.27	1.35
Duration of menstrual flow	3	9	4.71	1.24
Duration of cycle	24	35	30.12	2.85
		Dysmenorrheic		
Age	18	21	19.17	0.71
Duration of menstrual flow	3	7	5.17	1.25
Duration of cycle	26	35	31.33	2.57

Table 3
Means, standard deviations for STAI, MDQ, POMS, EPQ and BDI scales in non-dysmenorrheic and dysmenorrheic women

Questionnaire	Non-dysmenorrheic		Dysmenorrheic	
	Mean	SD	Mean	SD
STAI				
Trait -anxiety	20.63	1.52	22.63	2.09
State-anxiety	20.87	1.41	21.35	1.94
MDQ				
Pain	11.75	0.71	12.61	0.97
Concentration	14.03	0.82	14.09	1.12
Behavioural change	9.68	0.55	11.22	0.75
Autonomic reactions	5.29	0.33	5.88	0.60
Water retention	6.45	0.32	7.82	0.44
Negative affect	15.11	1.06	16.31	1.46
Arousal	12.80	0.63	12.79	0.86
Control	10.54	0.72	10.46	1.00
Total scores	85.47	4.07	90.72	5.59
POMS				
Tension	8.77	0.95	8.18	1.31
Depression	5.94	1.17	7.90	1.61
Hostility	7.09	0.94	6.55	1.29
Vigour	11.75	0.71	10.37	0.97
Fatigue	4.05	0.59	5.00	0.82
Confusion	6.39	0.76	7.44	1.05
Total scores	120.29	4.04	124.77	5.55
EPQ				
Extraversion	13.64	0.71	12.94	0.98
Neuroticism	11.76	0.85	12.55	1.16
Psychoticism	3.39	0.46	4.53	0.63
BDI				
Depression	5.18	0.89	6.64	1.22

appeared in the following scales: MDQ- water retention (F(2,96)= 3.324, P= 0.040) with higher scores for the D group during the premenstrual ($\bar{X}$ D= 9.4, SD=.7 vs. $\bar{X}$ ND= 7.3, SD=.5) and menstrual phases ($\bar{X}$ D= 8.2, SD= .6 vs. $\bar{X}$ ND= 6.4, SD= .4), and POMS-depression (F(2,96)= 4.610, P= 0.012) with the D group again scoring higher during the menstrual phase ($\bar{X}$ D=11.8, SD= 2.2 vs. $\bar{X}$ ND= 5.5, SD= 1.6).

Cycle type (ovulatory vs. spontaneous anovulatory) showed no effects upon menstrual symptomatology. A significant interaction «Phase × Cycle type» was found only for the vigour subscale of the POMS questionnaire (F (2,100)= 2.986, P= 0.05). Women with ovulatory cycles showed greater vigour during the ovulatory phase than women with SA cycles ($\bar{X}$ OC= 13.7, SD= .8 vs. $\bar{X}$ SA= 9.9, SD =1.4).

Discussion

Analysis of BBT charts indicated that 73.1% of the studied menstrual cycles were ovulatory (biphasic curve) while 26.9% of cycles were SA (monophasic pattern). This high frequency of anovulation found in our study may be explained by the joint effect of the subjects' young age (Vuorento & Huhtaniemi, 1992) and their condition as students (Metcalf & Mackenzie, 1980). This proportion of SA cycles, though high, was similar to the one found using more direct methods to identify the ovulation point (Ecochard, Boehringer, Rabilloud, & Marret, 2001), which shows that the SMC method may be a useful way to analyze the BBT chart and confirm ovulation retrospectively (McCarthy & Rockette, 1986). Although the percentage of anovulation in ND (32.35%) was almost twice than in D women (16.67%), this difference did not reach statistical significance and this effect could be due to the sample size. However, the presence of 16.67% of SA cycles in D women enables us to reject the hypothesis that primary dysmenorrhea occurs only during ovulatory cycles as had been asserted by some authors, based on findings from samples using oral contraceptives (Coupey & Ahlstrom, 1989). In addition, women with ovulatory cycles displayed more positive affect during the ovulatory phase, with higher scores on the POMS subscale of vigour, than women with SA cycles. Moreover, there were no significant differences between the two groups in any measure of negative mood. Therefore, our results can not confirm other studies where ovulatory cycles relate to greater symptomatology than anovulatory cycles in self-rating of negative affect (Hammarbäck, Ekholm, & Bäckstrom, 1991).

Our results with spontaneous anovulatory cycles may not be directly comparable with those induced by oral contraceptives reported by other studies; however they indicate that the relationship between ovulation and dysmenorrhea is not as clear or straightforward as had been proposed. Personal and family psychiatric history could mediate the oral contraceptives effect on negative affect variability, but only when the menstrual symptoms are assessed retrospectively (Oinonen & Mazmanian, 2001). Some authors, when using daily ratings, have found that oral contraceptives have little impact on the pattern or incidence of menstrual cycle symptoms, and suggest that menstrual and premenstrual changes are not dependent on the sequelae to ovulation (Ross, Coleman, & Stojanovska, 2003).

On the other hand, we have found very limited differences in symptomatology between D and ND groups. D women reported greater water retention in the MDQ and higher levels of depression in the POMS, during their menstrual phase, than ND women. However, contrary to expectations, no difference was found between the two groups of women either in the scale of pain or in the rest of the self-rating scales of negative affect. Both groups showed more pain, behavioural change, depression, confusion and fatigue during the menstrual phase, while the ovulatory phase was characterized by higher arousal, lower water retention, anxiety, negative affect, hostility and lower marks on the total scores of the MDQ and POMS. Nevertheless these cycle phase-related changes in negative symptomatology were unrelated to the ovulatory/ anovulatory condition of the cycle or the categorization of the women as dysmenorrheic or non-dysmenorrheic.

The hypothesis for finding a similar effect to that of the anovulatory cycles induced by oral contraceptives in the SA cycles was not confirmed either. In fact, menstrual symptomatology in our study was not associated with ovulatory cycles. The few differences found between D and ND women suggest that those who report suffering from regular and intense menstrual-related mood distress probably differ very little from women who report having normal cycles or with few alterations, when these are evaluated daily or longitudinally. There is evidence to indicate that retrospective measures of behavioral and physical symptoms may be exaggerated and differ from data collected prospectively, especially if the participants believe that the menstrual cycle is the focus of the study (Cook et al., 1990). Therefore, it could be possible that psychosocial factors, negative attitudes towards menstruation or social expectations are influencing the origin of such symptoms (Aubuchon & Calhoum, 1985; Pérez et al., 1995). In order to control for this problem, it would appear to be necessary to use the self-report questionnaires in a prospective form only.

Taken all together, our findings are in agreement with the notion that dysmenorrhea probably does not depend only on the endocrine factors which regulate the menstrual cycle (the oestrogen/ progesterone relationship and local prostaglandin levels) but also other factors such as social and psychological ones (Ross et al., 2003). Also, it appears that spontaneous anovulation is frequent in young women and its effects and implications should be explored in future studies.

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