Comparative analysis of swimming times during five phases of the menstrual cycle
by Cathy Jean Ferguson Cullum

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
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Abstract:
The general problem of this research was to determine the best phase of the menstrual cycle to participate in an exhaustive swimming event.

One hundred-nine untrained subjects were timed for a distance of 36.58 meters crawl stroke during the following phases of the. menstrual cycle: menstrual flow phase (first forty-eight hours of flow and last forty-eight hours of flow), proliferative phase (within a forty-eight hour period after flow had ceased), ovulatory phase (within forty-eight hours of the half-way point between menstrual flow phases), and secretory phase (within forty-eight hours before the onset of flow).

The data was processed by a computer and the findings were as follows: 1. There was no significant difference between the five phases of the menstrual cycle at the .05 level of significance.

2. The F ratio at 4 and 1,000 degrees of freedom was 2.38 at the .05 level of significance. The computed F ratio for this research was .3813.

The conclusion drawn from this research was to retain the null hypothesis. This conclusion indicates that there is no one best phase of the menstrual cycle to participate in an exhaustive swimming event.

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Date August 2, 1971

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by

CATHY JEAN FERGUSON CULLUM

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of

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Approved:

George Shroyer
Head, Major Department

Chairman, Examining Committee

Henry L Parsons
Graduate Dean

MONTANA STATE UNIVERSITY
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ABSTRACT

The general problem of this research was to determine the best phase of the menstrual cycle to participate in an exhaustive swimming event.

One hundred-nine untrained subjects were timed for a distance of 36.58 meters crawl stroke during the following phases of the menstrual cycle: menstrual flow phase (first forty-eight hours of flow and last forty-eight hours of flow), proliferative phase (within a forty-eight hour period after flow had ceased), ovulatory phase (within forty-eight hours of the half-way point between menstrual flow phases), and secretory phase (within forty-eight hours before the onset of flow).

The data was processed by a computer and the findings were as follows:

1. There was no significant difference between the five phases of the menstrual cycle at the .05 level of significance.

2. The F ratio at 4 and 1,000 degrees of freedom was 2.38 at the .05 level of significance. The computed F ratio for this research was .3813.

The conclusion drawn from this research was to retain the null hypothesis. This conclusion indicates that there is no one best phase of the menstrual cycle to participate in an exhaustive swimming event.

Chapter 1

INTRODUCTION

The menstrual cycle is not a recent topic for research. A crucial question is whether a woman can involve herself in exhaustive exercise during her menstrual flow and be free from complications. The controversies regarding the menstrual cycle and exercise need further research. The objective of this research was to find some answers and create new questions in regards to the best phase during the menstrual cycle to participate in physical activities.

Statement of the Problem

The general problem was to determine the best phase of the menstrual cycle to participate in an exhaustive swimming event.

The specific problem was to determine how the five selected phases of the menstrual cycle compared to each other in relation to times for a specific swimming event. The five phases tested were as follows: first forty-eight hours of the flow phase, last forty-eight hours of the flow phase, the proliferative phase, the ovulatory phase, and the secretory phase.

Definition of Terms

Menstrual cycle. The menstrual cycle is a hormonal cycle whereby estrogen and progesterone are produced by the ovaries. These hormones

cause the endometrial changes which include the following phases: the flow phase, the proliferative phase, the ovulatory phase, and the secretory phase (Guyton, 6:1145).

Menstrual flow phase. The flow phase is the period of uterine bleeding accompanied by shedding of the endometrium (Guyton, 6). In this research, the menstrual flow phase referred to the first forty-eight hours of flow and the last forty-eight hours of flow. The subject was tested twice during the flow to determine if any difference existed between the first days and last days of the menstrual flow phase.

Proliferative phase. The proliferative phase is the time during the cycle in which the endometrium is rebuilding itself (Guyton, 6). This term, as used in this research, referred to the first forty-eight hours after the menstrual flow had ceased.

Ovulatory phase. The ovulatory phase is that time during the menstrual cycle that the ovaries release a mature ova. It occurs approximately half way between menstrual flow phases (8:23-31). For purposes of this research, the subject was timed within forty-eight hours of the half-way point between menstrual flow phases.

Secretory phase. The secretory phase is the phase that occurs two or three days before flow. The arteries and endometrium constrict. This period is terminated by the opening up of the constricted arteries,

the breaking off of small areas of necrotic endometrium, and the beginning of menstruation with flow of menstrual fluid (Guyton, 6). For the purpose of this research, the secretory phase referred to the period within forty-eight hours before flow was noticed.

Untrained subjects. Untrained subjects were individuals who had never competed or trained with a competitive swimming team, or who had not competed for two or more years before the initiation of this research.

Delimitation of the Research

This research was delimited to 109 Montana State University female students. This research was further delimited to females between the ages of eighteen and twenty-four. Each subject was untrained but was able to swim the crawl stroke a minimum of 73.16 meters in no set time limit. All subjects were required to have had a physical examination before their participation in this research. This research was delimited to the dates from November, 1970 to June, 1971.

Limitations

Limitations of this research involved the following parameters:

1. The extent to which the subject could prepare psychologically for the exercise.
2. The control over rest and food consumption.
3. The control over the subjects' participation in other

physical activities.

4. The inability to determine the exact time of ovulation.

Justification

The study of the menstrual cycle has been investigated for centuries (Ortho, 8). The question of whether exercise, principally swimming, is beneficial to the female during menstrual flow is a very controversial issue (de Vries, 3). Some researchers feel that the menstrual cycle has no effect on motor performance (Pierson, 9; Sloan, 11 and 12). Other investigators feel that sports activities should be permitted only during the last half of the flow period (Ryan, 10). Some women have even been given hormones previous to athletic competition, to prevent the onset of the menstrual flow (Ryan, 10).

Erdeleji (5), in his survey of female athletes, found that performance was best in the post menstrual phase, fair during menstrual flow, and poor during the two or three days preceding menstruation.

Dawson (2) and Duntzer (4:29) confirm Erdeleji's study results.

Karpovich (7:35) states that there is no evidence to prove that participation in athletics during menstruation is harmful. Excusing a menstruating girl from classes requiring mild physical activities is not warranted.

Anderson (1) found that strenuous swimming had not caused menstrual disturbances.

It is the belief of this investigator that the knowledge

obtained from this research will add to the current information on the menstrual cycle and implications regarding exercise, specifically swimming.

To the best of this investigator's knowledge, no similar study has been done. As a result, this study will hopefully open up new questions and answers in regard to training and competing of female swimmers.

Chapter 2

METHOD AND PROCEDURE

Hypothesis

The hypotheses of this research were:

1. There will be no specific best phase of the menstrual cycle to participate in swimming.

2. There will be no difference in times during any of the phases in regards to swimming the 36.58 meters crawl stroke.

Population and Sampling

Due to the type of research, it was necessary to ask for volunteers. All subjects were to be untrained female students enrolled at Montana State University. The selection of subjects was further based on the ability of the subject to swim 73.16 meters crawl stroke in no specific time. At the termination of this research, there were 109 subjects.

Collection of Data

Tools used. A Hanhart stopwatch was used to determine the subject's time in swimming 36.58 meters crawl stroke and the beginning and end of the rest period.

Schedule - Procedure. Each subject was required to swim a distance of 73.16 meters at any set speed necessary to become acclimated

to the water temperature.

Upon finishing the above distance, the subjects rested for a total of three minutes. On termination of the rest period, the individual subject swam, non-competitively, a distance of 36.58 meters crawl stroke with maximum effort.

All timing was conducted by this investigator.

Results of the data. Results of the data were tabulated by use of an analysis of variance between the five phases of the menstrual cycle. The F ratio was used to determine the probability of reoccurrence.

This statistical analysis was to determine whether or not the hypothesis posed would be retained or rejected at the .05 level of significance.

The results of this research indicated that there was no significant difference between the five phases of the menstrual cycle tested. The table F at the 4 and 1,000 degrees of freedom showed 2.38 at the .05 level of significance. The computed F for this research was .3813. The null hypothesis was retained at the .05 level of significance (Table 1 and 2, page 8).

When comparing the mean times of each phase, the results indicated that the ovulatory phase had a lower mean time as compared with the other four phases; however, as stated above, the difference was not significant (Table 1 and 2).

Table 1

Mean and Standard Deviation

Treatment group	First 48 hr. flow phase	Last 48 hr. flow phase	Proli-ferative phase	Ovula-tory phase	Pre-flow phase
Sample Size	109	109	109	109	109
Mean	39.0778	39.3319	39.5172	37.8173	39.5016
Standard Deviation	11.2580	13.0226	13.5497	7.7885	13.4869

Table 2

Analysis of Variance for One-way Design

	Sum of squares	DF	Mean squares	F ratio
Between Groups	220.4068	4	55.1017	.3813
Within Groups	78028.2500	540	144.4967	
Total	78248.6250	544		

Chapter 3

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results of the data, it is concluded that there is no one best phase of the menstrual cycle for participating in exhaustive exercise. This researcher does, however, recognize that individual menstrual problems may alter this conclusion; but based on the results obtained from testing 109 women, there is no reason why a woman cannot participate in exhaustive exercise during any phase of the menstrual cycle.

Recommendations

It is recommended:

1. That a longer swimming distance be tested to determine if the results would be altered due to a greater workload.

2. That the amount of flow during the actual exercise be determined to indicate whether any differences in flow takes place before, during, or after the exercise.

3. That data be collected over a longer period of time for each individual to determine whether the individual's times change from one cycle to the next.

4. That research be conducted on highly competitive female athletes.

5. That research be conducted on the menstrual cycle in regards to other physical activities.

6. That there be more control over rest, food consumption, and physical exercise.

APPENDIX

SUBJECT'S TIMES

No.	First 48 hr. flow	Last 48 hr. flow	Proliferative phase	Ovulatory phase	Secretory phase
1	53.2	50.9	53.8	53.5	54.3
2	28.9	31.2	30.0	28.8	29.4
3	42.1	42.3	43.9	40.1	40.0
4	29.9	28.8	29.3	30.8	29.1
5	42.5	40.4	40.6	43.2	40.2
6	31.6	32.3	32.9	29.9	32.1
7	25.4	25.8	26.1	25.9	25.8
8	47.3	44.5	52.4	46.4	50.2
9	31.3	31.0	33.1	31.3	30.6
10	53.1	52.0	48.0	52.7	57.4
11	33.2	38.1	35.1	35.4	32.2
12	30.7	31.2	29.2	31.1	31.1
13	32.9	32.7	32.7	34.8	32.9
14	45.2	46.9	44.9	45.8	48.6
15	49.2	45.8	43.3	38.6	50.0
16	34.3	33.5	33.5	32.0	33.8
17	29.7	31.1	30.4	29.5	31.2
18	41.0	42.9	45.0	43.9	43.8
19	33.7	34.6	35.6	39.2	35.5
20	28.3	28.1	27.9	27.3	28.5
21	32.2	31.7	30.6	30.8	30.9
22	47.3	44.0	43.7	46.7	48.8
23	32.9	33.4	34.1	31.4	34.7
24	26.4	26.4	24.6	23.9	24.0
25	42.9	41.6	41.2	42.7	43.3
26	37.9	39.0	39.5	38.9	39.8

No.	First 48 hr. flow	Last 48 hr. flow	Proliferative phase	Ovulatory phase	Secretory phase
27	29.1	30.0	28.8	29.4	29.6
28	45.0	42.9	46.7	41.8	46.8
29	35.7	34.4	36.1	36.0	34.1
30	32.5	34.9	32.5	32.6	32.0
31	43.2	39.7	38.5	39.9	39.4
32	43.0	40.1	39.2	40.0	38.2
33	37.1	37.4	36.5	35.9	37.6
34	34.6	34.4	37.2	33.9	33.8
35	43.6	41.2	41.3	42.0	43.1
36	39.1	36.9	39.1	38.2	39.0
37	39.6	39.6	37.6	38.1	38.6
38	26.6	25.3	26.3	26.6	26.6
39	37.2	36.5	41.4	35.6	34.4
40	44.4	44.4	45.0	46.4	43.1
41	38.6	39.1	36.6	37.9	38.2
42	38.8	37.6	37.1	35.7	39.0
43	30.3	29.9	30.6	31.4	31.5
44	42.8	38.4	41.7	39.4	38.6
45	42.8	49.6	46.1	43.8	43.5
46	34.1	33.9	33.5	32.8	34.4
47	47.3	47.5	53.4	52.7	53.1
48	33.8	34.3	33.4	40.4	35.5
49	47.0	47.0	45.0	53.3	48.2
50	23.4	22.9	22.5	22.8	22.6
51	50.7	46.8	45.5	45.0	46.7
52	36.5	35.3	34.7	35.0	36.1
53	39.7	39.2	40.2	37.9	37.8

No.	First 48 hr. flow	Last 48 hr. flow	Proliferative phase	Ovulatory phase	Secretory phase
54	30.5	30.2	30.2	29.4	29.3
55	44.4	40.7	41.7	42.6	46.3
56	38.0	31.0	30.0	28.8	30.8
57	35.4	34.6	34.1	34.8	32.4
58	34.3	34.1	33.7	35.2	33.5
59	37.1	34.9	35.1	36.7	35.3
60	34.3	32.7	32.5	40.4	33.7
61	32.3	32.0	36.0	34.8	33.1
62	46.0	51.6	49.9	44.8	47.9
63	32.8	32.0	32.4	32.9	33.6
64	25.7	26.5	25.0	25.4	25.5
65	28.5	29.4	28.9	27.3	29.8
66	35.2	37.0	37.7	36.6	33.9
67	31.9	34.1	35.2	32.8	32.7
68	35.1	35.1	33.4	33.7	33.7
69	34.6	33.9	35.1	34.1	34.1
70	33.0	32.5	32.0	34.6	33.7
71	46.6	47.8	47.0	48.9	50.9
72	33.3	33.7	33.6	31.3	33.5
73	57.8	1:03.4	1:09.8	57.6	1:07.4
74	38.9	38.2	38.7	45.4	45.0
75	45.9	47.6	46.4	49.4	46.4
76	35.4	34.8	33.4	35.1	35.1
77	47.3	48.7	48.3	42.2	1:01.8
78	27.0	25.8	25.9	26.2	26.4
79	40.7	50.7	44.7	41.7	40.0
80	41.9	41.2	41.5	41.1	40.6

No.	First 48 hr flow	Last 48 hr flow	Proliferative phase	Ovulatory phase	Secretory phase
81	46.2	46.4	44.6	46.2	49.7
82	53.4	49.8	48.1	47.1	47.9
83	46.6	48.1	51.3	45.7	44.6
84	30.8	30.8	28.7	29.9	30.2
85	36.6	37.4	36.8	37.4	37.6
86	52.6	53.1	49.8	45.7	52.3
87	46.4	47.6	49.6	43.2	46.5
88	39.6	40.4	39.1	38.8	39.7
89	52.2	50.4	42.9	52.5	51.2
90	1:01.1	1:02.8	1:05.1	58.1	1:07.3
91	1:01.1	1:04.2	1:06.6	57.4	54.8
92	43.8	42.5	41.3	41.3	42.1
93	34.3	33.6	33.8	34.8	33.0
94	40.2	39.4	37.6	37.2	36.7
95	31.0	30.7	34.7	33.3	32.1
96	33.6	34.5	34.5	34.8	33.6
97	48.9	55.0	51.0	49.4	48.1
98	28.2	28.6	27.1	28.2	28.7
99	43.9	45.6	47.0	45.2	45.1
100	34.7	35.0	35.9	35.3	36.9
101	36.5	35.1	36.8	36.5	34.4
102	34.2	33.7	33.6	32.9	34.3
103	37.3	36.8	39.6	37.7	38.4
104	31.9	32.3	33.8	31.5	31.7
105	34.9	28.6	29.1	28.3	35.7
106	39.7	47.5	43.5	40.1	37.7
107	34.0	35.2	33.7	32.7	32.9

No.	First 48 hr. flow	Last 48 hr. flow	Proliferative phase	Ovulatory phase	Secretory phase
108	46.1	39.6	43.0	38.5	36.7
109	31.3	31.1	30.9	33.0	30.8

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