PATTERNS OF SEXUAL RESPONSIVENESS DURING THE MENSTRUAL CYCLE

Heidi Markowitz

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ABSTRACT

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The hypothesis was tested that changes in female sexual responsiveness occur during the course of the menstrual cycle. Twenty-five women, who were using birth control methods other than oral contraceptives, completed daily questionnaires concerning their sexual activity and basal body temperature for 2 consecutive menstrual cycles; 13 of these women furnished data for a third cycle. Ovulatory cycles were separated from anovulatory cycles according to the independent judgment of 2 experienced gynecologists. Results of the study suggested that the pattern of sexual activity during the menstrual cycle is comparable in ovulatory and anovulatory women. Both groups demonstrated a primarily bimodal pattern with postmenstrual and midcycle peaks in sexual interest. Psychological and hormonal factors, respectively, may account for these increases. Heightened sexuality was observed in women with anovular cycles. This could be mediated by endocrine changes, especially fluctuations

in progesterone and androgen, which have been associated with anovulation. It is suggested that greater understanding of female sexual behavior might be gained by measurement of both behavioral and endocrine variables during the menstrual cycle.

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Introduction

In recent years, a great deal of attention has been focused on the way in which circulating levels of gonadotropic and gonadal hormones may affect the sexual interest of the human female. The search for hormonal correlates of sexual activity in women is based upon a substantial body of animal research indicating that sexual responsiveness in subhuman females is dependent on endocrine events. In lower animals with estrus patterns, the relationship between hormonal variables and mating behavior is characterized by periodic female sexual receptivity or "heat" corresponding to increased estrogen production at the time of ovulation (Ford & Beach, 1951; Czaja & Bielert, 1975). In many primate species, the relation between sexual behavior and the ovarian cycle is different. Apes and most monkeys, like humans, have a menstrual cycle and females allow copulation throughout much or all of their cycle. For these species, the particular hormonal conditions associated with ovulation are thus not a necessary prerequisite for the display of certain components of female sexual activity. Nevertheless, numerous studies suggest that endocrine events do have a clear influence on primate sexual interactions. For the rhesus monkey, the species most studied in this regard, tests under controlled laboratory conditions have produced

maximal frequencies of male grooming activity, mounting, and ejaculation at the midpoint in the female cycle (Michael, Zumpe, Keverne & Bonsall, 1972). Female soliciting actions, time spent near the restrained male partner, and performance of operant behavior to gain access to the male have also been reported to peak at the high estrogen phase of ovulation (Baum, Everitt, Herbert & Keverne, 1977; Beach, 1975, 1976; Czaja & Bielert, 1975; Michael et al., 1972).

The quest for evidence of similar hormonal modulation in the human female has been an inevitability. A growing number of investigators have attempted to relate various aspects of female sexual behavior to the temporal phase of the menstrual cycle. A relationship to the gonadal hormone secretory pattern has then been inferred since it is known that plasma levels of gonadotropic and gonadal hormone fluctuate with characteristic cyclicity from one menses to the next (Dyrenfurth, Jewelewicz, Warren, Ferin & Vande Wiele, 1974; Taymor & Thompson, 1974).

Hormonal factors in the menstrual cycle

A description of the principal hormonal changes occurring during the normal menstrual cycle will serve as a background for the discussion of the changes in sexual responsiveness. Ovarian function is dependent upon the complex interplay between two integrated components: the

ovarian unit and the hypothalamic-pituitary system. The hypothalamus secretes follicle stimulating hormone releasing factor (FRF) and luteinizing hormone releasing factor (LRF) which promote the secretion of gonadotropins from the anterior pituitary. The gonadotropins are the follicle stimulating hormone (FSH) which induces maturation of the ovarian follicle, and the luteinizing hormone (LH) which causes release of ovarian hormones and induces ovulation. The gonadotropins promote the development and secretion of hormones by the ovaries and thus regulate the menstrual cycle. The ovaries secrete various hormones, including estrogens and progesterone, that in turn exert a "feedback" effect upon the hypothalamus, and thus regulate the output of FSH and LH by the pituitary (Melges & Hamburg, 1977). Other hormones, the androgens, are most likely produced by both the ovary and adrenal gland (Kinsey, Pomeroy, Martin & Gebhard, 1953; Taymor & Thompson, 1974). Knowledge concerning the significance of these steroids in the regulation of the menstrual cycle, however, has not yet been obtained.

Allowing for individual variation (Whalen, 1972), the hormonal changes in the normal menstrual cycle exhibit a rhythmic temporal pattern whose features are common to all cycles. Briefly, the onset of menstruation coincides with a clear elevation of FSH for approximately 7 to 10 days.

This is followed by an accelerating rise in estrogens. When follicular maturation is complete and estrogen levels are high, a surge of LH occurs which initiates ovulation within 24 to 40 hours. Immediately after the LH increase, estrogens fall abruptly. However, after ovulation, there is a secondary rise in estrogens accompanied by an important increase in progesterone secretion. Concentration of these gonadal hormones peak approximately 6 to 7 days after ovulation, after which there is a general decline to baseline levels as menstruation becomes imminent. Throughout the cycle, the androgen supply remains at a fairly constant level with a rise near and after ovulation. Gonadotropic levels are low after ovulation and begin to gradually increase again just at the onset of the next menses.

Review of previous research

Whereas data on the periodicity of hormones secretion during the cycle are generally consistent, findings concerning changes in sexual responsiveness show marked diversity. Different investigators, using different indices of sexual behavior, report peaks of sexual arousal and activity at numerous points in the menstrual cycle. Data bearing on the question come from three types of study. The first is a study using the psychoanalytical interpretation of dreams. Benedek and Rubinstein (1939)

conducted an intensive study of 15 women receiving psychotherapy. They kept records of the subjects' free associations and dreams and related them to hormone levels inferred from vaginal smears. Records included 2,000 day-by-day diagnoses and represented 75 cycles. The results showed that active heterosexual striving increased with estrogen production in the first half of the menstrual cycle whereas, during the second half of the cycle, a passive-receptive sexuality appeared to be associated with progesterone. The investigators suggest that the time of greatest sexual activity should be in the estrogenic midcycle period. However, they failed to present any substantive data on overt sexual behavior.

Retrospective studies provide a second source of data on female sexual behavior. A few of these investigations suggest that erotic interest peaks in the premenstrual period. Davis (1929) surveyed 2200 women by means of an original questionnaire presented to them on a single occasion. These women averaged 38 years in age and were mainly university alumnae. Subjects were asked to recall when "marked periods of sexual desire" occurred during the cycle. Davis (1929) found that almost 49% of the respondents indicated premenstrual enhancement of erotic feelings.

Stopes (1931) interviewed wives separated from

husbands through professional duties. These women were asked to report on "longing for intercourse" in husbands' absence. The interviews that Stopes (1931) conducted suggested a peak of sexual arousal just prior to menstruation, and an additional increase around midcycle.

By contrast, other studies have indicated a postmenstrual rise in female sexual interest. Hamilton (1929), who structured his questionnaire according to Davis' (1929) format, stated that 31% of his 100 married subjects, all under the age of 40, reported sexual desire to be greatest after the menstrual period. Terman (1938) studied 792 married volunteers recruited from organizational or church activites, also using Davis' (1929) methodology Subjects averaged 35 years of age. Retrospective records of unspecified time periods were gathered over sex months. The results supported a peak of erotic interest just after menstruation.

James (1971) collected data on the frequency of coitus by advertising for couples who had kept records on their sex life. Fourteen couples volunteered sex calendars which ranged in duration from 3 months to 20 years, with a median of more than 5 years. James (1971) did not include women in the following categories: separated from husbands, engaged in extra-marital intercourse, using oral contraceptives or rhythm-type

contraception, or concentrating intercourse around midcycle for the purpose of conception. Variation in the length of the menstrual cycle was treated by pooling cycles of the same duration and analyzing cycles of a given length together. In order to account for menstrual inhibitions, data analysis did not include any dates on which menstruation had occurred, regardless of whether intercourse had taken place. The results indicated a clear elevation on coital rates just after the menstrual period. The author suggests that the increased incidence of intercourse postmenstrually may be due to the influence of the male because of the preceding period of abstinence.

Retrospective studies have also suggested that female sexual interest may peak in both the postmenstrual and premenstrual intervals of the cycle. Hart (1960) asked 117 British married women, ranging from 19 to 49 years, during which part of the cycle they most felt like having intercourse. She reported that 22% felt the greatest sexual drive just before menstruation, 22% just after, 8% just before and after, and only 6% at midcycle. Thirty four percent of these contraceptive clinic patients noticed no change in libido. In the same study group, 47% considered "the safe period" to be associated with menstruation, 43% had no knowledge of it, and 10% placed it at midcycle. Hart (1960) concluded that such knowledge

had no influence on sexual drive.

Fisher (1973) paid $50 to each of 290 married university students, averaging 25 years of age, for participation in his research. Fifty to sixty-seven percent of the respondents were taking contraceptive medication. Questionnaires asking when the greatest amount of sexual responsiveness occurred were presented to subjects at five different times during their menstrual cycles. The investigator reported a definite trend to designate both the week before and the week after menstruation as the greatest points of erotic interest. However, Fisher (1973) neglected to compile separate data for pill users and nonpill users. Material from the entire sample was analyzed together--a questionable method since it remains controversial as to whether libidinal feelings are affected by ingestion of oral contraceptives (James, 1971; O'Connor, Shelley & Stern, 1974).

Finally, Griffith and Walker (1975), attempting to circumvent problems with retrospective data, conducted the following study. They exposed 60 university undergraduates to slides of explicitly erotic and/or pornographic stimuli and required subjects to rate the degree to which they were sexually aroused while viewing these slides. Participants were also to recall their menstrual cycle phase. The authors failed to find significant menstrual cycle effects

on slide ratings and hypothesize that such an effect may possibly have been obscured because women may not be able to report precisely on menstrual cycle phase without a self-monitoring procedure.

Other investigators have commented that retrospective studies tend to be unreliable (James, 1971; McCance, Luff & Widdowson, 1937; Persky, Charney, Lief, O'Brien, Miller & Strauss, 1978). The major problem associated with this procedure seems to be that the accuracy of retrospective reports is likely to be affected by what subjects are being asked to recall and over what time period. A comparison made by McCance, Luff and Widdowson (1937) between retrospective questionnaires and subsequent daily recordings of the same menstrual phenomena over the time period of a year shows no relationship between the two variables. This casts considerable doubt upon the value of retrospective reports.

Daily records on sexual behavior provide a third source of data for menstrual cycle research. One well known study of this type found a postmenstrual peak in female sexual responsiveness. In 1937, McCance, Luff and Widdowson analyzed the intercourse rates and sexual feelings of a group of 167 college-educated women. Subjects contributed daily entries in special individual diaries provided by the investigators. Data were

collected over 4 to 6 months and represent 780 complete menstrual cycles. For statistical purposes, cycles were standardized to 28 days. Ovulation was assumed to occupy the central position in the cycle, i.e., 14 days before the next menstrual period. This model does not now seem ideal because it has been demonstrated that the preovulatory phase of the cycle is more variable in duration than the postovulatory phase (James, 1971; Presser, 1974). Results showed that 61% of the subjects reported some pattern in sexual interest during the menstrual cycle. Among those who recognized a pattern, the major point of heightened desire and increased coital rates occurred around the 8th day following menstruation. The authors concluded that the postmenstrual peak may be due to the effect of abstinence on the part of the husband.

More recently, Spitz, Gold and Adams (1975) assessed 24 unmarried students of whom 13 were taking oral contraceptives and 11 were using other methods. Subjects ranged in age from 18 to 24 years and each was actively engaged in an ongoing heterosexual relationship. Participants submitted daily questionnaires which recorded sexual arousal, caressing, intercourse and the initiator of each experience, i.e., mutual, self or partner. Completed data represent 2 to 3 menstrual cycles per subject. Cycles of different lengths were pooled and

analyzed together. For each given cycle length, ovulation time was estimated by information collected by James (1972) on conception dates associated with basal temperature rise.

Results showed that both pill and nonpill subjects had the greatest frequency of male and mutually initiated intercourse during the postmenstrual interval. The number of female initiated experiences was too small to detect significant changes throughout the cycle. There was no evidence of systematic cyclic variations for the measure of caressing. Self-reports of sexual arousal also showed no fluctuations over the cycle but seemed to be highly correlated on a given day with the type of sexual encounter. The researchers concluded that since both pill and nonpill users showed similar patterns of sexual interest, hormonal effects played a minimal role in the results of their study. They propose that human sexual behavior is primarily influenced by learning and social factors and suggest that postmenstrual enhancement of coital frequency may be the effect of abstinence on the part of both partners since both male initiated and mutually initiated intercourse exhibited the postmenstrual peak.

Evidence for increased sexuality in the premenstrual phase has been presented by Kinsey, Pomeroy, Martin and Gebhard (1953). As part of their encyclopedic survey of female sexual behavior, the authors studied 32 middle-

-class, college educated women, none of whom were talking contraceptive drugs. Participants submitted daily calendars of durations ranging from 1 month to 5 years. Records contained entries on erotic responsiveness, orgasm, and variations in the quantity of vaginal mucous secretions, which Kinsey et al. (1953) regarded as one of the best indicators of sexual arousal.

The data showed that the time of maximum mucous secretion and the time of maximal erotic responsiveness are almost always the same. About 59% of the sample noticed a monthly fluctuation in vaginal secretions during sexual arousal. The majority of subjects who recognized such a fluctuation reported increases in secretions and in sexual desire that coincided with the premenstrual phase of the cycle, when both estrogen and progesterone are markedly reduced. The investigators also found that 80% of their female population preferred sexual activity at this time and noted that orgasm occurred more frequently and precipitously during this period than at other intervals of the months. Kinsey et al. (1953) proposed that the human female, through evolution, has become subject to lesser hormonal control over sexual responsivity and has "developed new characteristics which have relocated the period of maximum sexual arousal near the time of menstruation" (p. 608).

Several other studies using daily records have found that elevations in female sexual interest occur near the time of ovulation. Udry and Morris (1968) presented material derived from 40 married, non-white women from North Carolina. Approximately 60 percent of them had not graduated from high school and were employed in low status jobs. None were taking contraceptive medication. Each woman was paid 50 cents per day for participation in the research which included filling out a report slip containing yes or no responses to queries on coitus, orgasm and menstruation during the previous 24 hours. The slips were collected daily and represent 93 to 115 cycles (2 to 4 cycles per participant).

In order to estimate ovulation, the data were organized by using reverse cycle days as reference points. This was accomplished by simply counting backwards from the first day of menstruation and was based on earlier indications that the postovulatory phase of the cycle is less variable than the preovulatory phase (James, 1971; Presser, 1974). This method has the justification that ovulation is related physiologically to the next menstruation, not to the preceeding one. However, since the postovulatory phase itself is quite variable (James, 1971), this procedure for establishing the point of ovulation may not be entirely valid. The authors found

that the highest rates of intercourse and orgasm (42%) occurred at about the same time as ovulation, reverse cycle days 14 and 16, with a sharp drop in the luteal phase, reverse cycle days 18 to 25, and another rise (35%) in sexual activity occurred premenstrually. Udry and Morris (1968) concluded that the high estrogen concentration at midcycle increases the probability of human sexual activity.

In a second investigation (1970), Udry and Morris conducted a double-blind placebo study of 51 women followed over 3 menstrual cycles. Subjects were primarily white, married, and ranged in age from 18 to 35 years. Prior to the study, none had been taking oral contraceptives but had been using other methods of birth control. Daily records were submitted reporting on menstruation, coitus, orgasm, general feeling state, and whether the husband had sought intercourse. Participants were also asked to record the mileage they had clocked on a pedometer.

During the second and third cycles of the study, the women were randomly divided into 2 groups: one group was given contraceptive drugs and the other took lactose placebos. Subjects were cautioned to continue their usual method of contraception for neither they nor the investigators knew whether the medication they were taking could protect them from pregnancy.

Data were standardized to 28 day cycles and yielded 3 bursts of pedometer activity - one premenstrually, one postmenstrually, and one coincident with ovulation. The authors interpreted the points of increased physical activity as peaks of heightened sexual desire. This interpretation is supported by findings with lower animals presented by McCance, Luff and Widdowson (1937). Differences in sexual activity during the luteal phase of the cycle, days 18 to 25, were noted between women on oral contraceptives compared to women who were not. Rates of intercourse and orgasm increased during the luteal phase for women taking contraceptive pills. Women on placebos reported peak rates at midcycle and depression in sexual activity during the luteal phase. Since there were no data indicating that general feeling state and overall activity level were changed by the pill, Udry and Morris (1970) proposed that the differences observed may be due to the presence or absence of progesterone in the second half of the menstrual cycle. They speculated that the presence of progesterone in natural cycles affects the male so that he does not desire coitus frequently during the luteal phase, and that the absence of progesterone during pill cycles (because ovulation has been suppressed) abolishes whatever restraint progesterone had on the male. It was suggested that the influence on the male may operate

via a pheromone-like effect, parallel to observations made in subhuman primates (Michael et al., 1972).

Adams, Gold and Burt (1977) tested the hypothesis that an ovulatory peak (Beach, 1975, 1976; Spitz, Gold & Adams, 1975) may be found by examining behavioral measures which are determined primarily by female initiative. The sample consisted of 35 married women, aged 21 to 37. Twelve participants were taking contraceptive drugs and twenty--three were using other method of birth control. All had been carefully screened to eliminate individuals with medical or marital problems. Subjects filled out daily records on all aspects of female and male initiated sexual experience. Information was also contributed concerning the presence or absence of mittelschmerz, defined as ovarian pain felt at the time of ovulation. Questionnaires were collected weekly and comprise 171 cycles, each of which was normalized to 28 days. Reports of mittelschmerz were used to estimate ovulation time.

Female and male initiated sexual activities were calculated separately, with female initiated activities being divided into 2 categories: heterosexual and autosexual. The first measure encompassed intercourse and caressing sessions while the second included masturbation, fantasies and sexual arousal emanating from fantasies, dreams, or other erotic stimuli.

Results of the study generally supported the hypothesis. Women who did not use contraceptive agents showed a significant rise in female initiated sexual behavior around the time of ovulation. Women using oral contraceptives did not show such a rise; in fact, their female initiated activity was unexpectedly low. Adams et al. (1977) interpreted these findings in terms of hormonal mediation of sexual behavior. It was suggested that ovulation-associated female initiation appears to result from an increased level of ovarian steroids in natural cycles. In pill cycles, this effect is suppressed because contraceptive drugs alter the normal fluctuation of the various hormones associated with ovulation. Male initiated heterosexual activity did not peak at ovulation nor was it clarified whether this measure increased at other times during the cycle. The authors also found that female initiated heterosexual activity showed a strong postmenstrual and, to a lesser degree, a premenstrual elevation among all subjects.

Lastly, Wineman (1967) demonstrated that women do not experience significant changes in sexual interest during the course of the menstrual cycle. She evaluated 5 unmarried volunteers, averaging 26 years of age. None were using oral contraceptives. Subjects contributed daily reports on sexual responsiveness and activity. Data were

collected 5 days a week throughout the respondents' menstrual cycles with a 3 day overlap into their next cycle. Wineman (1967) found that sexual behavior frequencies and responsiveness ratings did not differ significantly over the cycle. However, these results are somewhat inconclusive because of the small sample size. It was also not clarified whether the subjects had access to regular sex partners.

To summarize, the evidence relating to libidinal fluctuations during the menstrual cycle is inconsistent. While there appears to be a link between sexual interest and hormonal levels, the relation remains unclear. Some reports indicate that the time of greatest female sexual desire occurs around ovulation, when estrogen levels are elevated, with interest decreasing during the luteal phase. Other investigators find that most women do not experiences significant erotic fluctuations during the cycle, and still others contend that a period of maximal desire exists just prior to or just following menstruation, a time coincident with reductions in both estrogen and progesterone secretions.

Many of the discrepancies in findings may be due to differences in both study design and procedures used. Data have usually come from retrospective studies in spite of evidence that records of this type may bear little correspondence to reports to immediate past behavior. The

typical information gathered has largely been restricted to questions concerning coitus, orgasm and sexual feelings although it has been demonstrated that there are other important indicators of female erotic desire such as masturbation (Kinsey et al., 1953; Masters & Johnson, 1970).

It may also be noted that minimal attempts have been made to date to determine empirically the timing and occurrence of ovulation for the individual subject. Although several studies have speculated on ovulation time in various ways, none have utilized the tests available for specifying the point of ovulation within a cycle. Moreover, it has been most often assumed that ovulation has occurred in the cycles studied. No efforts have been made to verify this assumption despite copious evidence that menstrual cycles which are quite normal in character, amount and rhythm may at times occur without the accompaniment of ovulation (Gombel & Silverberg, 1977; Novak & Woodruff, 1974; Wong, Engle and Buxton, 1950).

The basal body temperature (BBT) chart is the most widely used tool for determining ovulation (Vollman, 1977). The BBT is based on the thermogenic properties of progesterone and in a healthy, adult woman, describes a biphasic curve between two menstruations. The temperature runs at a low level during the premenstrual phase and at an elevated level during the premenstrual phase. The two

phases are joined together by an interval of ascending temperature which is believed to coincide with ovulation time (Moghissi, 1976). By contrast, some BBT charts do not show a premenstrual rise in temperature. These are called monophasic BBT curves and have been associated with anovulatory cycles (Johansson, Larsson-Cohn & Gemzell, 1972; Vollman, 1977).

It is beyond the scope of this paper to detail the biological criteria of anovulation. Briefly, it appears that normal ovarian function is somehow altered in an anovulatory cycle by the absence of or by defective corpus luteum formation, which is essential for the maintenance of physiological states characteristic of progesterone (Gombel & Silverberg, 1977; Hoffman, 1973; Jones, 1973; Novak & Woodruff, 1974). Specialists in the field have proposed that the anovular mechanism is indicative of a disturbed endocrine balance of pituitary origin (Novak & Woodruff, 1974; Wong, Engle & Buxton, 1950). This suggests that the differential diagnosis of ovulatory and anovulatory women during any cycle might be important in testing the hypothesis that changes in sexual arousability and sexual activity are linked to hormonal changes associated with the menstrual cycle.

The present study was undertaken to obviate many of the previous problems described by including additional

measures that have not been used before, by applying an empirical criterion to determine the time and occurrence of ovulation, and by using daily reports rather than retrospective data covering lengthly time periods.

Method

Recruitment of subjects

The menstrual cycle data were obtained from a group of white, adult, Canadian volunteers. Most of the participants were referred by gynecologists who were informed about the research. Seven subjects were recruited from a women's study group. All women who indicated an interest in participating in the project attended individual screening interviews. Each acceptor was then informed that the purpose of the project was to investigate patterns of sexual activity over a three month period. This explanation was an attempt to at least partially disguise the specific variable under study. The kinds of observations requested, and the precision and punctuality with which they were to be reported was explained in detail. The potential candidate was asked to provide information about her family, her background, medical and reproductive history. Only those who met the following requirements were selected for participation in the project: either married or engaged in a stable heterosexual relationship for a period of no less than six months; not using contraceptive pills, and not having marital, psychiatric or medical (especially gynecologic) problems that might affect sexual activity or menstrual cyclicity. The complete confidentiality of the participants' data was ensured by assigning an

anonymous code to each subject.

Characteristics of the sample

Of the thirty-seven women originally recruited, six dropped out because they had changed their minds about participating or because their husbands had objected to the method of investigation. Six others who displayed irregularities in their data contributions were deleted from the analysis.

The final group consisted of 25 healthy, regularly menstruating women. The ages of the respondents ranged from 20 to 40 with a mean age of 30.5 years. Thus the ages were well distributed throughout the reproductive period when menstrual cycles are least variable in length (Presser, 1974). Twenty-two of the women were married (mean 9.9 years, range 8 months to 20 years). The three unmarried subjects were engaged in an active stable sexual relationship of approximately one year's duration. Two of them had been previously married and divorced. Nineteen of the participants had borne children, averaging 2.2 each. All participants had graduated from high school and 75% had completed university. Their husbands or partners had comparable educational backgrounds. Modes of contraception included interuterine devices used by ten subjects, diaphragms used by three, and foam and/or male prophylactics used by seven. Four participants had

received tubal ligations at least a year or more before commencement of the study, and the husband of one subject had a vasectomy.

The subjects in the present study are not representative of the general population. Sample biases are apparent in the distribution of marital status (88 percent of the sample were married) and in the percentage of Jewish women in the group (76 percent). The subject pool also favored women drawn from the well-educated middle class. Fisher (1973) has recently shown that both the variables of education and social class have a high positive correlation with sexual responsivity. Finally, the women in the sample were distinguished by their interest in sexuality, their commitment of a substantial amount of time to the study and their willingness to record their sexual activities in detail.

Procedure and materials

A questionnaire (Appendix A) designed to illicit various aspects of sexual experience on a daily basis was used in this study. An abbreviated checklist version of the questionnaire (Appendix B) was also devised in order to facilitate subjects' recordkeeping. All participants were given a questionnaire form and a booklet of checklist sheets for entry of the following observations: heterosexual activity (including intercourse and lovemaking

sessions which did not involve intercourse); masturbation; sexual thoughts and fantasies; level of sexual desire; orgasm; the initiator of each heterosexual session (mutual, self or partner); the onset of all days of menstruation; the cycle day (the first day of menstruation is, by convention, designated day 1 of the menstrual cycle); and indicators of ovulation such as intermenstrual pain, intermenstrual bleeding, or cervical mucorrhea. Each subject was also asked to record her basal body temperature throughout the study, using a Becton-Dickinson certified basal thermometer. All women were carefully instructed on the procedure of taking and recording their temperature. The temperatures were taken orally for at least five minutes (by the clock) in the morning, immediately after awakening and before rising. It was recommended that participants fill out the questionnaire sheets while the thermometers were registering. A temperature curve for each cycle contributed was graphed later, in duplicate, from these readings. A complete set of temperature graphs was then presented to each of two gynecologists, neither of whom knew about the involvement of the other. Each physician was asked to independently identify ovulatory from anovulatory cycles, and to specify the point of ovulation within each ovulatory cycle. The occurrence of ovulation was diagnosed by a drop in basal body temperature followed

by a sustained thermal rise which was at least 0.5 degrees higher than the temperatures recorded in the earlier part of the cycle (Cohen, 1966; Haller, 1972; Van de Velde, 1947). Cycles that met this criterion according to the judgment of both gynecologists were regarded as ovulatory; cycles not meeting this criterion according to both raters were defined as anovulatory.

Participants were given stamped, addressed envelopes with instructions to mail the questionnaires daily to the investigator. Weekly telephone follow-up of all subjects was carried out in order to maintain interest in reporting as well as to make sure forms were being completed correctly and mailed back on a regular basis.

Length and variability of the menstrual cycle sample

The 25 participants completed data for 87 menstrual cycles. Five subjects supplied information on 2 cycles; nine contributed 3 cycles; seven 4 cycles; three 5 cycles; one contributed forms for 7 cycles. There were a few days when information from these women was missing. The average number of consecutive cycles completed per participant was 3.5. Cycle lengths ranged from 17 to 35 days. The most frequent length was 28 days with a mean of 27.2 days. There was great variability in cycle lengths within each subject. Individual subjects had cycle lengths that varied by up to 7 days. Almost all women with data

from at least 3 cycles had a minimum cycle length variation of 2 days. Similar data concerning the length and variability of the menstrual cycle have been presented by Adams, Gold and Burt (1978), Chiazze, Brayer, Macisco, Parker and Duffy (1968), and Vollman (1977). The length of the menstrual period ranged from 4 to 8 days with an average duration of 5.3 days. The patterns of menstruation seemed to show lesser temporal variability than cycle lengths. Some individuals were found to have characteristically short and others characteristically long periods. Parallel observations have been reported by McCance, Luff and Widdowson (1937).

Most participants began recording on the first day of a cycle and continued until the last day of a later cycle. A few women began recording after their cycle had begun. However, this data was discarded and only information contributed from the onset of the next menstrual cycle was included in the present analysis.

A final telephone interview at the end of each woman's participation was conducted to record subjects' reactions to the study and to thank subjects for their cooperation. At a later date, a brief summary of the study was mailed to all participants.

Results

The data from a study of this kind present a number of problems. Their interpretation is complicated by the variation in menstrual cycle lengths and by the different types of information yielded by the various measures of sexual interest. In order to deal with these difficulties, the sexuality measures were converted to standard (Z) scores so as to readily permit meaningful statistical comparison to each other (Ferguson, 1971). To cope with intersubject and intrasubject variations in cycle length, all menstrual cycles were normalized to 24 time categories. This was accomplished by converting each of the cycle days to a standard score and assigning them to 24 time categories with equidistant boundaries.

Statistical studies on the length of the human menstrual cycle indicate that cycle lengths of 24 to 33 days are most representative of regularly menstruating women in the reproductive years, i.e., 20 to 40 years of age (Haman, 1942). Thus, twenty four time categories were selected as the standardized menstrual cycle length and only cycles of 24 to 33 days were included in the analysis. Although the 24 time categories are actually statistical units, for the sake of convenience, they will be referred to frequently as "days". Each menstrual cycle standardized to 24 time categories was further divided

into six successive groups of four day time blocks each for purposes of analysis.

Ovulatory cycles were separated from anovulatory cycles according to the independent judgment of two experienced gynecologists. The division of cycles contributed to a reduction in sample size because the data of several subjects whose ovulatory status could not be agreed upon by both raters were deleted from the analysis.

The remainder of the data was further diminished by other factors. Firstly, there was a gradual loss of participants as the course of the study progressed. As a results of the attrition rate, there remained sufficient data to evaluate only three consecutive menstrual cycles. The first two cycles each represent contributions from 25 subjects and the third represents contributions from 13 women.

Secondly, for certain measures such as the incidence of masturbation and orgasm reached through masturbation, there were only a few participants reporting the behavior. Since the data on these two measures are based on a small N, the findings should be considered as tentative.

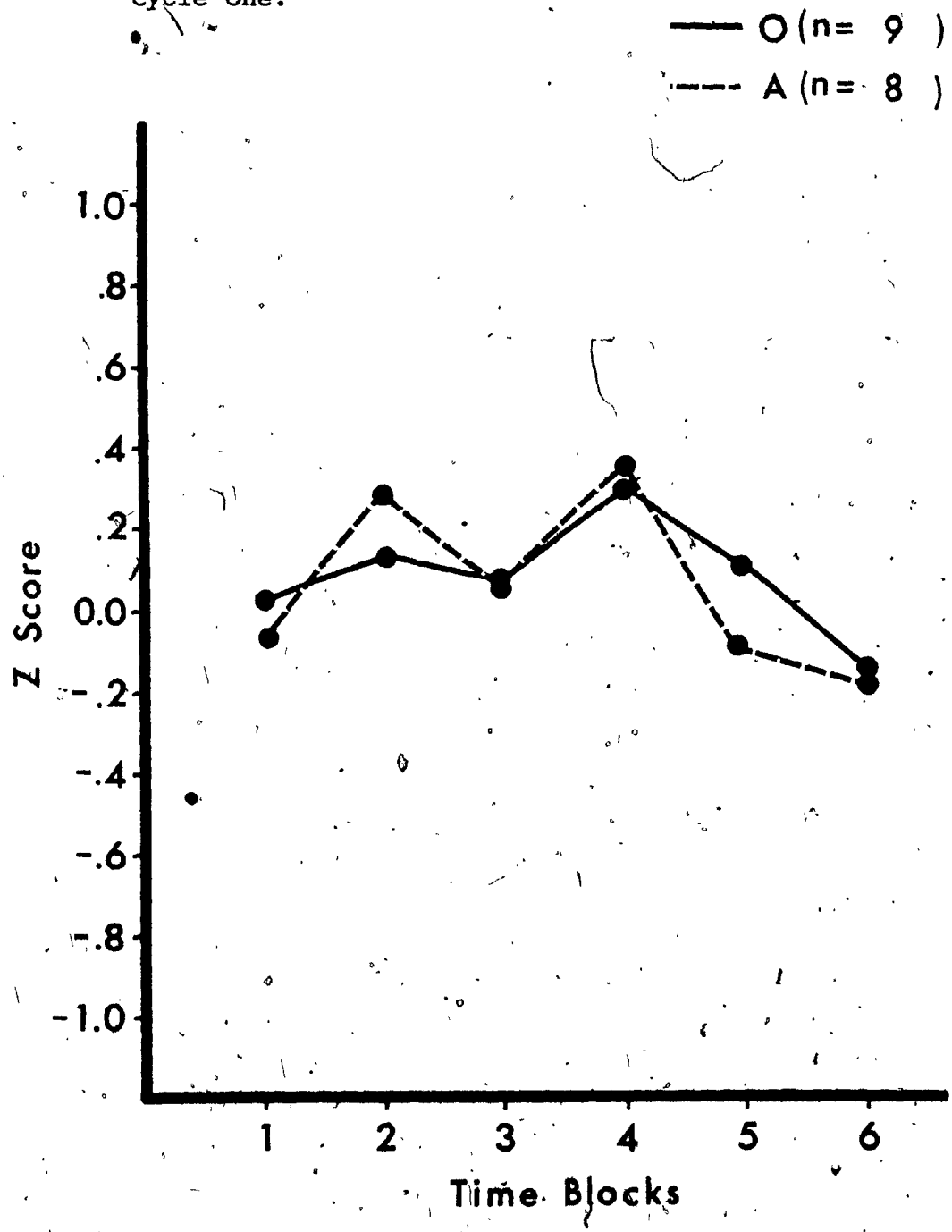
Finally, confining the conversion of menstrual cycles to normalized cycles of 24 day lengths required the elimination of eleven cycles - six below 24 days in duration and five above 33 days in length.

The data were analyzed using a Group (ovulatory versus anovulatory) x Block analysis of variance, repeated measures design (Winer, 1971). A separate analysis was conducted for each of the six measures of female sexual interest for each of three consecutive cycles. Post hoc comparisons between time Blocks were made using Scheffé's multiple comparison tests (Kirk, 1968) on each analysis of variance that yielded a significant Block effect to determine which phase or phases of the menstrual cycle accounted for the significant main effect.

Cycle one

The first cycle examined presents data contributed by 25 women. According to the judgment of both gynecologists, nine respondents (36%) ovulated and eight (32%) did not. There was lack of agreement between the raters on the ovulatory status of 8 subjects (32%). Among the women who met the ovulatory criterion, the BBT records indicated that ovulation most frequently occurred (six cycles out of nine) in time Block 4. The analyses of variance, summarized in Appendix C, Tables 1 and 2, revealed no differences between ovulatory and anovulatory groups in overall effects across cycle one. The major significant effect noted was due to time Blocks. A Block effect was found for number of sexual thoughts and fantasies, $F(5,75)=3.20$, $p<.01$, which is plotted in Figure 1. Peak

Figure 1: Mean number of sexual thoughts and fantasies in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle one.



periods for this measure appear to occur at time Block 2, which corresponds to the postmenstrual phase and at time Block 4 which, for the majority of subjects, represented the ovulation phase. Scheffé's tests confirmed that the incidence of sexual thoughts and fantasies was higher at Blocks 2 and 4 than at any other time of the cycle, $F(5,75)=12.09$, $p<.05$. Another Block effect was found for the measure of frequency of heterosexual activity, $F(5,75)=2.30$, $p<.05$. This is shown in Figure 2 which suggests that heterosexual activity peaks at time Block 2. Scheffé's multiple comparisons revealed that the frequency of heterosexual activity was higher at Block 2 than at Blocks 1 and 3, $F(5,75)=9.58$, $.10>p>.05$. A Block effect was also found for number of orgasms during heterosexual activity, $F(5,75)=2.71$, $p<.02$, which is represented in Figure 3. The temporal pattern seems to correspond quite well with that of heterosexual activity, as might be expected. The Scheffé tests showed that the number of orgasms at Block 2 was significantly higher than at Blocks 1, 3 and 5, $F(5,75)=11.75$, $p<.05$.

A Group effect was found for the measure of masturbation, $F(1,5)=20.8$, $p<.006$, which is plotted in Figure 4. It appears that the anovulatory group engaged more frequently in this activity than did the ovulatory group. However, this was an infrequently reported

Figure 2: Mean frequency of heterosexual activity in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle one.

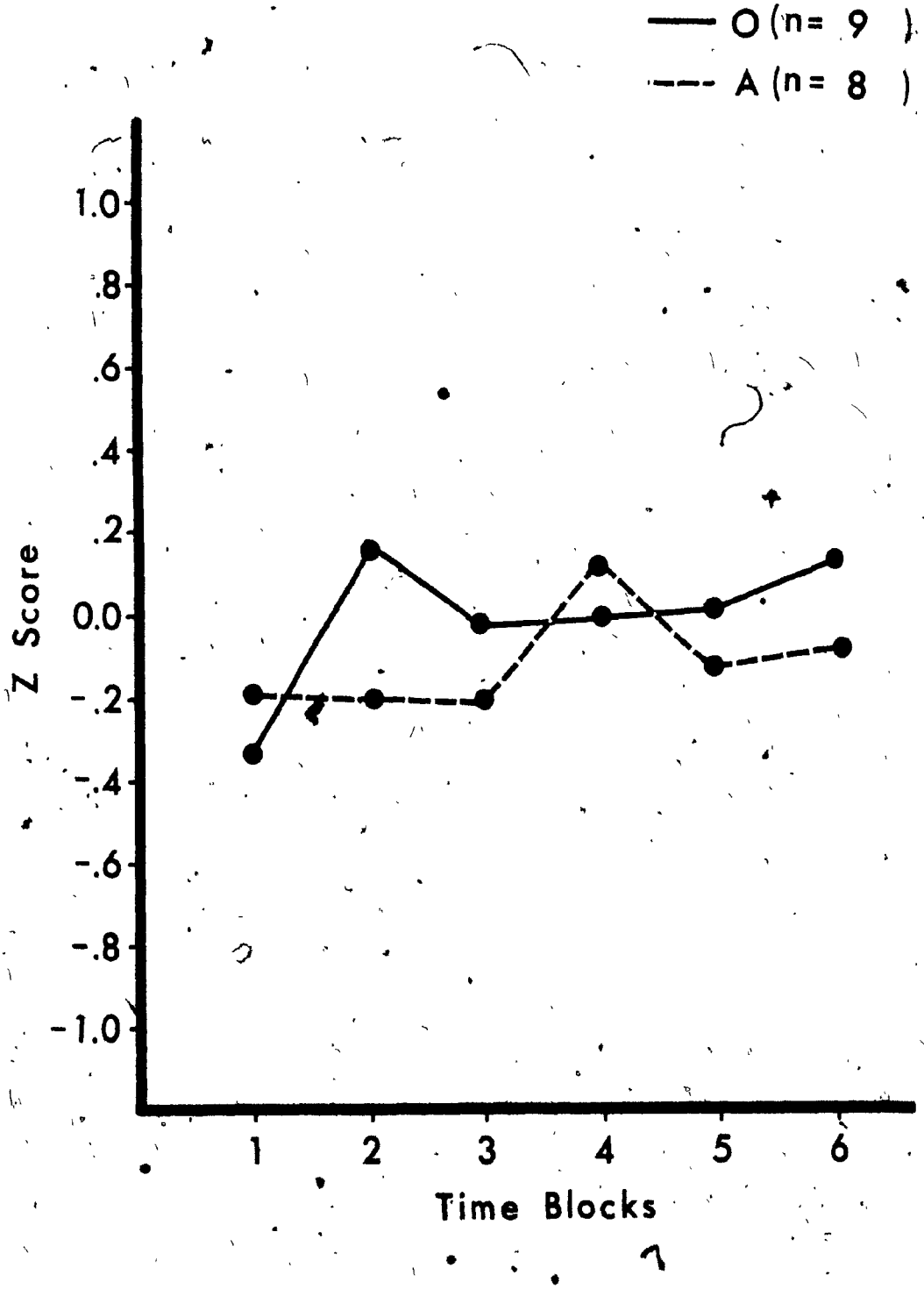


Figure 3: Mean number of orgasms reached during heterosexual activity in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle one.

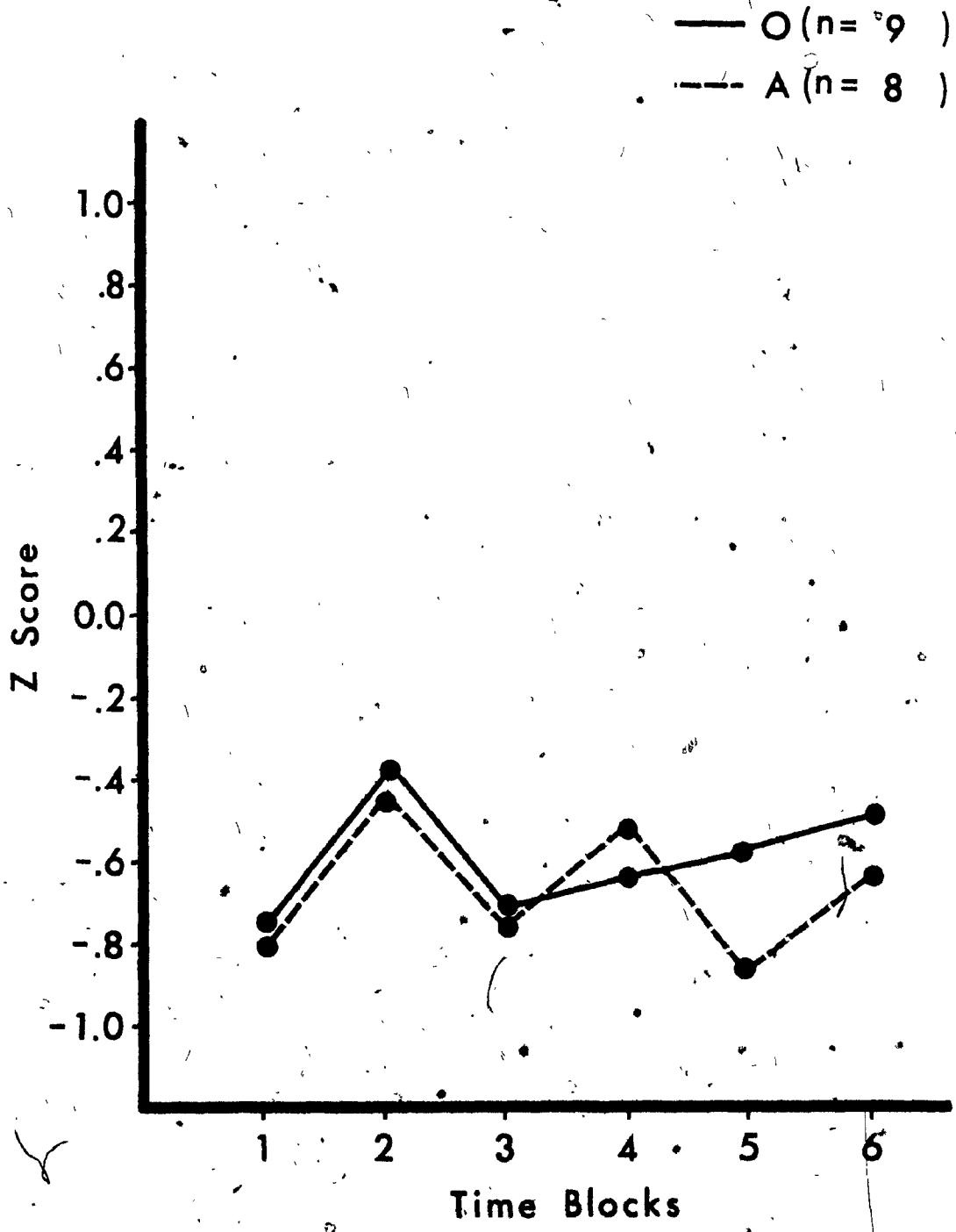
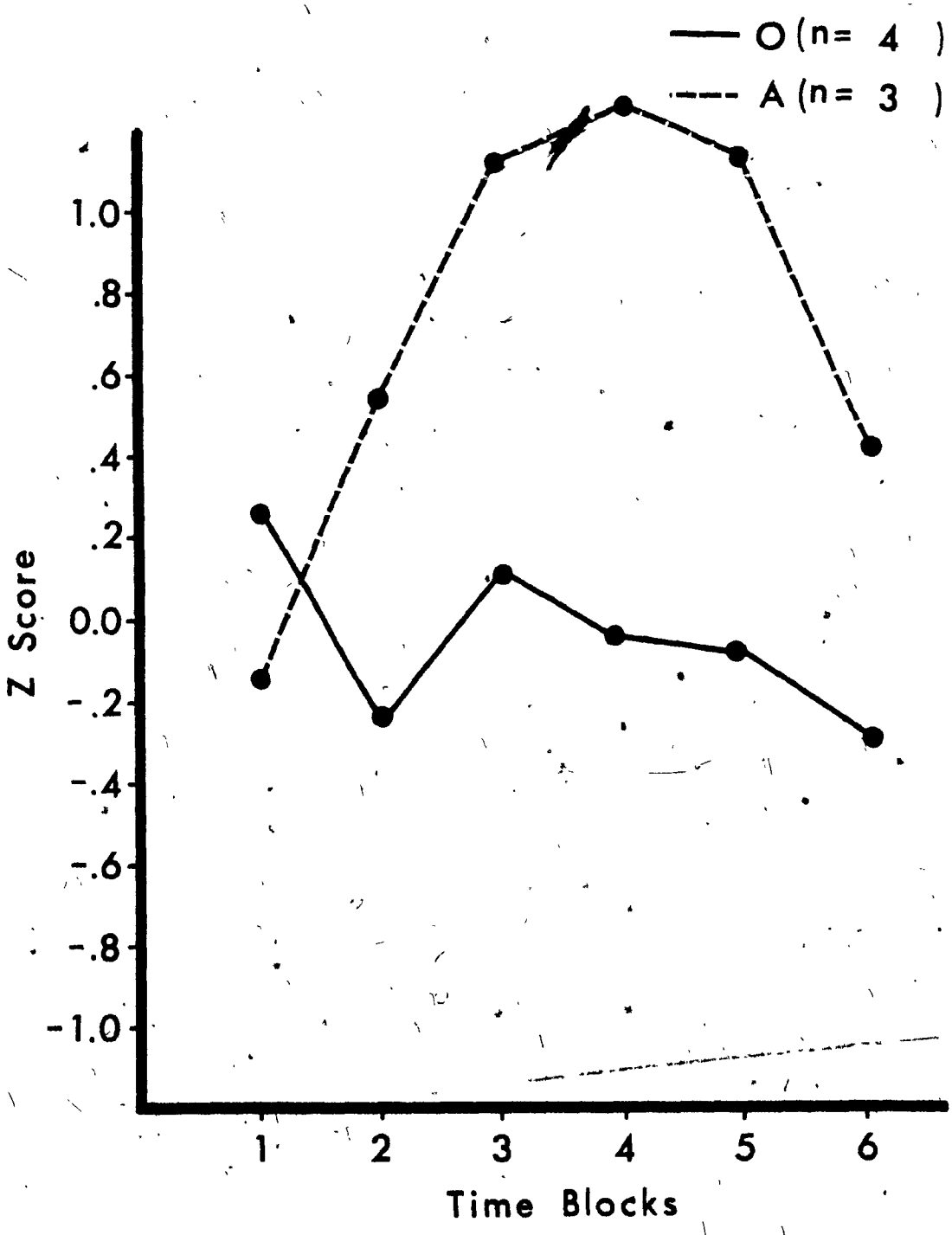


Figure 4: Mean frequency of masturbation in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle one.



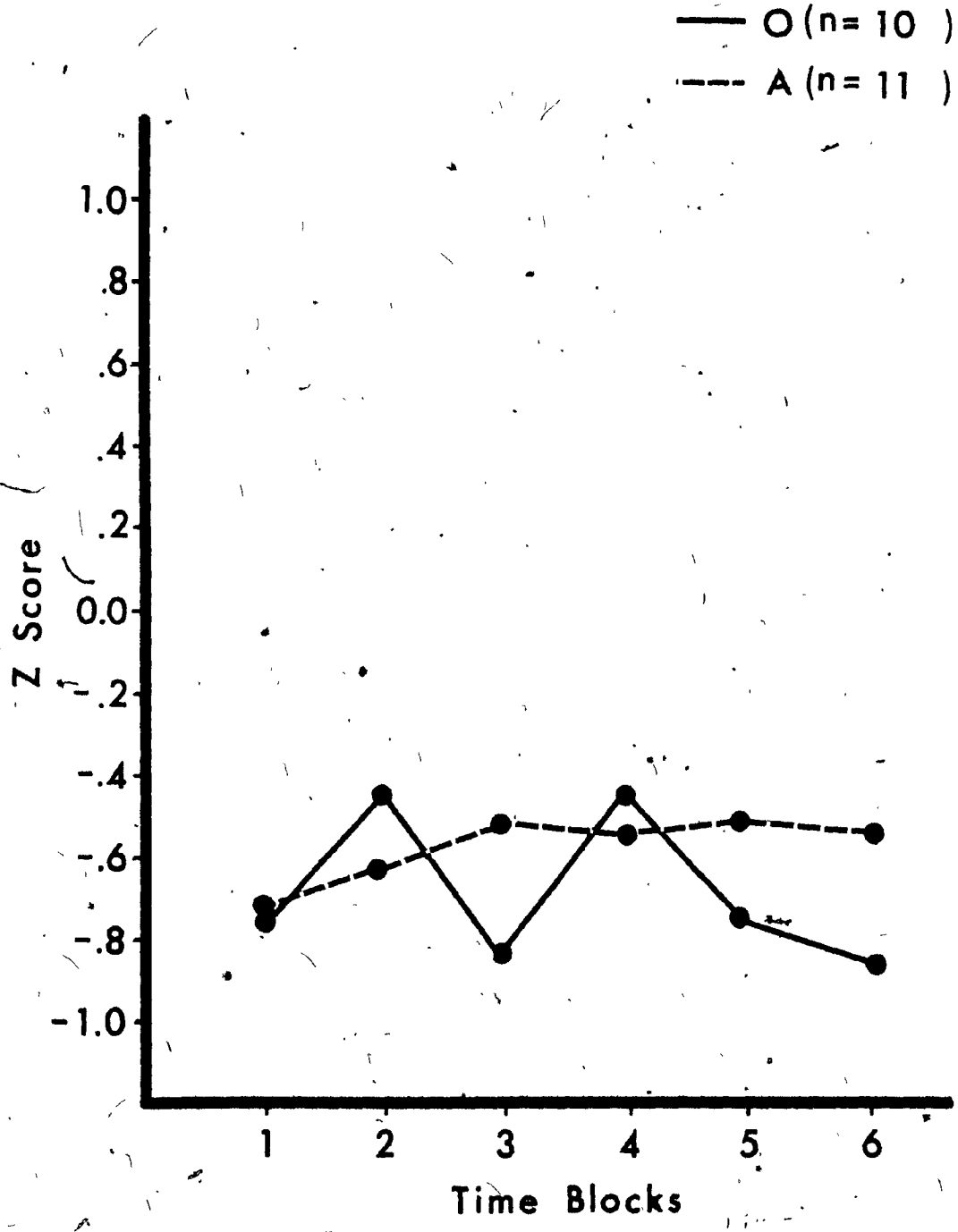
behavior representing data from only four subjects in the ovulatory group and three in the anovulatory group.

Cycle two

Twenty-five subjects furnished data for the second cycle. The judges agreed that ten subjects (40%) were ovulatory and that eleven (44%) were anovulatory. Thus, the rate of disagreement was lower (16%) than in cycle one, allowing data from more contributors to be analyzed. Among the ovulatory women, five (50%) provided BBT records which indicated that ovulation occurred in time period 4. Summary data of the two way analyses of variance are presented Appendix C, Table 3 and 4. There were again no differences between ovulating and non-ovulating women with respect to sexual responses and reactions. A significant Group x Block interaction was found for number of orgasms during heterosexual activity, $F(5,95)=2.57$, $p<.03$ (Figure 5). Elevated frequencies seem to occur in time Blocks 2 and 4 for the ovulatory group while the anovular subjects showed a less pronounced pattern of orgasmic frequency with slight elevations at time periods 3, 4 and 6. A Group x Block effect was not found for any other measure in any other cycle, suggesting that this interaction be interpreted cautiously.

A time Block effect was also found for number of orgasms during heterosexual activity, $F(5,95)=2.29$, $p<.05$.

Figure 5: Mean number of orgasms reached during heterosexual activity in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle two.



Scheffé's tests showed that the orgasm rate was elevated at Blocks 2 and 4, $F(5,95)=12.27$, $p<.05$. Level of sexual desire showed a significant time effect as well, $F(5,95)=2.37$, $p<.04$. This measure appears in Figure 6 and suggests that major elevations occurred in the time periods 2, 3 and 4. Scheffé's tests verified that these ratings were significantly higher than at other time Blocks in the cycle, $F(5,95)=11.76$, $p<.05$.

A Group effect was found for frequency of heterosexual activity, $F(1,19)=4.33$, $p<.05$. This measure is depicted in Figure 7 and indicates that the anovular women had more frequent heterosexual encounters than the ovulatory respondents.

Cycle three

Data in the third cycle was derived from a potential population of thirteen. The raters agreed that five (38%) of these women were ovulatory and five (38%) were anovulatory. There was lack of agreement between the gynecologists on the ovulatory status of 3 (28%) participants. Forty percent of the women who ovulated submitted BBT data indicating that ovulation occurred in time Block 4.

Summary data of the two way analyses of variance are presented in Appendix C, Tables 5 and 6. Group effects were found for the following three measures: orgasms

Figure 6: Mean level of sexual desire in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle two.

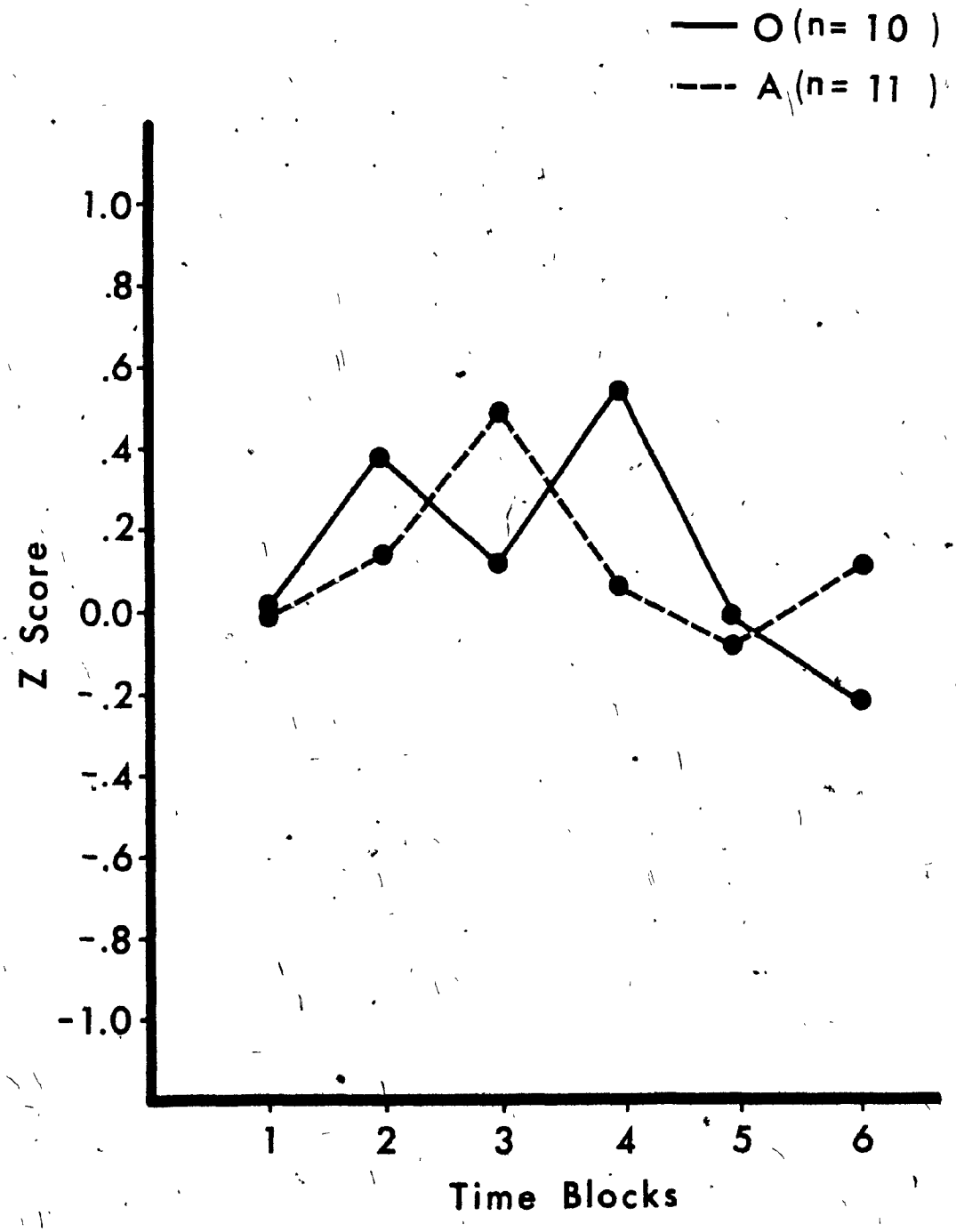
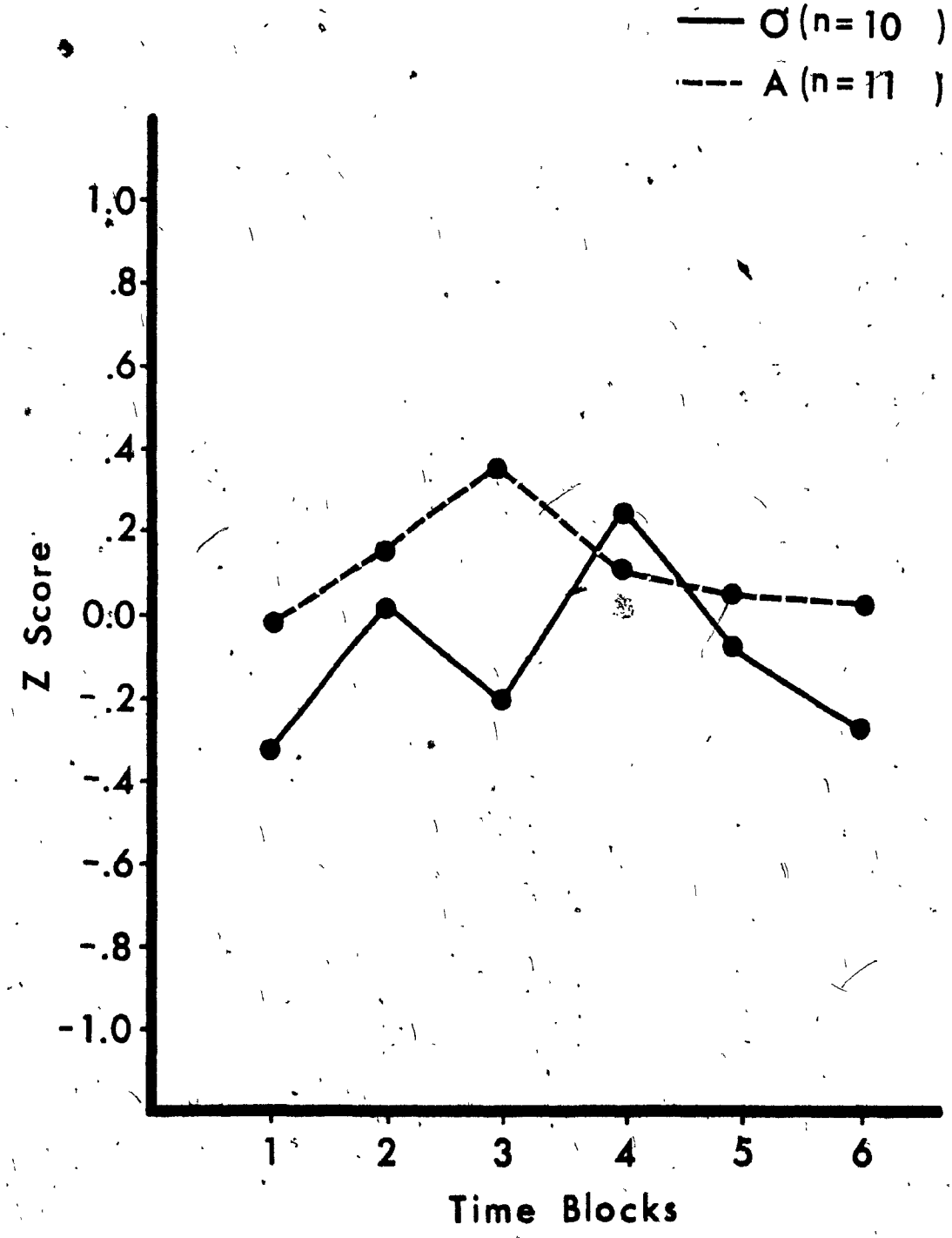


Figure 7: Mean frequency of heterosexual activity in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle two.



during heterosexual activity, $F(1,8)=14.01$, $p<.005$; masturbation, $F(1,5)=22.62$, $p<.005$; and orgasms reached through masturbation, $F(1,5)=11.92$, $p<.01$. These indices of female sexual interest are plotted in Figures 8, 9 and 10, respectively. In each case, the anovular respondents displayed a higher rate of activity. This finding strengthens the anovulatory Group effects reported in cycle one for the measure of masturbation and in cycle two for frequency of heterosexual activity. Further, the same tendency was reflected by other measures in cycle three which did not achieve an acceptable level of statistical significance. For example, a trend toward anovulatory Group effects was found for heterosexual activity, $F(1,8)=3.66$, $p<.09$ (Figure 11) and for level of sexual desire, $F(1,8)=3.16$, $p<.11$ (Figure 12).

There was a significant time Block effect found for level of sexual desire, $F(5,40)=2.80$, $p<.02$, as found in cycle two. Scheffé post hoc comparisons showed that time periods 2, 3, 4 and 5 were associated with greater elevations in level of sexual desire than Blocks 1 and 6, $F(5,40)=12.95$, $p<.05$. A Block effect was also found for the measure of masturbation, $F(5,25)=3.26$, $p<.02$. However, this behavior was reported by only four subjects in the ovulatory group and three in the anovulatory group. The Scheffé tests showed that the incidence of masturbation

Figure 8: Mean number of orgasms reached during heterosexual activity in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle three.

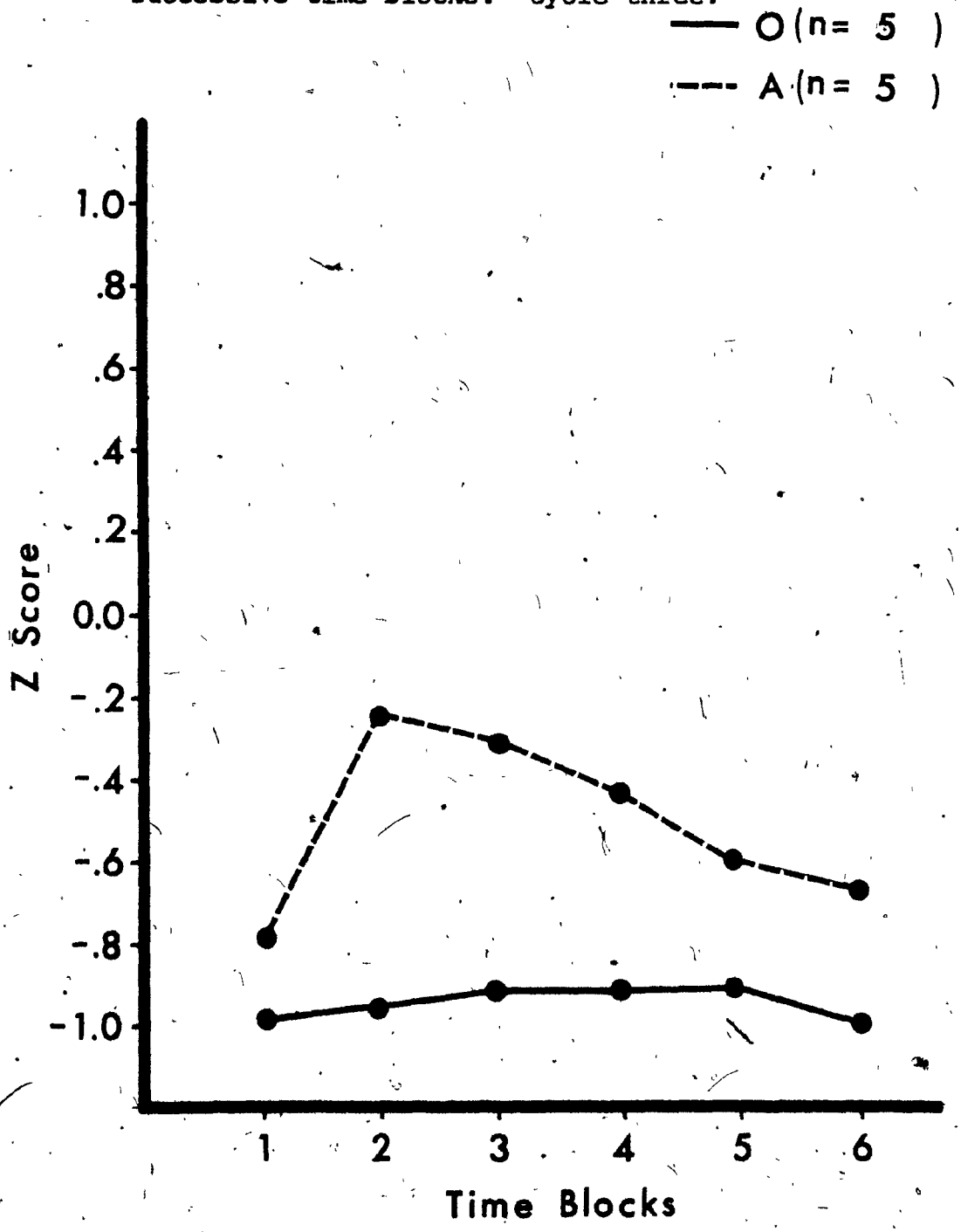


Figure 9: Mean frequency of masturbation in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle three.

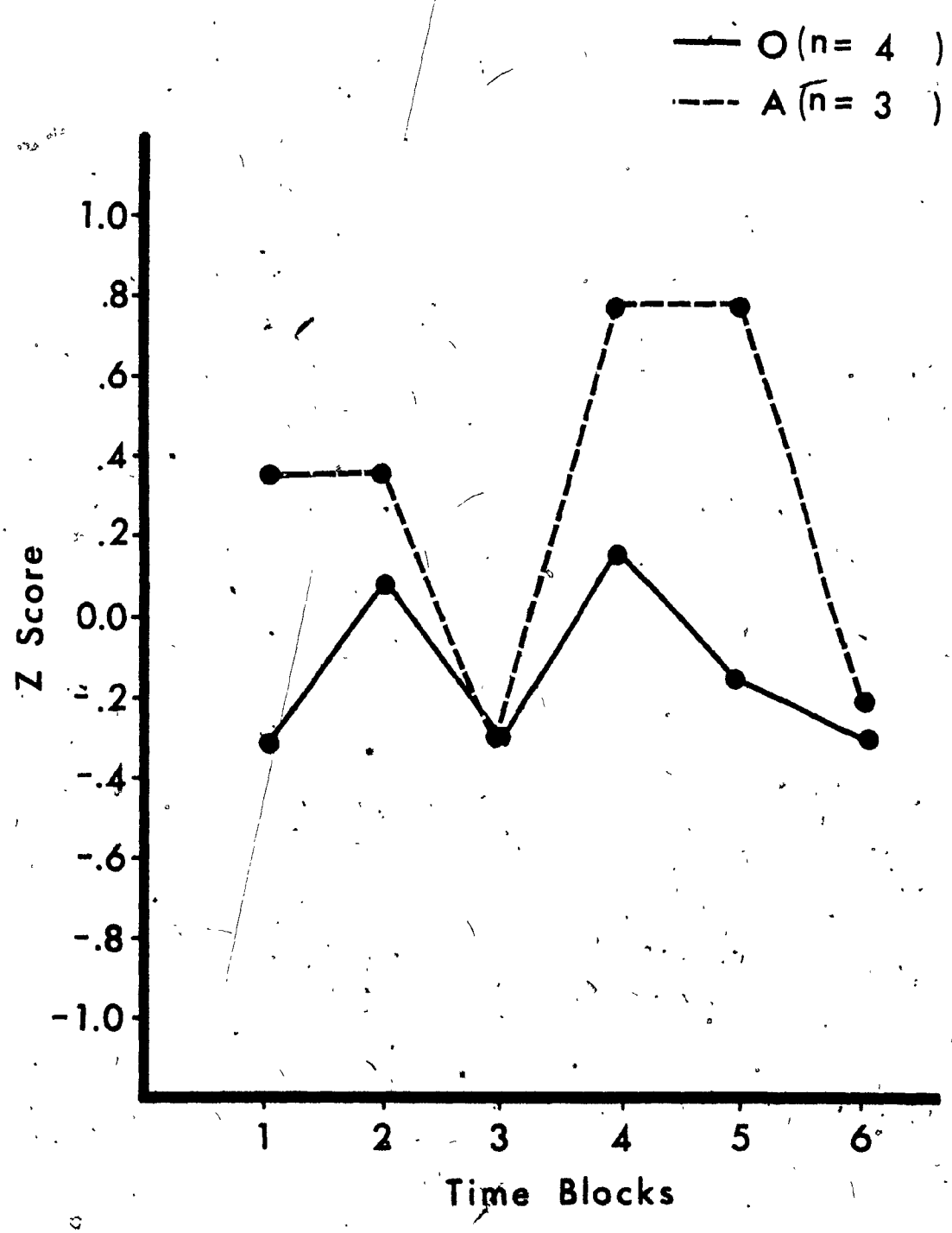


Figure 10: Mean number of orgasms reached during masturbation in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle three.

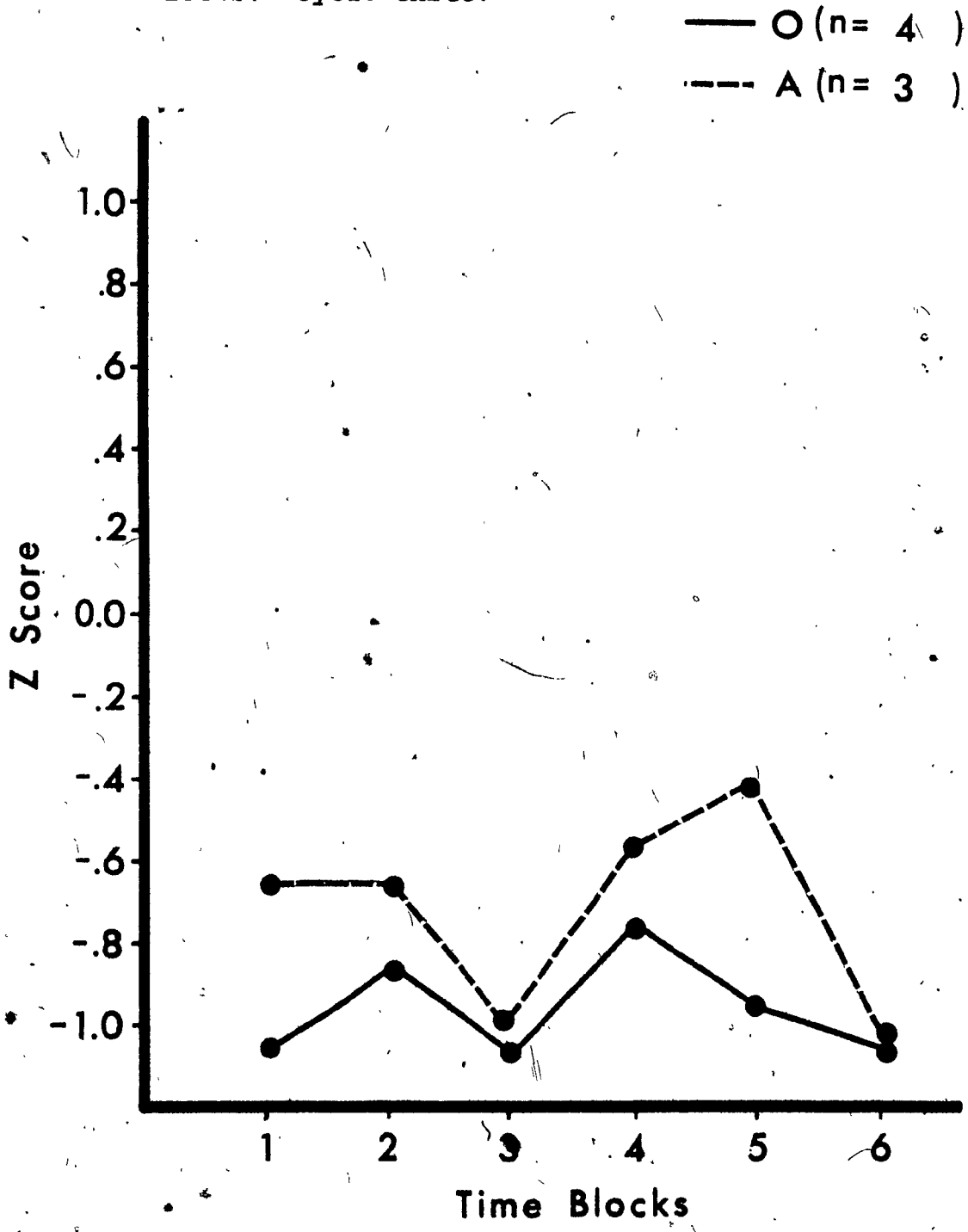


Figure 11: Mean frequency of heterosexual activity in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle three.

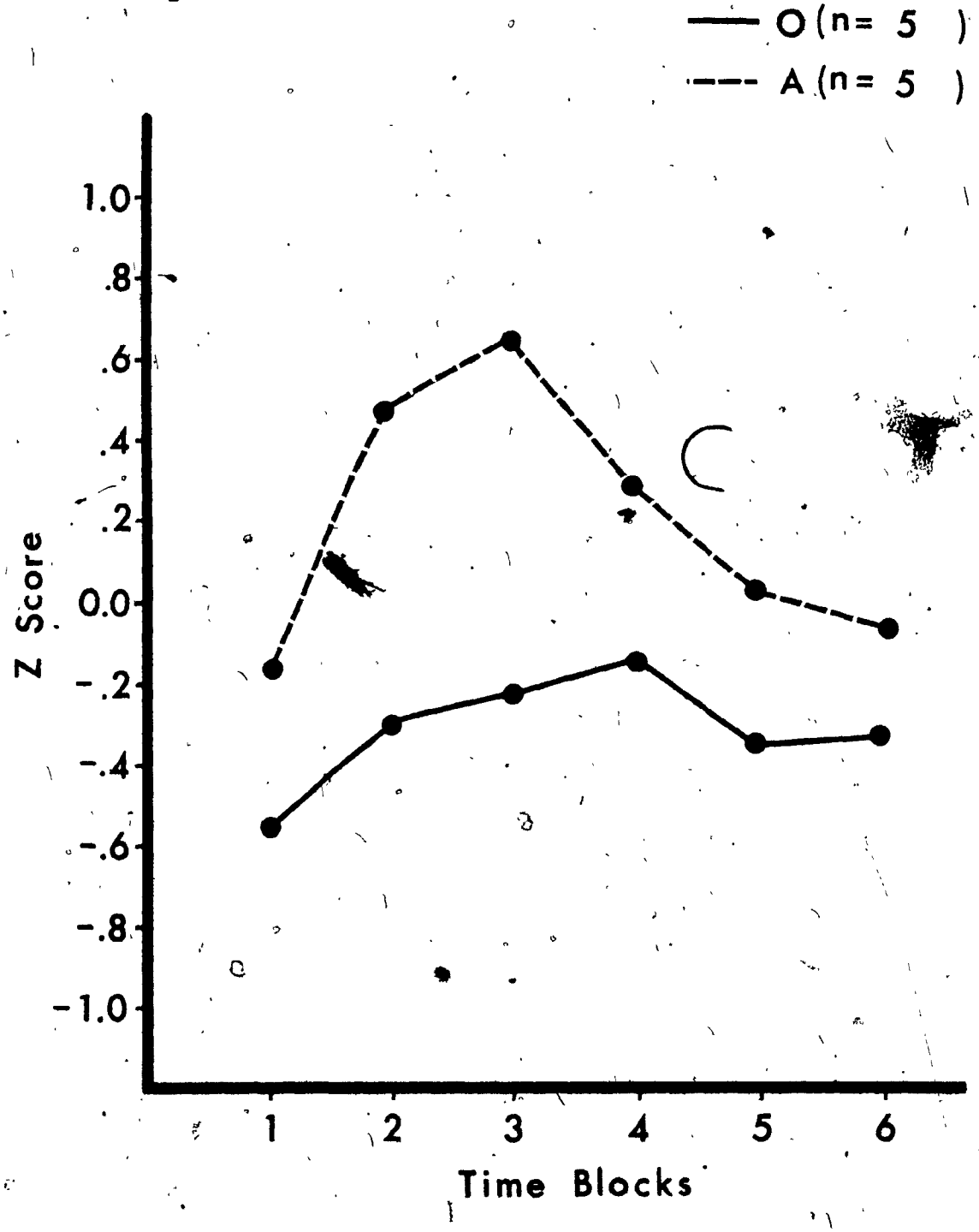
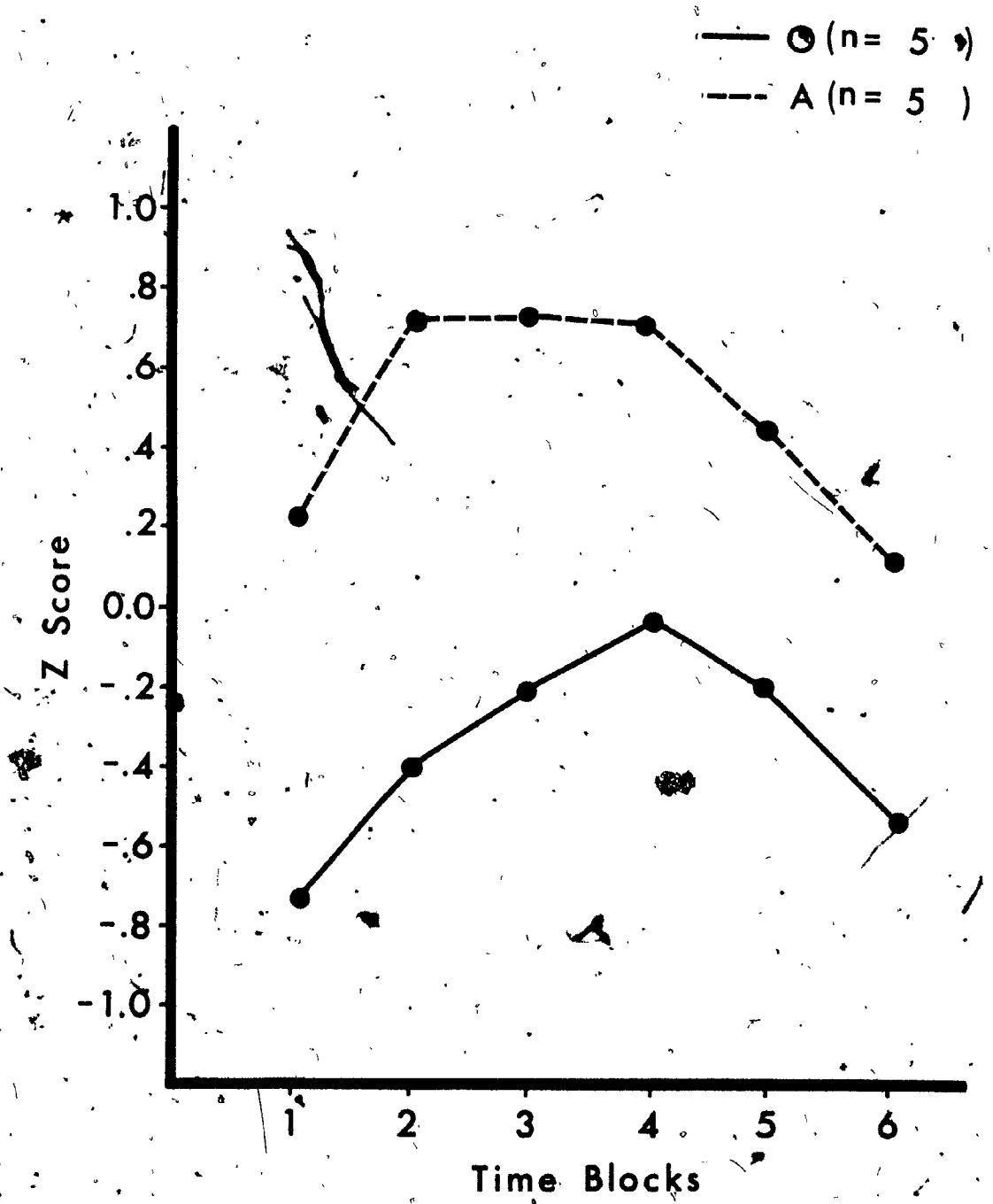


Figure 12: Mean level of sexual desire in ovulatory (O) and anovulatory (A) Groups as a function of 24 standardized cycle days divided into 6 successive time Blocks. Cycle three.



was higher at time period 2, 4 and 5 than at Blocks 3 and 6, $F(5,25)=15.06$, $p<.05$.

Summary

The hypothesis was tested that changes in female sexual responsiveness occur during the course of the menstrual cycle. The differential diagnosis of ovulatory and anovulatory cycles was based on the agreement of two gynecologists who had independently evaluated BBT charts provided by the experimental subjects. The frequency of anovulation averaged 38% over the three menstrual cycles analyzed. The physicians disagreed about the ovulatory status of 8 subjects (32%) in cycle one, 4 subjects (16%) in cycle two and 3 subjects (23%) in cycle three. Thus, the overall rate of disagreement between the judges in three cycles averaged 23.8 per cent.

Group x Block analyses of variance were employed on measures obtained during three cycles to assess changes in sexual activity in the ovulatory subjects and the anovulatory subjects over time. Significant effects due to time Blocks were observed in three out of six measures in cycle one, namely sexual thoughts and fantasies, frequency of heterosexual activity, and number of orgasms during heterosexual activity. Block effects were also yielded by measures of level of sexual desire and orgasms during heterosexual activity in cycle two and by level of

sexual desire and masturbation in cycle three. The Scheffé multiple comparison tests indicated that significant differences in these measures occurred primarily at two specific times during the menstrual cycle: at time Block 2 on two occasions and at time Blocks 2 and 4 on five other occasions. Time Blocks 2 and 4 correspond, respectively, to the postmenstrual phase of the cycle and to the period most often indicated (52% of the time over three cycles) by subjects' BBT records as ovulation time.

Group x Block effects were obtained only in cycle two on one measure: number of orgasms. Ovulatory subjects displayed elevations at time Blocks 2 and 4 while anovular subjects showed a less pronounced pattern of orgasmic frequency. No interaction effects were found for any other measure in any other cycle.

Group effects appeared mainly in cycle three with the anovular respondents consistently displaying a higher rate of sexual interest. Group effects for a single measure were also obtained in cycles one and two. The N in cycle three was greatly reduced from that of previous cycles.

Discussion

Two major findings emerge from this study. First, evidence was found for changes in female sexual interest and activity as a function of time during the menstrual cycle. Second, the pattern of these changes in sexual responsiveness was comparable in ovulatory and anovulatory cycles, as judged by basal body temperature readings.

Female sexual interest was found to peak either right after the menstrual period, or in a biphasic pattern, with increases after menstruation and again in midcycle. The tendency towards rises at these specific times appeared strongest in cycle one in which effects of time in cycle were found for three of the six dependent measures. Two of these measures, frequency of heterosexual activity and number of orgasms during heterosexual activity, indicated an elevation in female sexual activity following menstruation. The third significant measure, number of sexual thoughts and fantasies, indicated that a bimodal pattern exists, with postmenstrual and midcycle peaks. Receptivity patterns were also found in the following two cycles, but to a lesser degree, possibly reflecting some deterioration in the quality of data being provided by the subjects. Greatest confidence, therefore, should perhaps be placed

in the findings of cycle one. Two measures in cycle two, level of sexual desire and orgasms during heterosexual activity, and the same two measures in cycle three showed significant effects over time. In each of these four instances, the bimodal pattern of female sexual interest was demonstrated.

Because some of the dependent variables were found to yield more consistent results than others over more than one cycle, some commentary is merited on the various indices of female sexual responsiveness used in this study. The measures were chosen to reflect common sexual behaviors, ideational states of sexual expression, and sexual activities independent of the availability of a partner. The present measures can be divided into those that involve self monitoring of overt reactions and responses, i.e., heterosexual activity, masturbation and orgasm, and those which involved self-rating of thoughts or feelings, i.e., level of sexual desire and number of sexual thoughts and fantasies. There were two self-ratings of thoughts and feelings as opposed to four ratings of overt responses. The former showed little consistency across cycles. Sexual thoughts and fantasies showed significant changes over time in the first cycle but did not in the remaining two. Level of sexual desire did not vary significantly over time in the initial cycle, but

did in cycles two and three. All of the four measures of overt behavior showed significant changes in at least two cycles. Masturbation in cycle three varied significantly both as a function of time and group. The measure of orgasm frequency was consistently significant across all three cycles and seems to be a potentially productive measure for future research in this area.

The tendency in the present study for sexual interest to peak following menstruation and again at midcycle parallels findings obtained to other investigations in female sexual receptivity. The most generally reported peak in female sexual interest follows the menstrual period (Hamilton, 1929; James, 1971; McCance, Luff & Widdowson, 1937; Terman, 1938). Rises at midcycle, i.e., presumedly around ovulation, have been reported frequently as well (Adams, Gold & Burt, 1978; Benedek & Rubinstein, 1939; Udry & Morris, 1968). Several of the above studies (James, 1971; McCance et al., 1937; Udry & Morris, 1968) have found increases at both points in the menstrual cycle although the authors have chosen to emphasize one point or the other.

While it is certainly possible that both psychological and hormonal influences produce the postmenstrual peak, endocrine changes probably play a minor role. The period following menstruation coincides

with the time when gonadal steroids are secreted by the ovary in small amounts. Cognitive and cultural factors, therefore, seen more useful in explaining the postmenstrual peak. Ford and Beach (1951), in their survey of sexual behavior across various societies, have observed a definite trend towards depression of sexual activity during the menstrual period following by an increased frequency in activity immediately thereafter. In the present study, the incidence of sexual reactions and responses was low during menstruation (time Block one) and rose significantly in the interval right after menstruation (time Block two). Ford and Beach (1951) hypothesized that the postmenstrual peak occurs because humans tend to abstain from sexual activity during menstruation. They interpret the rise following menstruation as a rebound effect following sexual deprivation. If the peak is the result of release from menstrual abstinence, the findings of this study suggest that the effect involves both partners and not just the male, as in the "husband effect" proposed by James (1971). Both autoerotic (e.g., self-ratings of sexual desire, sexual thoughts and fantasies, masturbation) and heterosexual measures exhibited this peak.

The midcycle rise in sexual responsiveness may be mediated by fluctuations in hormone levels associated

with ovulation. In mammals exhibiting an estrous pattern, sexual receptivity at ovulation appears to result from an increase in production of estrogenic or androgenic hormones or both (Czaja & Bielert, 1975; Michael, Zumpe, Keverne & Bonsall, 1972). Since the serum level of estrogens and androgens peak around the time of ovulation in women, it seems likely that a midcycle rise in female sexual interest is associated with increased secretory activity of either or both of these steroids.

If the increase is, in fact, modulated by hormonal secretions associated with ovulation, the question might be raised as to why subjects going through an anovulatory cycle appeared to have a similar sexual interest pattern to those in ovulatory cycles. It is thought that anovulatory cycles may be accompanied by different hormonal changes (at least, in degree) from those of ovulatory cycles. Anovulation is believed to be related to low LH production and inadequate levels of progesterone in the luteal phase (Gombel & Silverberg, 1977; Hoffman, 1973; Jones, 1978; Novak & Woodruff, 1974). It has been proposed that the function of luteal phase progesterone is to block the continued feedback effects of estrogen in the hypothalamic-pituitary-ovarian network (Taymor & Thompson, 1974). Since this regulatory control by progesterone of estrogens is deficient during an

anovulatory cycle, it is possible that estrogens circulate at relatively unchecked levels (Kistner, 1979).

Two findings on the metabolic effects of estrogens are relevant here. It has been documented that estrogens stimulate androgen production (O'Connor, Shelley & Stern, 1974; Persky, Charney, Lief, O'Brien, Miller & Strauss, 1978). In addition, in vitro studies on human polycystic ovaries have suggested that enzymatic defects in the synthesis of estrogens could accelerate production of androgen (Turner & Bagnara, 1976). This information may have prompted the recent speculation that the increase in estrogenic output in a disturbed menstrual cycle might be accompanied by a disproportionately high production of androgens (Kistner, 1979).

If this is the case, it then appears that the same hormones associated with a midcycle peak in ovulatory cycles are present to at least an equal degree, if not more, in anovulatory cycles. Since estrogens and androgens may be similarly secreted during both processes, it therefore seems reasonable to conclude that ovulatory and anovulatory women would not differ with respect to midcycle rises in sexual activity. It would appear that the presence or absence of ovulation per se is not the major contributing factor to the midcycle effect but rather, the secretory activity of estrogens and androgen.

Before attempting to discuss the finding that anovular subjects displayed heightened sexuality in comparison to ovulatory women, it is perhaps worthwhile to comment on the measure of ovulation used and on the incidence of anovulatory cycles. Evaluation of the data on daily thermal shifts revealed that a substantial number of women did not ovulate in each cycle. Past research has indicated that the incidence of anovulatory cycles in regularly menstruating women is nine percent or less (Gombel & Silverberg, 1977; Levan & Szanto, 1944; Wong, Engle & Buxton, 1950). In the present study, the proportion of cycles judged to be anovulatory on the basis of daily basal body temperature recordings substantially exceeded this level. As noted earlier, a biphasic temperature curve has been taken to indicate that ovulation has taken place; a monophasic curve to indicate the absence of ovulation. Some studies, however, have suggested that a monophasic BBT can occur during an ovulatory cycle (Johansson, Larsson-Cohn & Gemzell, 1972; Moghissi, 1976). Although the BBT is probably as accurate as any laboratory test, it may, for certain purposes, need to be supplemented by other methods such as progesterone measurement or endometrial biopsy in establishing the presence or absence of ovulation. Nevertheless, the ovulatory-anovulatory division of cycles made by the

raters on the basis of the BBT in this study did yield Group effects that were significant in the third cycle, with tendencies in the same direction in the earlier two cycles. Analysis of measures of sexual interest in the third cycle showed clearly that the anovular participants were more sexually active than the ovulatory subjects.

Several lines of evidence suggest that hormonal factors played a significant role in this effect. Two possible, although not mutually exclusive, explanations will be discussed. The first hypothesizes that it is the excessive androgen production associated with unchecked estrogen levels during an anovulatory cycle which heightens sexual drive. Androgen is commonly viewed as the libido enhancing hormone in female sexuality. Major evidence for the stimulatory effects of this steroid emanates from studies concerning the effects of exogenous androgen administration. Sopchak and Sutherland (1960) found that the use of exogenous androgen heightened sexual desire in patients who had been given radical mastectomies. Willson, Beecham and Carrington (1975) reported a marked increase in sexual interest among women receiving testosterone for metastic carcinoma of the breast.

Data from Persky, Lief, Strauss, Miller & O'Brien

(1978) tends to support the present hypothesis as well. These authors determined gonadal hormone levels and sexual behavior measures for a group of eleven women over a three menstrual cycle time period. Inspection of subjects' plasma testosterone profiles indicated that some women showed a high baseline level and others a low baseline level. When subjects were dichotomized on this basis, it was found that increased androgen secretion was associated with high self-rated sexual gratification and an increased frequency of intercourse. These findings suggest that the heightened sexual interest noted among anovular subjects in the present study may be related to their presumedly higher androgen level.

An alternative explanation for the data on anovulatory Group effects may be that the low progesterone secretion in anovulatory cycles (Gombel & Silverberg, 1977; Hoffman, 1973; Jones, 1978; Novak & Woodruff, 1974) augments sexual interest. It is generally accepted that progesterone inhibits sexual drive in subhuman mammals and it has been suggested to suppress sexual activity in women. Michael et al. (1972) found that ovarietomized rhesus monkeys treated with estrogen maintained a high rate of sexual activity. However, subsequent administration of progesterone resulted in a significant decrease of mating response. In women, clinical studies

of the effects of oral contraceptives indicate that females receiving highly progestinic agents were far more likely to complain of a decrease in sexual responsiveness than those taking highly estrogenic compounds (Grant & Mears, 1967).

The major feature which the above studies on progesterone and androgen have in common is that the levels of each of these hormones were demonstrated to be related to sexual interest. It is possible that either or both of these steroids mediate the heightened sexuality noted among anovular subjects.

Further speculation on hormonal influences seems inappropriate, however, since endocrine variables were not quantified and assessed. In part, the present study exemplified what may be a doubtful tradition in research on sexual behavior during the menstrual cycle, i.e., the isolation of psychological and endocrinologic factors. The classic work of Benedek and Rubinstein (1939) as well as the more recent investigations of Persky, Charney, Lief, O'Brien, Miller and Strauss (1978) and Persky, Lief, Strauss, Miller and O'Brien (1978) are exceptions. Psychologist have focused on changes in moods and sexual behavior without using appropriate hormonal markers. At the same time, there are many papers documenting daily endocrine changes during the cycle but without

psychological and behavioral assessment.

Because variability in the menstrual cycle in well established, levels of estrogens, androgens, or progesterones are difficult to infer from estimated cycle day alone. Further, there are large individual differences in hormone secretion patterns (Whalen, 1975). Psychological research without endocrine data has tended to regard these variations as negligible. The absence of endocrine data in the current investigation therefore presents difficulties in the understanding of possible mediating endocrine mechanisms, but does not negate the major findings. Greater understanding of female sexual responsiveness awaits consideration of both endocrine and behavioral changes during the menstrual cycle. The introduction of radioimmunoassay procedures for determination of gonadal hormones in body fluids (Taymor & Thompson, 1974) provides a distinctive opportunity to clarify the nature of the relationship between sexual behaviors and plasma hormone levels.

Summary

The results of the present study suggest that the pattern of sexual activity during the menstrual cycle is comparable in ovulatory and anovulatory women. The cyclicity observed in both groups demonstrated a primarily bimodal pattern with postmenstrual and

midcycle peaks in sexual interest. Psychological and hormonal factors, respectively, may account for these rises. Endocrine changes, especially fluctuations in progesterone and androgen, could play a role in mediating the heightened erotic desire observed in anovular women. The absence of appropriate hormone level data, however, prompted the suggestion that future research in female sexuality should be designed to measure both behavioral and endocrine variables. Additional studies are needed in which rate of sexual activity is directly correlated with assays of circulating hormone levels in larger groups of women whose menstrual cycles can be reliably identified as to ovulatory status.

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APPENDIX A

DAILY SELF-REPORT QUESTIONNAIRE

DIRECTIONS

Please note your sexual feelings and activities as you observed them during the last 24 hours only. Indicate your choice by putting a circle around the appropriate number or by filling in the blank spaces with specific information.

For purposes of clarification, masturbation is defined as stimulation of one's own genitals by other parts of one's body and/or by any other means.

Orgasm is defined as an intense peak in sexual excitement or feeling by relaxation. It involves such things as involuntary pelvic and/or other body movements. It is sometimes accompanied by intense emotional responses such as a subsequent feeling of exhilaration. These are common but not inclusive feelings that some people report.

Date: Time filled out:
Identification Number:

THOUGHTS AND FEELINGS

1. Indicate the degree of your sexual desire during the preceding 24 hours.

LOW SEXUAL DESIRE	1	2	3	4	5	6	7	HIGH SEXUAL DESIRE

2. Try to estimate how many separate sexual thoughts or fantasies you have had in the past 24 hours. _____

HETEROSEXUAL RELATIONS

3. How many separate times did specifically sexual activity (e.g. intercourse, erotic play) occur with your partner? _____

4. Rate the level of sexual arousal you experienced. If sexual activity occurred more than once, rate each incident separately.

A)

LOW SEXUAL AROUSAL	1	2	3	4	5	6	7	HIGH SEXUAL AROUSAL

B)

LOW SEXUAL AROUSAL	1	2	3	4	5	6	7	HIGH SEXUAL AROUSAL

C)

LOW SEXUAL AROUSAL	1	2	3	4	5	6	7	HIGH SEXUAL AROUSAL

5. How many times did you reach orgasm during the sexual activity or activities? _____

6. Who initiated the sexual activity? Circle the appropriate item.

SELF	PARTNER	MUTUAL

MASTURBATION

7. How many times did you engage in masturbation during the preceding 24 hours? _____

8. Rate the level of sexual arousal you experienced during masturbation. If masturbation occurred more than once, rate each incident separately..

A)

LOW SEXUAL AROUSAL	1	2	3	4	5	6	7	HIGH SEXUAL AROUSAL

B)

LOW SEXUAL AROUSAL	1	2	3	4	5	6	7	HIGH SEXUAL AROUSAL

C)

LOW SEXUAL AROUSAL	1	2	3	4	5	6	7	HIGH SEXUAL AROUSAL

9. How many times did you reach orgasm during masturbation? _____

MENSTRUAL CYCLE

10. Yesterday was day _____ of your menstrual cycle. (By convention, the first day of your menstrual period is designated as day 1 of the cycle).

11. Were you menstruating during the past 24 hours? If so, circle M in the space where you record day of cycle.

12. During the preceding 24 hours, did you have any physical signs of ovulation? (e.g. rise in temperature, midcycle bleeding, ovarian discomfort)? Yes _____ No _____ If yes, please describe briefly: _____

13. Were you in a very familiar milieu, i.e. at home, in your country house, etc? Yes _____ No _____

14. Were there any particular events in the day that may have considerably influenced your sexual responsiveness e.g. seeing an erotic film, spat with partner, etc? Yes _____ No _____ If yes, please describe briefly: _____

15. My Basal Body Temperature this morning was _____

COMMENTS

A) Note anything that you think is relevant and that is not included under the other headings.

B) Qualify any entry that you feel is not sufficiently explained by the symbols provided.

APPENDIX B

CHECKLIST VERSION OF DAILY SELF-REPORT QUESTIONNAIRE

DIRECTIONS: CIRCLE APPROPRIATE NUMBER OR FILL IN BLANK WITH SPECIFIC INFORMATION.		
THOUGHTS	IDENTIFICATION NUMBER:	DATE: TIME:
	Level of sexual desire	LOW 1 2 3 4 5 6 7 HIGH
	Number of sexual thoughts or fantasies	
HETEROSEXUAL ACTIVITY	Number of sexual activities with partner	
	Rate level of sexual arousal by episode	LOW 1 2 3 4 5 6 7 HIGH LOW 1 2 3 4 5 6 7 HIGH LOW 1 2 3 4 5 6 7 HIGH
	Number of orgasms	
	Sexual activity initiated by - Specify:	
MASTURBATION	Number of masturbations	
	Level of sexual arousal by episode	LOW 1 2 3 4 5 6 7 HIGH LOW 1 2 3 4 5 6 7 HIGH LOW 1 2 3 4 5 6 7 HIGH
	Number of orgasms	
CYCLE	Day of cycle	M
	Signs of ovulation: describe under comments	YES NO
	Influential events of the day: describe under comments	YES NO
	At home	YES NO
	Basal Body Temperature:	
	COMMENTS:	

APPENDIX C

SUMMARY TABLES

FOR THE

ANALYSES OF VARIANCE

TABLE 1

ANALYSES OF VARIANCE SUMMARY TABLE. MEASURES OF SEXUAL INTEREST DURING THE MENSTRUAL CYCLE FOR OVULATORY AND ANOVULATORY GROUPS. CYCLE ONE.

Measure	Source	df	ms	F
Level of sexual desire	Groups (G)	1	.24	.03
	Subjects (S)	15	6.88	
	Blocks (B)	5	2.02	1.56
	G x B	5	.44	.34
	S x B	75	1.29	
Sexual thoughts and fantasies	G	1	.03	.003
	S	15	9.53	
	B	5	2.17	3.20 **
	G x B	5	.26	.38
	S x B	75	.67	
Heterosexual activity	G	1	.09	.06
	S	15	1.38	
	B	5	1.58	2.30 *
	G x B	5	.44	.64
	S x B	75	.68	
Orgasm	G	1	.49	.28
	S	15	1.74	
	B	5	1.33	2.71 *
	G x B	5	.26	.54
	S x B	75	.49	

* $p<.05$

** $p<.05$

TABLE 2

ANALYSES OF VARIANCE SUMMARY TABLE. MEASURES OF SEXUAL INTEREST DURING THE MENSTRUAL CYCLE FOR OVULATORY AND ANOVULATORY GROUPS. CYCLE ONE.

Measure	Source	df	ms	F
Masturbation	Groups (G)	1	30.88	20.80 **
	Subjects (S)	5	1.48	
	Blocks (B)	5	1.25	.81
	G x B	5	1.66	1.08
	S x B	25	1.53	
Orgasms reached during masturbation	G	1	3.08	1.81
	S	5	1.67	
	B	5	.32	.90
	G x B	5	.44	1.25
	S x B	25	.35	

* $p<.01$

TABLE 3

ANALYSES OF VARIANCE SUMMARY TABLE. MEASURES OF SEXUAL INTEREST DURING THE MENSTRUAL CYCLE FOR OVULATORY AND ANOVULATORY GROUPS. CYCLE TWO.

Measure	Source	df	ms	F
Level of sexual desire	Groups (G)	1	.08	.01
	Subjects (S)	19	5.89	
	Blocks (B)	5	2.74	2.37 *
	G x B	5	2.41	2.08
	S x B	95	1.15	
Sexual thoughts and fantasies	G	1	17.16	1.96
	S	19	8.73	
	B	5	1.43	1.71
	G x B	5	1.07	1.20
	S x B	95	.83	
Heterosexual activity	G	1	6.32	4.33 *
	S	19	1.45	
	B	5	1.50	1.83
	G x B	5	1.11	1.35
	S x B	95	.82	
Orgasm	G	1	1.11	.65
	S	19	1.68	
	B	5	.90	2.29 *
	G x B	5	1.01	2.57 *
	S x B	95	.39	

* $p<.05$

TABLE 4

ANALYSES OF VARIANCE SUMMARY TABLE. MEASURES OF SEXUAL INTEREST DURING THE MENSTRUAL CYCLE FOR OVULATORY AND ANOVULATORY GROUPS. CYCLE TWO.

Measure	Source	df	ms	F
Masturbation	Groups (G)	1	2.61	.58
	Subjects (S)	10	4.48	
	Blocks (B)	5	.83	.69
	G x B	5	1.02	.85
	S x B	50	1.19	
Orgasm reached during masturbation	G	1	.66	.49
	S	10	1.36	
	B	5	.26	.78
	G x B	5	.32	.99
	S x B	50	.33	

TABLE 5

ANALYSES OF VARIANCE SUMMARY TABLE. MEASURES OF SEXUAL INTEREST DURING THE MENSTRUAL CYCLE FOR OVULATORY AND ANOVULATORY GROUPS. CYCLE THREE.

Measure	Source	df	ms	F
Level of sexual desire	Groups (G)	1	43.27	3.16
	Subjects (S)	8	13.68	
	Blocks (B)	5	2.35	2.80 *
	G x B	5	.37	.44
	S x B	40	.83	
Sexual thoughts and fantasies	G	1	22.41	.89
	S	8	25.14	
	B	5	.05	.42
	G x B	5	.09	.71
	S x B	40	.13	
Heterosexual activity	G	1	15.57	3.66
	S	8	4.24	
	B	5	1.86	2.19
	G x B	5	.59	.69
	S x B	40	.85	
Orgasm	G	1	11.14	14.01 **
	S	8	.79	
	B	5	.60	1.07
	G x B	5	.39	.70
	S x B	40	.55	

* $p<.05$

** $p<.01$

TABLE 6

ANALYSES OF VARIANCE SUMMARY TABLE. MEASURES OF SEXUAL INTEREST DURING THE MENSTRUAL CYCLE FOR OVULATORY AND ANOVULATORY GROUPS. CYCLE THREE.

Measure	Source	df	ms	F
Masturbation	Groups (G)	1	7.72	22.63 **
	Subjects (S)	5	.34	
	Blocks (B)	5	2.63	3.26 *
	G x B	5	.93	1.15
	S x B	25	.80	
Orgasms reached during masturbation	G	1	2.43	11.92 **
	S	5	.20	
	B	5	.76	2.33
	G x B	5	.30	.92
	S x B	25	.32	

* $p<.05$

** $p<.01$