

Mood, Sexuality, Hormones, and the Menstrual Cycle. III. Sexuality and the Role of Androgens

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Sexual interest and activity at different stages of the menstrual cycle was recorded by 55 women with normal ovulatory cycles. In women with marked cyclical mood change, there was an associated cyclical pattern of sexual feelings. Subjective sexuality independent of mood change, was maximal in the mid-follicular (i.e., postmenstrual) and late luteal (i.e., premenstrual) phases. Sexual activity was maximal in the mid-follicular phase. There was no evidence of a periovulatory increase in sexual interest or activity. Mean testosterone levels were correlated with masturbation frequency but not with sexuality involving the partner. A weak association between testosterone and life style (i.e., in full-time work or a housewife) was also evident.

The role of hormones in adult human sexual behavior remains uncertain, particularly in women. The menstrual cycle with its changing levels of steroid hormones provides one obvious source of information. Are these hormonal changes reflected in women's sexuality? In animals, the answer is usually clear. In most subprimates, sexual behavior is restricted to a limited phase of the hormonal cycle, closely linked to ovulation and determined by appropriate levels of estrogen and, to a variable extent from one species to another, progesterone. This is the so-called estrous cycle. In subhuman primates, the picture is less clear in that sexual activity is not necessarily confined to a brief estrous phase; but in most species studied, it nevertheless shows an

increase around the middle of the cycle and ovulation. Experiments with animals in captivity have shown that the midcycle increase involves a number of factors including attractiveness of the female to the male, physiological changes in the female genitalia and increased likelihood of the female initiating sexual contact, i.e., proceptivity (1). The relative importance of these different factors to the overall behavioral pattern and the precise mechanisms involved are not fully understood.

What is the situation in women? Does their attractiveness vary? Do they undergo genital changes that in some way influence their sexuality? Does their spontaneous interest or their ability to enjoy sexual activity increase at certain times of the hormonal cycle? These questions are of more than theoretical interest; they are directly relevant to understanding the effects of the various hormonal methods of contraception that are currently being used by millions of women and may be relevant to treatment of loss of sexual desire.

There is no shortage of studies of the distribution of sexual activity through the

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menstrual cycle. In a recent review, Schreiner-Engel (2) listed 32 such studies. In only 8 studies was there evidence of increased sexuality around the time of ovulation; whereas in 17 others, increases were observed premenstrually; 18 postmenstrually; and 4 during menstruation. Definitions of menstrual phases varied greatly and many of these studies relied upon retrospective reporting the reliability and validity of which are open to question. A few used daily recordings of sexual behavior; but in most of these, no attempt was made to distinguish between sexual intercourse and other types of sexual activities such as masturbation, or to identify subjective feelings of sexual interest or to establish whether sexual activity was initiated by the woman herself or her partner. Adams et al. (3) were an exception in attempting to distinguish between partner-initiated and self-initiated sexual acts, the latter including masturbation, reading erotic literature, and sexual daydreaming. These workers reported a midcycle increase in self-initiated behavior in women not using oral contraceptives. The main shortcoming of this study apart from the small numbers involved was that no hormonal markers were used (4). This is particularly important if one is interested in behavior temporally related to ovulation and less so when relating behavior to menstruation. Abplanalp et al. (5) combined daily recordings of sexual activity and mood with hormone assessment in 14 women, and failed to find any cyclical pattern. As yet they have only reported limited data as far as the sexuality of these women was concerned. A recent attempt to study an aspect of female sexuality which is independent of the partner was reported by Schreiner-Engel et al. (6) who used laboratory measurements of

vaginal bloodflow in response to erotic stimuli at three different stages of the cycle. They found vaginal responses significantly greater in the follicular and luteal phase than in the periovulatory phase of the cycle.

Method of Analysis

The mean scores for each behavioral variable were computed for each of the six hormonal phases of the cycle. Analyses of variance with repeated measures was carried out for each variable. A principal components analysis of the subjective variables was also carried out, details of which are given in Part I. It showed that approximately one-third of the variance of the subjective sexual measures (i.e., sexual feelings and pleasant sexual thoughts) was taken up in the first component which was labeled "general well-being." The scores on this component showed a marked cyclicity in the clinic and non-clinic PMS women, with the women feeling at their best in the late follicular phase and their well-being declining thereafter. For those women who experienced a cyclicity of well-being, there was therefore some associated cyclicity of their sexual feelings. The fourth component included most of the remaining variance of the sexual variables contrasted with self-rated energy. This component was called "sexuality" and has been taken to represent sexual feelings which are independent of general well-being and which persist in spite of lack of energy. The scores on this component will be presented as a further variable.

Results

Distributions of sexual activity with a partner (i.e., for those women who had

partners), and of orgasm through the six phases of the cycle are shown in Table 1. The peak of activity occurred in the mid-follicular (i.e., postmenstrual) phase in the whole group. The three subgroups showed similar but nonsignificant patterns.

For those women who recorded the initiator, there was a significant peak of female or mutual initiation in the mid-follicular phase; mutual initiation was recorded more frequently than self-initiation. Partner initiation showed a nonsignificant tendency to be greater in the luteal half of the cycle (See Table 2). The frequency of masturbation, in those women who reported it, is shown in Table 2. There was a nonsignificant tendency for it to increase in the later luteal phase.

Changes in subjective ratings (i.e., sexual feelings and pleasant thoughts) through the cycle are shown in Table 3. This again shows a peak in the mid-follicular phase for the whole group. For the subgroups, only changes in sexual feelings in the clinic women reached significance. The non-clinic PMS group showed a similar pattern, whereas the no PMS women tended to show a further increase in sexual feelings in the late luteal phase.

Changes in the scores for the fourth principal component, labeled "Sexuality," is shown for the three subgroups in Figure 3 of Part I with peaks in the mid-follicular and late luteal phases. This pattern for the three groups combined was statistically significant ($p < 0.05$), though not for the three groups separately.

The Relationship Between Testosterone and Sexual Behavior

Plasma levels of testosterone and androstenedione, while showing a substan-

tial midcycle rise (Figure 1) do not show the variability through the cycle found with the other steroids. We therefore correlated the average testosterone levels throughout the cycle as well as the mid-cycle levels (i.e., mean of the late follicular and early luteal phases) with the mean level of each behavioral variable through the cycle. In this way, we could explore tonic rather than phasic hormone/behavior relationships. As the pattern of correlations was very similar for the mid-cycle testosterone and whole-cycle mean testosterone levels, only the former are shown in Table 4.

We found a high correlation between testosterone and masturbation frequency in those women who masturbated, but negative or insignificant correlations with other aspects of sexuality. The negative correlations were, however, stronger in women who did not masturbate than those who did, although the levels of testosterone did not differ between these two groups of women.

Average testosterone levels were also weakly associated with certain aspects of the women's lifestyle. Levels were lower in women who cohabited than in those who did not, and lower in those who did not work full-time outside the home than in those who did. In both cases, the difference was small, just reaching significance at the 10% level.

DISCUSSION

These results showed unequivocally that there was no increase in sexuality associated with ovulation in these women. There was, however, convincing evidence of a peak in the mid-follicular (postmenstrual) phase in those women who did not experience a marked premenstrual decline in well-being.

TABLE 1. Distribution of Sexual Activity with Partner and Orgasm Through the Six Phases of the Cycle

	Follicular			Luteal			N	F ratio	P
	Early	Mid-	Late	Early	Mid-	Late			
Frequency of sexual activity with partner, per week	Total	1.4 (0.3)	2.7 (0.3)	1.9 (0.3)	2.0 (0.3)	2.0 (0.3)	40	3.1	< 0.01
	Clinic	1.3 (0.2)	2.4 (0.3)	2.2 (0.3)	2.1 (0.3)	2.6 (0.3)	14	1.51	NS
	PMS								
Mean (SD)	Non Clinic	1.1 (0.3)	2.4 (0.3)	1.5 (0.3)	1.5 (0.2)	1.5 (0.2)	13	1.5	NS
	PMS	1.9 (0.4)	3.2 (0.3)	2.0 (0.4)	2.3 (0.4)	1.8 (0.3)	13	1.49	NS
	PMS								
Frequency of orgasm, per week	Total	0.7 (0.2)	1.4 (0.2)	0.9 (0.2)	0.9 (0.2)	0.9 (0.2)	39	1.6	NS
	Clinic	0.3 (0.1)	1.0 (0.2)	0.9 (0.2)	0.5 (0.1)	1.1 (0.2)	14	1.41	NS
	PMS								
Mean (SD)	Non Clinic	0.8 (0.2)	1.7 (0.2)	0.8 (0.2)	0.8 (0.2)	0.9 (0.2)	13	1.52	NS
	PMS	1.0 (0.2)	1.5 (0.3)	1.0 (0.2)	1.5 (0.3)	0.6 (0.1)	12	0.75	NS
	No PMS								

^aNS = not significant.

TABLE 2. Frequency of Masturbation and Sexual Activity with Partner Initiated by Self, or Mutually, or by Partner

	Follicular			Luteal			N	F ratio	P
	Early	Mid-	Late	Early	Mid-	Late			
Frequency of masturbation, per week	Total	0.6 (0.2)	1.1 (0.2)	0.9 (0.2)	1.0 (0.3)	1.0 (0.2)	26	1.16	NS
Mean (SD)	Clinic	0.8 (0.2)	2.6 (0.3)	1.1 (0.2)	1.0 (0.2)	1.0 (0.2)	17	4.29	< 0.002
	PMS								
Frequency of sexual activity initiated by self or mutually, per week	Total	0.3 (0.1)	0.4 (0.1)	0.5 (0.1)	0.8 (0.2)	0.7 (0.2)	17	1.27	NS
Mean (SD)	Clinic								
	PMS								

MENSTRUAL CYCLE. III

TABLE 3. Subjective Ratings of Sexuality in Different Phases of the Cycle

	Follicular			Luteal			N	F ratio	P
	Early	Mid-	Late	Early	Mid-	Late			
Sexual Feelings (0-10)	Total	3.7 (2.3)	4.8 (1.9)	4.2 (2.0)	4.0 (2.1)	3.8 (2.1)	3.7 (2.4)	4.02	< 0.002
	Clinic	3.8 (2.5)	5.3 (2.1)	5.2 (1.6)	4.0 (1.9)	4.2 (2.0)	3.2 (2.3)	3.4	< 0.01
	PMS								
Mean (SD)	Non	3.6 (2.1)	4.3 (1.9)	3.6 (2.1)	4.2 (2.2)	3.5 (2.2)	3.7 (2.3)	1.01	NS
	Clinic								
	PMS								
Pleasant thoughts (0-3)	Total	1.1 (0.8)	1.4 (0.8)	1.3 (0.7)	1.2 (0.8)	1.0 (0.7)	1.1 (0.8)	3.54	< 0.005
	Clinic	0.9 (0.8)	1.3 (0.9)	1.3 (0.7)	1.0 (0.8)	1.0 (0.6)	0.9 (0.8)	1.7	NS
	PMS								
Mean (SD)	Non	1.0 (0.8)	1.2 (0.6)	1.1 (0.7)	1.2 (0.8)	0.9 (0.7)	1.1 (0.7)	0.8	NS
	Clinic								
	PMS								
	No	1.3 (0.9)	1.5 (0.8)	1.4 (0.8)	1.3 (0.9)	1.2 (0.9)	1.2 (0.9)	1.2	NS
	PMS								

TABLE 4. Correlations Between Midcycle Testosterone Levels and Various Aspects of Sexuality

	Sexual Feelings	Sexual Thoughts	"Sexuality" (P.C. 4)	Frequency of Masturbation	Frequency of Sexual Activity with Partner	Subjective Rating of Orgasm	Frequency of Orgasm
All Women (n)	-0.20 (37)	0.04 (38)	-0.17 (37)				0.34 ^a (38)
Women with partners (n)					-0.09 (33)	-0.19 (32)	-0.06 (33)
Women who masturbate (n)	-0.05 (21)		-0.02 (21)	0.79 ^c (21)	-0.10 (21)	-0.18 (18)	0.64 ^c (21)
Women who do not masturbate (n)	-0.44 ^a (15)	0.06 (16)	-0.26 (15)		-0.26 (16)	-0.14 (15)	-0.27 (16)

^a*p* < 0.05.
^b*p* < 0.01.
^c*p* < 0.001.

The association between subjective sexuality and well-being observed in this study was not surprising. It is to be expected that a woman will be more likely to express her sexuality when she is generally feeling well and energetic. Nevertheless, this association has not previously been taken into consideration when studying sexuality through the menstrual cycle. The occurrence of a marked cyclical

mood change will tend to maximize sexual feelings and behavior in the good part of the cycle but the degree of cyclical mood change, as discussed in Part I, varied considerably between women as well as between cycles in the same woman. Therefore, any comparison of groups of women should take into account the degree of cyclical mood change.

The observed pattern of postmenstrual

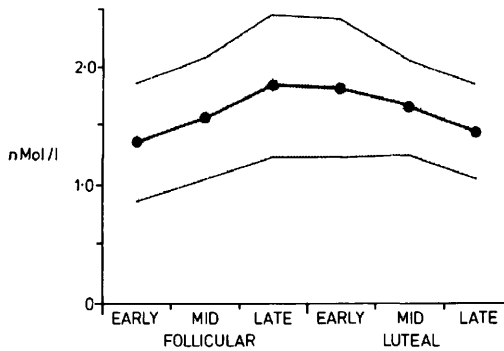


Fig. 1 Mean testosterone level (± 1 S.D.) in the six phases of the cycle in 36 women.

and to a lesser extent, premenstrual sexuality, is consistent with the majority of previous studies as mentioned in the introduction. The likely determinants of such a pattern remain uncertain. It is widely assumed to result from the abstinence that usually accompanies menstruation but this is unlikely to be a sufficient explanation. This issue is discussed more fully elsewhere (7).

It is probable that there is some basic cyclical pattern present in many women, which may be amplified by the effects of menstrual abstinence, and thus accounts for our findings. Possible biological determinants of such a pattern are as yet difficult to identify but may involve hormonal as well as nonhormonal mechanisms. It has been widely believed for many years that testosterone is the "libido hormone" of women as well as of men, though the evidence has been largely anecdotal and very limited (8). In this study, as maximum testosterone levels occurred in the middle third of the cycle when sexuality is at its lowest, there was obviously no positive association of a short-term kind. But it is possible that the behavioral effects of testosterone are of relatively long latency, with the midcycle "rise" contributing to the perimenstrual peak that follows. We have discussed this possibility elsewhere (7).

Alternatively, the time relationship between testosterone rise and behavioral effect may be too long to be reflected cyclically in a series of normal menstrual cycles. In that case, we should look for "tonic" rather than phasic effects. For this purpose, we examined the association between average testosterone levels and average behavior through the cycle. Here the results suggested a complexity with profound implications. The one aspect of female sexuality measured by us which

showed a clear and striking positive association with testosterone levels was the frequency of masturbation. This is behavior which is independent of the sexual relationship. Other measures, such as sexual activity with a partner, or general sexual feelings, showed negative, if any, associations.

Is there some difference between masturbating and nonmasturbating women that would account for their apparently different response to testosterone? There was no difference between the two groups in their levels of testosterone, suggesting that testosterone may be relatively unimportant in determining whether a woman accepts or rejects masturbation, though Schreiner-Engel (personal communication) did find a negative correlation between current testosterone levels and age at onset of masturbation. It is possible that other personality or sociological factors may characterize masturbating and nonmasturbating groups and that these would permit testosterone to produce sexual behavioral effects in one group while provoking difficulties in the sexual relationship of the others. It is therefore of relevance that we found a weak association between testosterone levels and lifestyle comparable to that reported by Purifoy & Koopmans (9). As yet, we cannot say whether the testosterone is causally related or is a consequence of the lifestyle. From other evidence, such as the developmental consequences of androgenization in females (8), it is distinctly possible that women with higher testosterone levels are more likely to pursue careers and less likely to conform to the conventional stereotype of the "happily married woman." Such testosterone effects could also be manifested as increased conflict within heterosexual relationships, at least those of certain types. Such an effect

could account for the paradoxical contrast between masturbation and sexual activity with a partner as observed in the study. It is noteworthy that a comparable paradox was found by Schreiner-Engel et al (2). All her subjects masturbated, but those with higher testosterone levels, in spite of their greater capacity for sexual response in the laboratory, reported more difficulties in their sexual relationships and less frequent intercourse.

If there is any validity in these sugges-

tions, then the implications are of considerable importance. But it must be stressed that they are based on as yet limited evidence, and further evidence relating androgen levels to sexuality and lifestyle in women is clearly required.

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