

## VARIATIONS IN SEBUM EXCRETION DURING THE MENSTRUAL CYCLE

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**Abstract.** A study of 10 women with mild acne has shown that there is a cyclic variation in the sebum excretion rate (SER) during the menstrual cycle. The variation is small relative to the error of the method, so that the changes become apparent only after standardization of the cycle length and statistical analysis of the pooled data. There is a steady decrease in the first half of the cycle, with the nadir occurring a few days after ovulation. The SER increases in the luteal phase of the cycle, but decreases again in the premenstrual phase. The explanation of this finding is unknown. Cyclic variation in hormone secretion and the possibility of duct blockage by oedema are discussed.

The cause of the premenstrual exacerbation of acne is unknown, but in view of the relationship between seborrhoea and acne, it has been suggested that there may be an increased sebum production before menstruation. The few reported quantitative studies on the effect of the menstrual cycle on sebum excretion are conflicting. Hodgson-Jones et al. (12) using the Emanuel cup method, found that sebum excretion reached a plateau at about the time of ovulation and decreased premenstrually. Kalz & Scott (14) using a semiquantitative osmic print method claimed that sebum excretion increased in the latter half of the cycle, but Strauss & Kligman (19) using a more reliable gravimetric method could find no evidence of cyclic variation related to menstruation, and neither could Pawlowski & Petrykiewicz (17). In view of this controversy we have looked for possible variation in sebum excretion during the normal menstruation cycle.

### MATERIALS AND METHODS

The sebum excretion rate (SER) from the forehead skin of 10 women with mild acne, aged 15-23 years, was

measured on 8 occasions at consecutive weekly intervals by the method of Strauss & Pochi (20) as modified by Cunliffe & Shuster (4). All the subjects had normal regular periods and none were taking oral contraceptives. Subjects with mild acne were chosen because they tend to have seborrhoea, and we hoped this might minimize the fairly large experimental error of the method. We excluded patients with more than a mild acne because of the possibility that cyclic fluctuation might be damped down at very high rates of sebum excretion. The severity of the acne was assessed clinically at each visit, and the patient was asked whether her acne was more or less severe than usual.

Since the cycles did not last for exactly 28 days in every subject the results were standardized to a 28 day cycle by calculation, using the fact that the time from ovulation to the onset of menstruation is normally constant at 14 days (1). The day of ovulation was thus determined for each cycle and the portion of the cycle before ovulation was then also corrected to 14 days by a ratio method.

### RESULTS

The SERs for each subject are shown in Fig. 1. There is a wide variation in consecutive measurements throughout the cycle and no clear pattern is apparent. The pooled results expressed as a percentage of the mean for each subject over a standard 28 day cycle are shown in Fig. 2, and when these results are analysed in 7 consecutive 4 day periods a cyclic variation becomes apparent (Fig. 3). There is a steady and significant decrease ( $P < 0.02$ ) in sebum excretion during the first half of the cycle, the mean SER falling from  $108.6 \pm \text{S.E. } 5.2\%$  in the first 4 day period to  $89.9 \pm \text{S.E. } 4.1\%$  in the fourth 4 day period. The decrease is followed by a significant increase ( $P < 0.01$ ) in the second half of the cycle, the mean SER being  $111.8 \pm \text{S.E. } 5.1\%$  in the interval from

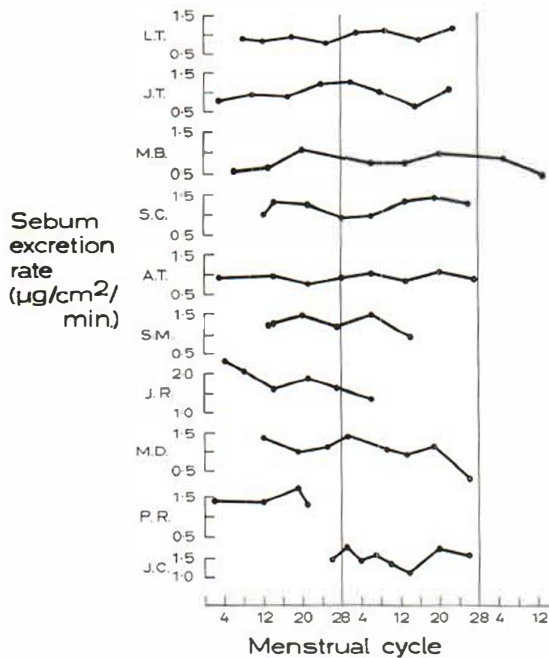


Fig. 1. Sebum excretion rates during 2 menstrual cycles in 10 women with mild acne.

17–20 days. There was a further significant decrease ( $P < 0.01$ ) just before the onset of menstruation, the SER falling to  $92.0 \pm \text{S.E. } 3.3\%$ . This division of the menstrual cycle into 4 day periods is arbitrary, but a similar cyclic variation is seen if 2 or 3 day periods are chosen. The pattern of variation is also the same if the results for each subject are expressed as a percentage of the SER at a fixed point in the cycle, say day 14, rather than as a percentage of the mean.

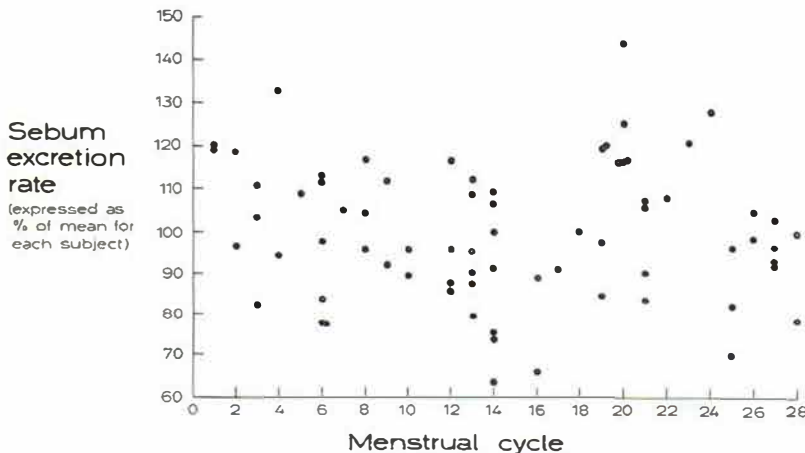


Fig. 2. Pooled sebum excretion rates expressed as a percentage of the mean for each subject over a standard 28-day cycle.

Only 2 premenstrual SER measurements were made at a time when the subjects' acne was worse than usual, so that no firm conclusion can be drawn, but there was no change in SER in these two subjects.

## DISCUSSION

Sebaceous glands are hormonally controlled and the main hormones known to vary during the menstrual cycle are oestrogens and progesterone. Oestrogens reach a peak at the time of ovulation (2) and progesterone rises in the luteal phase of the cycle but falls just before menstruation (15).

The temporal relationship of these hormonal changes to our present findings is shown in Fig. 4; whether our results are related to these hormonal changes is debatable. It is generally agreed that oestrogens depress sebum production, and our data suggest that the lowest rates of sebum excretion occur a few days after the peak of urinary oestrogen excretion, which is at the time of ovulation. Little is known of the minimum time required for the sebum excretion rate to respond to changes in endogenous hormone levels. Strauss et al. (21) found that the glands appeared to take about 2 weeks to respond to exogenous oestrogens and androgens, but many of their experiments involved prepubertal subjects with undeveloped sebaceous glands. Their published figures relating to adults also suggested a response time of about 2 weeks, but their SER measurements were infrequent and it remains possible that the minimum time for response may be shorter than is generally believed. Certainly sebum excretion is measurably increased in the rat within a week

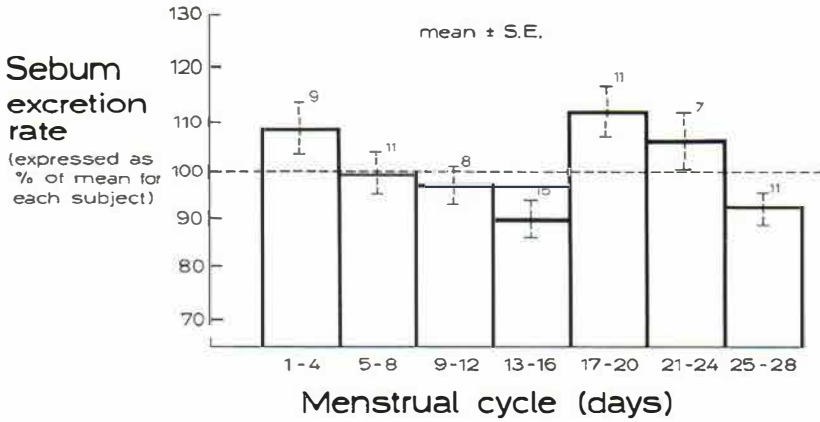


Fig. 3. Pooled sebum excretion rates analysed in consecutive 4-day periods during a standard menstrual cycle.

of androgen treatment (Archibald & Shuster 1965, unpublished data).

The changes in SER in the second half of the cycle are even more difficult to attribute to hormonal variation. The effect of progesterone on the sebaceous gland is controversial. Zeligman & Hubener (22) found that the administration of

progesterone produced acne in previously normal women, and Haskin et al. (11), Lasher et al. (16), Smith (18) and Groot et al. (9) found that progesterone stimulated sebum secretion in the rat and man. Other workers, however, found that progesterone in physiological doses was without effect on sebum production in man (13, 19) and animals (6, 7, 8, 10). A rapid response to endogenous progesterone might explain the increased SER in the second half of the cycle, but it would not explain the premenstrual nadir followed by an increase early in the next menstrual cycle. It therefore seems likely that changes other than variation in oestrogen and progesterone production might be important in producing the cyclic SER variations we have observed. Cyclic variation in other hormones such as the pituitary sebostrophic factors is possible and there is evidence of a powerful sebostrophic influence, for example during pregnancy (3). A 1°C change in skin temperature alters the SER by about 10% (5) and changes in skin temperature could be important. Fluid retention during the premenstrual phase of the cycle is another factor which might affect the SER. It is possible for example that increased interstitial pressure due to fluid retention could impede the free flow of sebum to the surface with a consequent decrease in SER and an exacerbation of clinical acne.

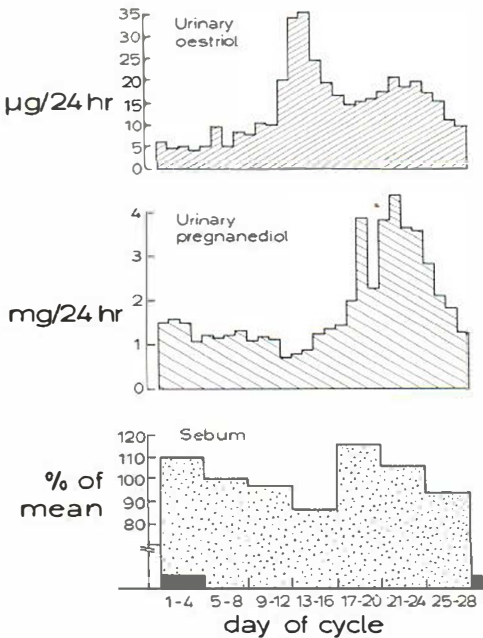


Fig. 4. The temporal relationship between urinary oestriol and pregnanediol excretion (after Brown 1955 and Klopper 1957) and pooled sebum excretion rates expressed as a percentage of the mean for each subject, in our 10 subjects.

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