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## SEXUAL AROUSABILITY AND THE MENSTRUAL CYCLE

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### SUMMARY

We have repeated a study of the objective (labium minus temperature) and subjective (semantic scales) changes in sexual arousability over the menstrual cycle to erotic video stimulation in 20 women with natural cycles. We extended the study with concomitant vibrotactile stimulation of the clitoral region. In an earlier study women tested for the first time in their follicular phase were sexually more aroused (as indicated by greater increase in labium minus temperature) than women tested for the first time during their luteal phase. When these women were retested in their alternative phase of the menstrual cycle, those who were then follicular did not score higher than those who were then luteal. We then postulated the involvement of a cognitive or conditioned phenomenon which was responsible for the women's repeating their initial phase-dependent response when tested the second time in their alternative phase of the cycle.

Identical results were obtained in the present study as far as sexual arousability is concerned during the first test, i.e. follicular women generally scored higher than luteal women; this difference in response persisted during the second test. Concomitant vibrotactile stimulation had no effect on labium minus temperature change but raised subjective sexual arousal and caused a 'more pleasurable' response to the erotic video. Subjective sexual and subjective genital arousal were positively correlated, but neither was significantly correlated with labium minus temperature change.

The relationship between menstrual cycle phase and sexual arousal was further substantiated by the reported greater increase in sexual desire after the first erotic video in follicular women than in luteal women. This increased desire, as well as more erotic fantasies, persisted during the next 24 h.

In conclusion, studies into effects of menstrual cycle phase on sexual arousability in the laboratory should seriously consider the possible learning and conditioning effects as suggested by the present investigation. Copyright © 1996 Elsevier Science Ltd

**Keywords**—Menstrual cycle; Sexual arousal; Psychophysiology; Labium minus temperature; Vibrotactile stimulation.

### INTRODUCTION

In lower mammals there is a strict time relationship between ovarian cycle and sexual behavior such that virtually all sexual activity takes place around the time of ovulation, i.e.

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the time of maximal fertility (e.g. Beach, 1948; Leshner, 1978; Nelson, 1995). In nonhuman primates this relationship is less distinct but nevertheless sexual activity is highest during the late follicular and periovulatory period of the menstrual cycle (e.g. Nieuwenhuijsen et al., 1986; Wallen, 1990, 1995). More or less tenuous associations have been found between sexuality of women and their menstrual cycle (e.g. Bancroft, 1989; Dennerstein et al., 1994; Harvey, 1987; Morris & Udry, 1982; Stanislaw & Rice, 1988).

In an earlier study we have found that women when first tested in the laboratory while in their follicular phase were sexually more aroused by erotic video than women first tested during their luteal phase (Slob et al., 1991). This was true for objective sexual arousal, i.e. an increase in labium minus temperature (and, marginally, for subjective genital arousal). When these women were retested in their alternative phase of the menstrual cycle, those who were then follicular did not score a higher temperature change than those who were then in their luteal phase. In fact, during the second test women generally scored as high or low again as during their first test. This phenomenon was observed both in women with and without oral contraception. The nature of the menstrual phase, i.e. natural or pill-induced, seemed irrelevant in this respect.

Apparently the menstrual cycle phase during the first test determined the initial response, which indirectly affected the magnitude of response during the second test approximately 11 days later. Perhaps a cognitive or conditioned phenomenon was involved in that the women more or less repeated the second time in the laboratory the magnitude of their initial response regardless of the underlying phase of their menstrual cycle. In other studies on the effects of menstrual cycle phase upon psychophysiological parameters, possible carry-over effects of a first test on subsequent laboratory tests have not been published. For further discussion of this matter see Slob et al. (1991).

These somewhat unexpected findings prompted us to investigate again the relationship between menstrual cycle phase and sexual arousal of women in the laboratory. We recorded changes in the temperature of a labium minus while subjective sexual and genital arousal were recorded on semantic scales immediately following an erotic video. As part of this investigation, the influence of vibrotactile stimulation of the clitoral region on responses to erotic video was studied. On the basis of recent laboratory studies with men (Janssen et al., 1994a, 1994b; Rowland & Slob, 1992; Rowland et al., 1992, 1993, 1994) it was assumed that vibration might magnify the responses to erotic video.

## SUBJECTS AND METHODS

### *Subjects*

Recruitment took place through advertisement, which indicated the nature of the study, i.e. the relationship between sexual arousal and menstrual cycle. Participants were offered a fee of Dfl 75 (about US\$ 40). Selection was made with the following criteria: age between 18 and 45 years, in good physical and mental health, menstrual cycles regular and not using oral contraception. Procedures of the study were fully explained and all subjects gave informed consent. The women were invited to visit the laboratory twice, once approximately 3 or 4 days before anticipated onset of menstruation (luteal phase), and once approximately 1 or 2 days before the expected ovulation (follicular phase). About half of the women paid their first visit to the lab during their follicular phase (group F,  $n = 9$ ), followed by a second visit during their subsequent luteal phase. The others (group L;  $n = 11$ ) were studied in a reverse order, first during luteal phase and secondly during follicular phase of the next cycle.



Fig. 1. Experimental room used for psychophysiological research. A = television monitor; B = headphones; C = ventilator; D = intercom.

On the basis of the serum progesterone values 20 of 25 women were found to be in the expected phase of their menstrual cycle on both visits to the laboratory. Progesterone values averaged 2.5 (SEM: 0.4) nmol/l during the follicular phase and 34.7 (SEM: 5.8) nmol/l during the luteal phase. Five women had to be excluded from further analysis because they did not show luteal values of serum progesterone on either occasion.

### *Experimental Setting*

The experimental setting has partly been described earlier (Slob et al., 1990b, 1991). The study was carried out in a testing room (mean temperature 24°C), connected to an antechamber. The subject was seated in a comfortable chair (Fig. 1). In the antechamber the female investigator (CMB) was able to monitor labial temperature and to control presentation of the stimulus materials. An intercom connection between the two rooms enabled experimenter and subject to communicate. The thermistorclip used for measuring labial temperature was similar to the device first described by Henson et al. (1977). The minivibrator used for vibrotactile clitoral stimulation was developed in our laboratory and described recently (Rowland et al., 1994). This minivibrator (approximately 20 g weight) generated vertical and lateral displacement, with an area of surface stimulation of approximately 270 mm<sup>2</sup>. The whole minivibrator is contained in a sealed casing dipped in silicon coating so that it can be washed and sterilized without damage to the motor.

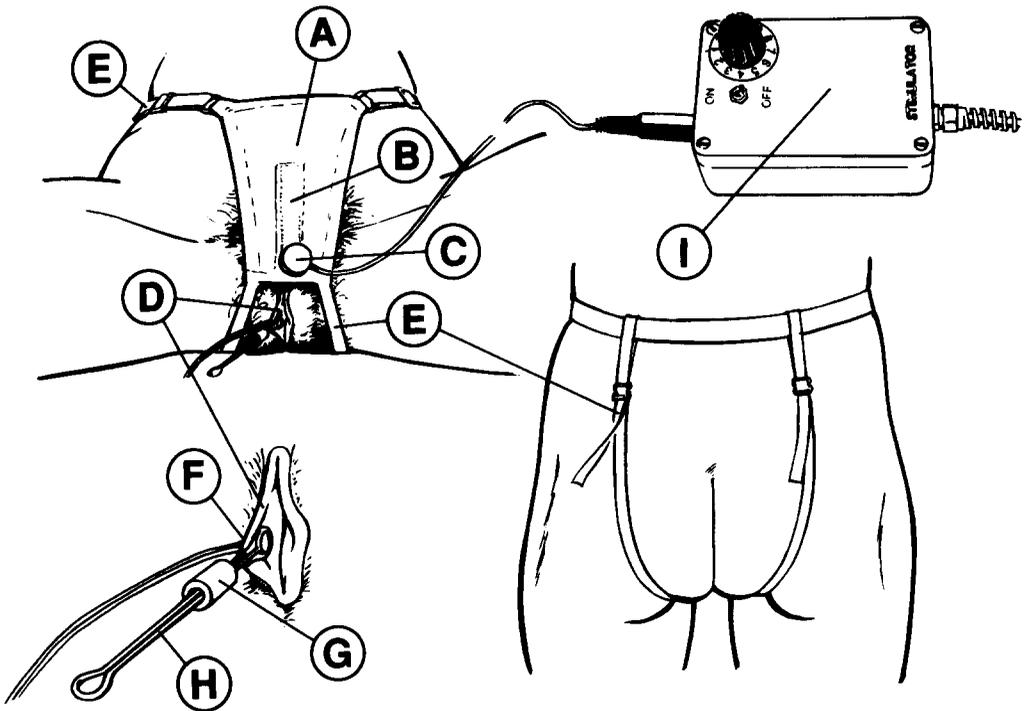


Fig. 2. Diagram showing the application of the minivibrator (C) and the thermistor clip (H) A = girdle; B = velcro for personal attachment of minivibrator (C) D = right labium minus; E = elastic bands of girdle; F = thermistor; G = movable beadle; H = thermistor clip; I = variable control panel of minivibrator.

### *Experimental Procedures*

During the initial interview, which took place in the testing room, the investigator explained the experimental procedures. The subject was instructed how to don the girdle and how to attach the minivibrator to the velcroband on the girdle and the thermistor clip at the base of the widest portion of the right labium minus, with the thermistor at the side of the labium major (Fig. 2). Subjects were asked to place the minivibrator close to the clitoris/mons veneris area such that vibrations could be sexually arousing. At this time the subject was given a number of questionnaires as described in the following section. The investigator left the room briefly to allow the subject to put on the girdle, and to attach the minivibrator and thermistor clip. After checking the correct position of thermistor clip and minivibrator, the experimenter retired to the antechamber. Before testing began, the experimenter varied the vibration frequency from low to maximum (19–75 Hz) so the subject could indicate the frequency she 'preferred' most. Then the minivibrator was temporarily switched off. On inspection the minivibrator was found to have been placed within 1 cm of the clitoris on 34 of 40 occasions and between 1.5 and 2.5 cm of the clitoris, on the remaining 6 occasions.

While the subject filled in the moods scale and self-image of body questionnaire the temperature prerecording was started by the experimenter. On completion of the forms, the subject signaled the investigator, who started the experimental period of temperature

recording as soon as the temperature of the labium minus had reached a stable level. Two minutes later the video films began: 3 min neutral film (Sesame Street) followed by a first erotic film (EV), the latter presented with or without concomitant vibrotactile stimulation (VIB). Following the erotic film the subject filled in the sexual arousal and feelings list and the social and sexual activity inventory. The subject removed the thermistor clip, the investigator entered the testroom and placed a ventilator at a distance of 30 cm from the subject's genitalia which were thus cooled off for 30 s. The thermistor clip was then attached again and the second prerecording was carried out. After a stable temperature was reached, the second set of video films was started: first neutral, then EV with or without VIB. To control for possible order effects, VIB was presented either during the first EV or during the second EV. Following the last EV the subject filled in again the sexual arousal and feelings list and a final assessment list. The session was closed with a short debriefing, combined with venapuncture for blood progesterone determination (de Jong et al., 1974).

### *Questionnaires and Films*

The *moods scale* was adapted from Sanders et al. (1983) (see also Slob et al. (1993)) and consisted of 4 positive items (cheerful and happy; sociable and friendly; energetic and active; relaxed) and 4 negative items (depressed and unhappy; irritable; fatigued and tired; tense and anxious), with a 100 mm analog scale for each (0 = not at all; 100 = very much). This scale consists of items which show partial overlap with other scales of this type (PANAS: Watson et al., 1988; Differential Emotion Scale: Izard, 1972). Furthermore, this scale has been found to correlate strongly ( $r = .70$ ) with the Lorr–McNair Mood Adjective Check Lists (McNair & Lorr, 1964), and has been used successfully to discriminate affect and mood over the course of the menstrual cycle (Sanders et al., 1983). Finally, the items on this scale have been found to load onto a single factor, with positive item factor loadings ranging from 0.59 to 0.83, and negative item loadings ranging from  $-0.54$  to  $-0.84$ . The *self-image of body questionnaire* (Slob et al., 1993) consisted of 8 negative and 7 positive statements with a 5-point semantic scale each from 0, not at all, to 4, very much, concerning the perception of the body self. Negative statements were: 'I wish I were more attractive', 'I am too fat', 'I am too thin', 'I am too short', 'I am too tall', 'I am very unhappy about some parts of my body', 'I have too much body hair', 'I feel uneasy when my partner sees me naked'. Positive statements were: 'I have an attractive face', 'I have a well-formed body', 'I have attractive breasts', 'I have attractive legs', 'Men find my body attractive', 'I like to be seen in bathing suit', 'I am satisfied with the appearance of my vagina'. Total negative scores could range from 0 to 32, total positive scores from 0 to 28. The *sexual arousal and feelings questionnaire* assessed subjective sexual arousal, genital and extragenital physiological responses, and psychological and emotional feelings in response to the EV. Subjective sexual arousal was scored on a 7-point scale: no arousal (1) to very strong arousal (7). Subjective genital arousal was scored on an 8-point scale: no genital feelings (1), strong tickling sensations (4), fully lubricated vagina (7), orgasm (8). The *post-film emotional feelings scale* included 10 positive items (passionate; desire to have intercourse; desire to masturbate; horny; voluptuous; pleasant; increased heart rate; excited; at ease; comfortable) and 9 negative (distaste; sad; ashamed; disdainful; angry; unpleasant; sense of guilt; uptight; scared). Each one of these items could be scored on a 7-point scale: not at all (1) to very strong (7). All 10 scores for positive items were averaged as were the 9 negative scores. Such items have been used extensively in laboratory research of this type and have been found to be sensitive indicators of arousal and emotional response in women (e.g. Heiman &

Hatch, 1980; Palace & Gorzalka, 1992), with reliability indices (Cronbach alpha) for arousal, positive emotion, and negative emotion dimensions typically reaching .70 or higher (Rowland et al., 1995, 1996). The *sociosexual inventory* consisted of 50 questions, including questions dealing with quantitative and qualitative aspects of sexual relationship(s) and sexual activities (adapted from Slob et al. (1991)). The last (50th) question was: "At this very moment would you like to make love or to masturbate?" (1 = very much; 3 = rather; 5 = not at all). Note that this question was asked following the first erotic video during both visits to the laboratory. The *final assessment* list dealt with the subjects' experience of the technical aspects of the physiological measurements, their subjective judgments of the erotic videos and their general impression of the entire study.

On the second day after each visit the subjects received unexpectedly by mail, a *day-after inventory* about their sexual activities and fantasies during the 24 h following their visit to the lab.

Four video films were used, all were approximately 10 min segments of films directed and produced by Candida Royalle. Each depicted a man and a woman making love in various ways: cunnilingus, fellatio, mutual masturbation, female orgasm and intravaginal ejaculation and orgasm of the male.

### *Statistical Analysis*

Repeated measures ANOVA, with visits (first, second) and, if appropriate, vibration (yes, no) as within subject factors and sequence (first visit follicular, second visit luteal, group F, or in the reverse order, group L) as a between subjects factor was used to evaluate these factors simultaneously. When a significant sequence effect was found for a particular item, indicating a visit  $\times$  phase interaction (i.e. the difference between both cycle phases depends on the visit number), that item was compared between both phases (groups F and L) at the first visit only using the *t*-test (Hills & Armitage, 1979). Correlation coefficients given are Pearson's.  $p = .05$  (two-tailed) was considered the limit of statistical significance.

## RESULTS

### *Sociosexual Data*

The 20 subjects had a mean age of 32.6 years (range 21–46), an educational level of 3.7 (range 2–4) on a 1 (= low) to 4 (= high) scale and a profession level of 4.6 (range 3–5) on a 1 (= unskilled) to 5 (= university trained) scale. Seventeen women were heterosexual, 2 indicated a homosexual orientation and 1 was bisexual. Twelve women had a steady partnership which averaged 5.7 years (range 0.7–15 years). Eighteen subjects were currently sexually active, with a mean solitary masturbation frequency of 1.1 (range 0.2–3) per week, and a mean coital frequency of 2.4 (range 0.2–4 or more) per week. Contraception used was a condom in 11 instances, sterilization in 4, while 5 women had no need of contraception. All these characteristics appeared to be well-balanced between groups F and L.

The sociosexual inventory (50 questions) yielded two significant differences between women of groups F and L: the duration of sexual partnership ( $F(n = 6)$ : 3.0 years vs.  $L(n = 6)$ : 8.4 years,  $p = .02$ ) and the avowed significance of 'sexuality' in their life (1 = not important; 5 = very important) ( $F(n = 10)$ : 4.3 vs.  $L(n = 10)$ : 3.4,  $p = .04$ ).

Table 1. Moods (0 = not at all; 100 = very much) and self image of body (0 = not at all; 4 = very much) on days of investigation, and objective and subjective responses while watching erotic video film without (-VIB) and with (+VIB) simultaneous vibrotactile genital stimulation. (Mean  $\pm$  SE), and post-film emotional feelings (1 = not at all; 7 = very much). Group F: subjects in follicular phase during first visit, in luteal phase during second visit. Group L: subjects in luteal phase during first visit, in follicular phase during second visit

	First Visit		Second visit	
	Group F ( <i>n</i> = 9) Follicular	Group L ( <i>n</i> = 11) Luteal	Group L Follicular	Group F Luteal
Age (years)	30.9 $\pm$ 2.6	34.0 $\pm$ 2.3		
Moods (scale 0-100)				
positive	58.7 $\pm$ 3.7	64.3 $\pm$ 3.3	62.8 $\pm$ 5.4	54.7 $\pm$ 4.4
negative*	21.0 $\pm$ 2.5	10.0 $\pm$ 1.7	18.9 $\pm$ 4.1	22.1 $\pm$ 5.2
Self-image of body (scale 0-4)				
positive	1.7 $\pm$ 0.1	2.2 $\pm$ 0.2	2.2 $\pm$ 0.2	1.8 $\pm$ 0.1
negative†	0.5 $\pm$ 0.1	0.5 $\pm$ 0.1	0.3 $\pm$ 0.1	0.7 $\pm$ 0.2
Labial temperature (°C)				
- VIB		- VIB	- VIB	- VIB
+ VIB		+ VIB	+ VIB	+ VIB
Onset erotic film	33.1 $\pm$ 0.5	34.3 $\pm$ 0.5	34.2 $\pm$ 0.4	33.5 $\pm$ 0.5
Change during film‡	1.6 $\pm$ 0.3	1.5 $\pm$ 0.3	0.6 $\pm$ 0.1	1.7 $\pm$ 0.4
Subjective sexual arousal (scale 1-7)§	4.9 $\pm$ 0.5	4.4 $\pm$ 0.3	4.7 $\pm$ 0.4	5.1 $\pm$ 0.4
Subjective genital arousal (scale 1-8)	4.8 $\pm$ 0.7	4.7 $\pm$ 0.5	4.7 $\pm$ 0.5	5.6 $\pm$ 0.2
Post-film emotional feelings (scale 1-7)				
positive	4.2 $\pm$ 0.4	4.0 $\pm$ 0.3	3.9 $\pm$ 0.4	4.4 $\pm$ 0.4
negative¶	1.7 $\pm$ 0.2	1.3 $\pm$ 0.1	1.1 $\pm$ 0.0	1.4 $\pm$ 0.1

\* During first visit: F vs L, *p* = .002.

† Overall effect of phase: Follicular (0.4) vs Luteal (0.6), *p* = .002.

‡ During first visit: without vibration F vs L, *p* = .03; with vibration F vs L, *p* = .06 (one-tailed).

§ Overall effect of vibration: with (5.3) vs without (4.8), *p* = .01.

¶ Overall effect of visits: 1st visit (1.5) vs 2nd visit (1.3), *p* = .01.

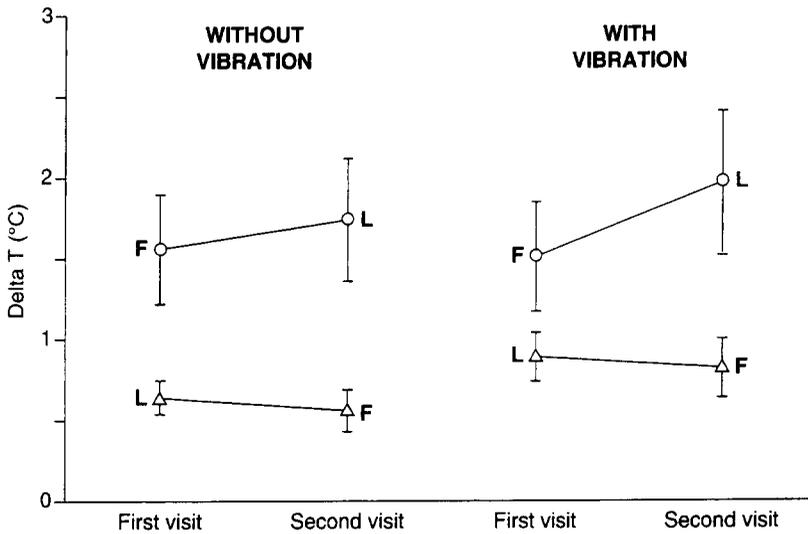


Fig. 3. Mean ( $\pm$ SE) rises in labium minus temperature (delta T °C) while watching erotic videofilm, without and with concomitant genital vibration, during first and second visit to the lab. F = during follicular phase; L = during luteal phase. Lines F-L = group F; Lines L-F = group L.

### *Moods and Self-image of Body*

The mean scores for positive moods (see Table I) on the days of investigation did not differ significantly between the phases of the menstrual cycle and the two visits; there was also no significant visit-phase interaction.

Overall analysis of the negative mood scores indicated a marginally significant visit-phase interaction ( $F[1,18] = 3.88$ ,  $p = .06$ ). Further analysis revealed a highly significant difference between groups F and L during the first visit to the lab (F more negative than L;  $t[18] = 3.73$ ,  $p = .002$ ).

The mean scores for positive self-image of body (see Table I) did not vary significantly between the two phases of the cycle and the two visits. Overall analysis of negative self-image of body scores only indicated a significant effect of cycle phase ( $F[1,18] = 12.33$ ,  $p = .002$ ): when tested during the luteal phase the women reported on the average more negative self-image of body than during the follicular phase.

### *Labium minus temperature*

In Fig. 3 are depicted the mean changes in labium minus temperature while watching erotic video films. Statistical analysis revealed that without vibration there was an overall phase-visit interaction ( $F[1,18] = 9.01$ ,  $p = .008$ ). Analyzing temperature changes obtained during the first visit, showed that women in their follicular phase generally had a greater increase in labium minus temperature than women in their luteal phase (means:  $1.56^{\circ}\text{C}$  and  $0.64^{\circ}\text{C}$ ,  $t[18] = 2.61$ ,  $p = .03$ ). With vibration also a phase-visit effect was discerned ( $F[1,18] = 5.65$ ,  $p = .03$ ). During the first visit the women in their follicular phase had a mean increase in labium minus temperature which was somewhat greater than women in the luteal phase (means:  $1.51^{\circ}\text{C}$  and  $0.89^{\circ}\text{C}$ ,  $t[18] = 1.67$ ,  $p = .06$  one-tailed). Vibration did not significantly affect increase in labium temperature.

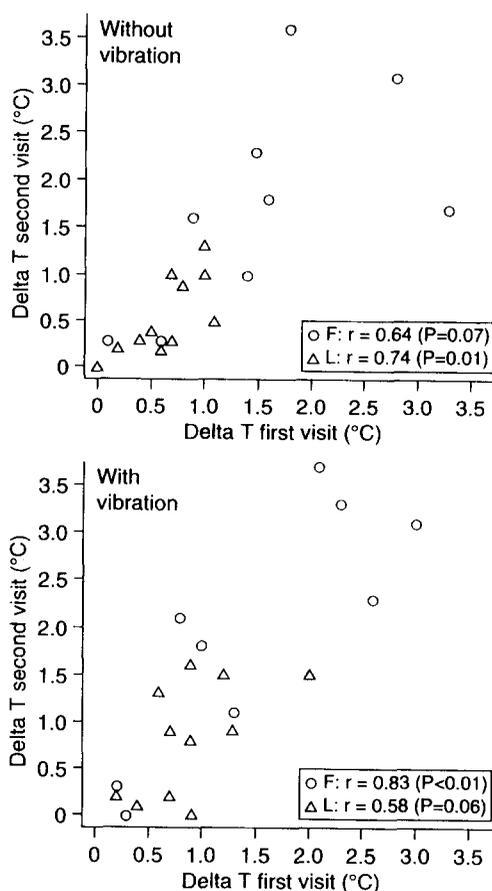


Fig. 4. Individual changes in labium minus temperature ( $^{\circ}\text{C}$ ) while watching erotic videofilm during first and second visit to the lab. ○ = group F (first visit in follicular phase); △ = group L (first visit in luteal phase). Top: without genital vibration; Bottom: with genital vibration.

During the second visit women of group F had again a higher increase in labium minus (without and with vibration) temperature than women of group L, despite the fact that they were in the reverse phase of their cycle.

Individual changes in labial temperature are depicted in Fig. 4, where it is shown that the changes during the first visit are positively correlated with those during the second visit, both without and with concomitant genital vibration.

The initial labial temperature, prior to the onset of the erotic film (see Table I), did not significantly differ between cycle phases (follicular vs luteal), visits, or absence or presence of genital vibration (+VIB vs -VIB). The group F women had a slightly lower mean initial labial temperature during the first visit, but this difference was not significant (+VIB and -VIB: both  $t[18] = 1.5$ ,  $p > .15$ ).

Individual initial labial temperatures are shown in Fig. 5. Data for first and second visit to the lab are highly positively correlated for group L women, but not for group F subjects.

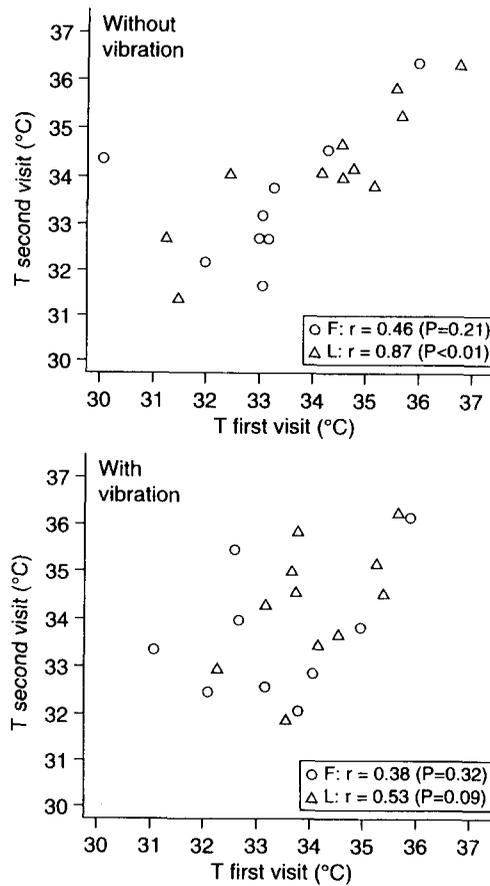


Fig. 5. Individual labium minus temperatures ( $^{\circ}\text{C}$ ) before watching erotic videofilm during first and second visit to the lab.  $\circ$  = group F (first visit in follicular phase);  $\triangle$  = group L (first visit in luteal phase). Top: without genital vibration; Bottom: with genital vibration.

Since the two distributions of initial temperatures of groups F and L were not significantly different from each other, the data of groups F and L were combined. This yielded the following Pearson's correlations between first and second visits: without vibration  $r = .72$  ( $p < .001$ ), with vibration  $r = .48$  ( $p = .03$ ).

### Subjective Arousal

Statistical analysis of subjective-sexual arousal showed only an overall stimulatory effect of genital vibration ( $F[1,18] = 6.99$ ,  $p = .01$ ; see data Table I).

Subjective genital arousal did not vary significantly between the two cycle phases, visits, or with absence or presence of genital vibration.

Correlations between subjective sexual and genital arousal were highly positive. When examined in detail it appeared that during the second visit to the lab  $r$  values were  $\geq .64$  (all  $p \leq .05$ ) for each of the groups F and L, without and with concomitant vibration. During the

first visit, highly significant correlations between sexual and genital arousal were found for group F without vibration ( $r = 0.85$ ,  $p = .004$ ) and for group L with vibration ( $r = .80$ ,  $p = .003$ ). During the first visit group F with vibration ( $r = .54$ ,  $p = .13$ ) and group L without vibration ( $r = .53$ ,  $p = .10$ ) these correlations between sexual and genital arousal failed to achieve statistical significance.

Correlations of subjective sexual arousal with 'objective' arousal, i.e. increase in labium minus temperature were positive but never reached statistical significance (all  $r \leq .38$ , all  $p \geq .22$ ). Similarly, no significant positive correlations were observed between subjective genital arousal and 'objective' arousal (all  $r \leq .39$ , all  $p \geq .23$ ).

### *Post-film Emotional Feelings*

In general, the women's sexual feelings appeared to be quite positive following the erotic videos, with relatively low scores for negative feelings (see Table I). The positive post-film feelings did not vary between both cycle phases, visits, or absence or presence of genital vibration. The negative post-film feelings were significantly less during the second visit than during the first visit.

### *Post-first-film Sexual Desire*

Immediately after viewing the first erotic video group F women indicated a much greater sexual desire (i.e. to make love or to masturbate) than group L women ( $2.7 \pm 0.5$  SE vs  $4.4 \pm 0.2$  SE;  $t[18] = 3.58$ ,  $p = .002$ ). After the first film during the second visit to the lab the sexual desire for group L women (then in their follicular phase) remained very low ( $4.5 \pm 0.2$ ) while the group F women (then in their luteal phase) had a somewhat lower sexual desire compared to their first lab visit ( $3.9 \pm 0.3$  vs  $2.7 \pm 0.5$ ,  $t[16] = 2.08$ ,  $p = .06$ ).

### *Day-after Sexual Activities and Fantasies*

During the 24 h following the first visit to the lab more F women (6 of 9) experienced an increased desire for making love than L women (2 of 10, one woman failed to report) (Fisher exact test two-tailed,  $p = .07$ ). Increased erotic fantasies were reported more often by F women (5 of 9) than by L women (1 of 10) (Fisher, two-tailed,  $p = .06$ ). No statistically significant differences were found in the incidence of actual sexual intercourse and masturbation of the two groups of women. After the second visit to the laboratory no significant differences were found between the two groups of women.

From the final overall assessment of the laboratory procedures it was clear that all women enjoyed their participation in the study and expressed their willingness to take part in similar future experiments. No technical difficulties were encountered with respect to the attachment of the thermistorclip and the minivibrator. The majority of the women found the combination of erotic video and vibration more enjoyable (first visit 11 of 20; second visit 13 of 20) and more sexually exciting (first visit 12 of 20; second visit 16 of 20) than erotic video alone.

## **DISCUSSION**

The two objectives of the present study were to attempt to replicate the findings of an earlier study, and to investigate a possible contribution of vibrotactile stimulation of the clitoral region on sexual arousability. In the earlier study (Slob et al., 1991) it was found that women tested for the first time in their follicular phase were generally sexually more aroused

by erotic video than women tested for the first time during their luteal phase as evidenced by a higher increase in labium minus temperature. We were then surprised to find that the difference between these two groups of women persisted when they were tested a second time, i.e. during the alternative phase of their menstrual cycle. In the present work these same phenomena were encountered once more. The fact that the women more or less repeated their initial response supports our earlier suggestion that we may be dealing with a learned or conditioned phenomenon that is obtained with the presentation of the initial sexual stimulation. This latter hypothesis is further supported by the finding that the 5 women whose data were omitted from the present study because of irregularities in their endocrine profiles, also showed a high positive correlation between labium minus temperature increase during the first and second visit to the laboratory (without vibration  $r = .96, p = .009$ ; with vibration  $r = .67, p = \text{ns}$ ). The tenor of this hypothesis is reminiscent of findings obtained with rats, in which state-dependent memory retention (a conditioned flavor aversion) was found after a learning experience with or without estrogen (Constanzo et al., 1995). These authors state 'whether tested while estrus or anestrus, the aversion was strongest if the test state matched the training state' (Constanzo et al., 1995, p. 1010).

Vibrotactile stimulation appeared to have no significant effect on objective sexual arousal (i.e. labium minus temperature increase), or on subjective genital arousal. In contrast, subjective sexual arousal was significantly increased. Furthermore, vibration resulted in a more pleasurable experience to erotic video stimulation in the majority of women.

Subjective sexual and genital arousal were positively correlated, but neither was significantly correlated with objective sexual arousal as measured by labium minus temperature increase. This lack of a correlation between a recorded physical change such as labium minus temperature or vaginal photoplethysmography (e.g. Laan et al., 1995; Palace & Gorzalka, 1990) contrasts with the findings in males in whom recorded penile response correlates highly with reported subjective sexual arousal (e.g. Janssen et al., 1994b; Rosen & Beck, 1988; Slob et al., 1990a). This interesting sex difference in psychophysiological responding calls for detailed investigation. One possible cause for this difference may reside in the character of the subjective reports elicited by the questionnaires. In males, subjective sexual arousal may partly be based on the conscious sensation of their penile reaction, whereas, in women, subjective sexual arousal is not likely to be based so much on the conscious sensation of their genital responses. If the latter supposition is correct, perhaps women should not only be asked how sexually aroused they are, but also how much they desire lovemaking or want to masturbate (as was done in the present study), as these measures may provide an index of the subject's 'arousability', a dimension that is not typically assessed in psychophysiological studies of this type.

Although subjective sexual and genital arousal did not seem to vary significantly with the phase of the menstrual cycle, there appeared significant differences in other aspects of subjects' sexuality during and following the first visit to the laboratory. Immediately after the first erotic video women in the follicular phase reported a greater sexual desire which persisted during the next 24 h, when more of them indicated an increased desire to make love and the experience of more erotic fantasies than the luteal phase women. Thus, in future studies investigating the relationship between sexual arousability and the menstrual cycle it may be desirable to include questions about sexual desire and fantasies in questionnaires which supposedly measure subjective sexual arousal in women.

An alternative explanation of the present results could be that the F and L women were not comparable at the outset of the experiment. That is, besides the difference in the initial phase

of the menstrual cycle under which subjects were tested, these groups might have differed on other important sociosexual or behavioral parameters. Such a difference could explain why the differences attributed to menstrual cycle phase persisted in the alternative phase of the cycle, that is, the second test in the laboratory. Indeed, it may have been that some of the scales used in the present study (e.g. body-image scale) were not sufficiently sensitive or reliable to manifest such differences, and therefore may have had limited usefulness in differentiating the groups in ways other than the time of first exposure (luteal or follicular phase). Nevertheless, the multiple measures of arousal, affect, and self-perception used in this study unveiled no characteristic variation between the groups. In addition, thorough examination of the sociosexual inventory (50 questions) yielded only two significant differences between women of groups F and L: the duration of sexual partnership and the avowed significance of 'sexuality' in their life. It is unlikely that such minimal differences could account for the effect size on genital response observed in the present study. Furthermore, one might expect several such differences in a series of 50 items simply by chance, so it is unlikely that these two items, only tangentially related to the purpose of the present study, signify a real difference between groups. This, together with the fact that the same phenomenon was established in an independent group of women tested in an earlier study (Slob et al., 1991), raises the possibility of a conditioning or cognitive mechanism that might facilitate response to sexual stimulation should it first be encountered during the follicular phase.

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