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Effects of Three Pre-Competition meals Upon Subsequent Performance in a Two-Mile Run

Jeffrey D. Fair

EFFECTS OF THREE PRE-COMPETITION MEALS UPON SUBSEQUENT PERFORMANCE IN A TWO-MILE RUN

by
Jeffrey D. Fair
Bachelor of Science, Kent State University, 1971

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This Thesis submitted by Jeffrey D. Fair in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota is hereby approved by the Faculty Advisory Committee under whom the work has been done.

W. C. Koenig
(Chairman)

William W. Bolonchuk

Elton M. Hall

William Johnson
Dean of the Graduate School

Permission

Title Effects of Three Pre-Competition Meals Upon Subsequent Performance in a Two-Mile Run

Department Health, Physical Education and Recreation

Degree Master of Science

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VITA

Jeffrey D. Fair
Candidate for the Degree of
Master of Science

Thesis: Effects of Three Pre-Competition Meals Upon Subsequent Performance in a Two-Mile Run

Major Field: Health, Physical Education and Recreation

Biographical:

Personal Data: Born in Delphos, Ohio, April 6, 1947, the son of Col. and Mrs. Stanley D. Fair; married July 6, 1968, to Carolyn Ann Mallon.

Education: Graduated from Annandale High School in June, 1965; received the Bachelor of Science Degree from Kent State University in March, 1971, with a major in Health and Physical Education. Received training in corrective therapy from the Cleveland Veterans Administration Hospital, Cleveland, Ohio, May, 1971; attended the University of North Dakota on a graduate teaching assistantship and as assistant trainer 1971-1972. Certified as an Athletic Trainer by the National Athletic Trainers Association, June, 1972. Completed requirements for the Master of Science Degree at the University of North Dakota in August, 1974, with a major in Health, Physical Education and Recreation.

Professional Experiences: Student Trainer, Kent State University, 1965-71; Summer Assistant Trainer, Cleveland Browns Professional Football Team, 1971; Assistant Trainer and Graduate Teaching Assistant, University of North Dakota, 1971-72; Head Football Trainer, Oklahoma State University, 1972-present; Trainer at the 1973 Blue and Gray Classic.

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ABSTRACT

It has always been desired that the meal consumed prior to competition would enhance the athlete's performance. The problem is that no one knows how different pre-competition meals affect the performance of the athlete.

Sixty-eight Oklahoma State University football players ran a two-mile run after consuming one of four treatments--steak and eggs, pancakes, oatmeal and eggs, and a control meal. Subjects were grouped by football position and blocked in fours based on a pre-test time. Subjects were assigned treatments randomly with each subject in each block having a different treatment. A questionnaire was filled out after testing by the subjects to get their feelings toward their performance with their assigned treatment. Using the analysis of variance, the data indicated that according to the requirements of the F value, the four treatments had no effect on performance in the two-mile run. The questionnaire indicated that a greater number of the subjects did not feel they were affected by their treatments. The majority of the subjects who ate steak and eggs showed a preference for that meal, whereas the subjects who ate the other meals disliked them or indicated that it did not matter to them what they ate.

The treatments did not have an effect on the subjects' performance in the two-mile run, and the questionnaire suggested that the psychological factors involving the pre-competition meal may be more important than the meal itself.

CHAPTER I

INTRODUCTION

More questions have been asked and more misinformation has been circulated on the contents of the pre-competition meal than almost any other subject discussed by trainers and coaches. It has always been desired that the food consumed directly prior to competition would enhance the athlete's performance. The problem is essentially that no one knows how different pre-competition meals affect the performance of the athlete.

Athletes are fed a wide variety of pre-competition meals based mainly on tradition. Coaches have passed down their ideas on the content of the pre-competition meal from coach to coach for many years.

The pre-competition meal has come through several trends from steak and eggs to liquid supplements to pancakes and recently back to steak. Most of these trends were started at major universities where some research was taking place.

It is evident from limited amounts of scientific facts and the great variance concerning the contents of pre-competition meals that an investigation be made to clarify

some of the conflicting opinions concerning the pre-competition meal's effect on performance.

The main purpose of this study is to investigate the effects of three different pre-competition meals on maximum performance in a two-mile run. The study hypothesis that was tested is that different pre-competition meals do not have an effect on an athlete's performance.

SURVEY OF LITERATURE

One of the first documented concerns over what to feed an athlete dates back to the 5th century B.C. when the "practice of consuming large quantities of meat to replenish the supposed loss of muscular substances during heavy muscular work (1)" was the common practice. Through the centuries, such practices as vegetarian diets, fluid restriction, laxative use, bloodletting, large vitamin doses and protein tablets have been accepted by various successful athletes.

Perhaps, the reason for use of specific pre-game rituals and pre-game meals is largely dependent upon the psychological value of the meal or ritual. "The food that is consumed during training and immediately before an athletic contest may have a psychological significance for the athlete that exceeds its physiological and metabolic importance (2)." Van Itallie et al. stated that the pre-competition meal provides each athlete with a "sense of

security and reassurance generally obtainable by the practice of rituals (2)." One of the most significant food rituals athletes commonly participated in was the eating of red meat which was usually slightly under-done. Throughout the centuries, eating rare meat has been considered viril and manly, and many teams have included it in both their training table and pre-game meals. The Oxford rowing crew from 1861 to 1869 ate under-done beef or mutton, tea, bread and beer, and jelly or water cress for their pre-game and training meals. Other foods which appeared to play a greater role than nutrition in the training and pre-game meals have been milk and eggs.

During training, an athlete often must give up many pleasures while working hard. He developed a need to gratify his senses--smell, sight, sound, taste, touch. Part of the need can be fulfilled by providing the athlete with foods he likes and enjoys and serving the food in pleasant surroundings. Van Itallie et al. have stated, "The atmosphere in which food is served is frequently more important than the quality of the food served (2)." Thus, food does affect the performance of an athlete if he believes it can.

The idea about the contents of the pre-event meal used by many coaches is passed from coach to player to coach and so forth. Coach Paul Bryant (3) of the University of Alabama suggested that the pre-game meal be served at least four hours before game time. The meal he suggested consists of an eleven to twelve ounce sirloin steak, green peas, dry

toast and honey. Bryant stated no particular reason for this meal except that he gets the subsequent results from his players which he deems desirable.

Walker (4), a successful high school coach, stated, "Pre-game meals should be light and free from starchy or fatty foods that are hard to digest." He suggested two different pre-competition meals. The first one consisted of one cup beef broth, dry toast, two patties of butter, peaches or pears and tea. The second meal consisted of a small steak, baked potato, dry toast, three patties of butter, peaches and tea.

Team physicians as well as coaches have specific opinions concerning the pre-competition meal. Donald Cooper (5), team physician at Oklahoma State University, stated that he felt the athlete needed to modify his diet forty-eight hours before a game involving endurance. Cooper continued by stating, "Serious impairments may thus be avoided, such as loose bowels, abdominal cramps, depleted salt stores, and inadequate energy supplies (5)." Foods which produce gas, roughage or which are spicy or oily should be deleted from the diet.

Cooper was an advocate of a low protein, high carbohydrate pre-competition meal because the high protein meal requires five percent more oxygen to digest than the high carbohydrate meal (6). He also suggested that the digestion of protein gives off an acid residue which the kidneys must

excrete, but with exercise "effective kidney function stops (5)." Cooper continued,

> Increased acid in the muscles and system in general account for fatigue, cramps, and inability to continue to function, so it is easy to see why the athlete who eats a large steak, eggs or a protein meal before a contest can expect more troubles with fatigue and acidosis than one who keeps food in primarily the carbohydrate family (5).

Cooper recommended pre-competition meals consisting of orange juice, pancakes with butter and syrup, dry toast and honey, plain jello mold, milk and tea with sugar (7).

He further pointed out that it is important for the athlete to rest or have curtailed workouts prior to an event. This allowed the muscles to rest and the liver to replenish its glycogen stores. The athlete then has stored energy for longer endurance in performance.

Cooper et al. (8) conducted a study with the varsity football squad using one or two cans of liquid Nutrament for the pre-game meal during the ten-game season. The players felt no discomfort during the game--no nausea, stomach cramps or vomiting. The stamina of the players appeared to improve as the season progressed.

White (9) concluded after his test of serving a liquid meal to subjects one-half hour, one hour and two hours before running the one-mile run that there was no significant difference in the performance of the subjects and that no adverse effects were noticeable.

Rasch et al. (10) gave protein supplements to one group of subjects and placebos to another group who were

participating in physical training at Quantico. The protein supplement did not significantly improve the performance of the experimental group but Rasch states that this group did develop "sports anemia when the control group did not (10)." Sports anemia is the "destruction of erythrocytes due to the higher body temperatures resulting from vigorous muscular work (10)." This study did not support the hypothesis that increased protein intake will increase physical performance.

Fordtran and Saltin (11) found that intestinal absorption was unaffected by exercise and that gastric emptying was slightly affected. They concluded that replacement of water, sugar and sodium during exercise was limited by the normal mechanisms of gastric emptying and not exercise.

Klafs and Arnheim (12) suggested that athletes avoid foods high in cellulose content (lettuce), highly spiced foods and fatty or fried foods before performance. These authors believed that such foods caused gastrointestinal irritation. They continued by stating that fish, eggs and meat should be eliminated from pre-competition meals, carbohydrate meals should be increased significantly, and fatty foods should be reduced sharply.

Asprey, Alley and Tuttle (13, 14, 15) selected a meal consisting of cereal, toast, butter, sugar and whole milk to feed to the subjects who subsequently ran the 50-yard dash, 100-yard dash, 440-yard dash, half-mile run, mile run or two-mile run. There was a time interval of one-half hour, one hour, or two hours between eating the meal and running

the given distance. The researchers found that the time interval had no effect upon performance. The meal which consisted of 500 calories did not cause nausea, vomiting, or cramps.

Van Itallie et al. (2) recommended having the pre-game meal at least three to four hours before the event to lessen the possibility of stomach cramps, nausea, vomiting and diarrhea. They also suggested respecting individual food preferences since individuals know what will cause them discomfort and what will not. In general, only foods which are known to be highly digestible should be eaten at the pre-game meal.

The American Association for Health, Physical Education and Recreation (16) supported the idea of allowing players to choose their own pre-game meal within certain boundaries set by the coach. The AAHPER continued by stating that "The essential point is that nutrition should not interfere with competitive performance, with its physical and psychological stresses (16)."

Rasch et al. (10) discussed a study of the effects of high and low carbohydrate meals (eaten three hours before the event) on performance in the 100-yard swim which concluded that performance and blood sugar concentrations were not significantly affected by the pre-competition meal. They also concluded that in brief, strenuous exercise performance was affected by the training and energy reserves of the athlete.

Rasch continued:

> Although the preponderance of available evidence indicates that the composition of the pre-exercise meal does not affect efficiency during athletic events of brief duration, there appears to be little doubt that the capacity to endure prolonged muscular work is enhanced if carbohydrate stores are repleted prior to the exercise period (10).

Astrand (17) indicated that the consumption of a high carbohydrate diet the day before an event improves the capacity for heavier, prolonged exercise. It increased the respiratory quotient and gave a higher glycogen content in the muscle--the higher the glycogen storage, the longer the prolonged exercise. Astrand stated:

> It should be emphasized that excessive quantities of sugar should not be ingested some hours prior to the event, since Christensen and Hansen showed that this may drastically impair the maximal work capacity (17).

Astrand further explained that the more strenuous the exercise, the higher the energy yield from carbohydrates.

In reference to diet on the days preceding the competition, Astrand commented that after the muscles are exercised to exhaustion, the athlete should eat fat and protein exclusively for three days, and then switch to a diet high in carbohydrates.

Protein combustion was no higher when in a resting state than when strenuously exercising. Astrand stated "protein is not used as a fuel to any appreciable extent when the caloric supply is adequate (1)." The choice fuels were carbohydrates and fats.

In a study reported by Astrand (17), the subjects were able to work three times longer when placed on a diet high in carbohydrates than when placed on a high fat diet. He further stated that in order to replace the glycogen deposits in the muscles, it was necessary to ingest a high carbohydrate diet the day before competition. It should be noted, however, that in events where one's body weight must be lifted, "an excessive glycogen store should therefore be avoided (17)" because each gram of glycogen had 2.7 grams of water with it when it was stored in the muscle.

Astrand (1) described an experiment in which two subjects rode one ergometer where each had one resting leg and one working leg. The subjects exercised until the working leg was exhausted as was the glycogen content. The glycogen content in the resting leg remained the same. During the next few days the subjects were fed a carbohydrate-rich diet. There was no effect on the resting leg but the working leg almost doubled the initial glycogen content. "Exercise with glycogen depletion enhances the resynthesis of glycogen and the factor (presently unknown) must be operating locally (1)." Astrand concluded that the "higher the initial glycogen content the better the performance (1)."

The pre-competition meal should be fed at least two-and-one-half hours prior to the event. Astrand further commented that the pre-competition meal should be light and consist of porridge, eggs, bread, butter, milk and coffee (17).

With such diversity of opinion on the composition of pre-competition meals, it is evident confusion exists especially on the influences pre-competition meals have on performance.

CHAPTER II

METHODOLOGY

The test used in this study to measure the subject's performance was a two-mile run field performance test. K. H. Cooper (18) stated, "A run of at least 1.5 miles or a duration of at least 12 minutes is necessary to estimate accurately by field-testing methods the maximum oxygen consumption." The 12-minute run was not used because of the many problems involved in measuring large groups. A two-mile run was selected because it does meet K. H. Cooper's specifications for cardiovascular fitness. The test itself consists of a maximal run for a distance of two miles. The length of time it took a subject to maximally run the two miles is a measurement of actual performance during the test.

A pre-test was given the subjects two weeks prior to the actual testing. The purpose of the pre-test was to give the subject a chance to physically learn what it was like to run two miles maximally. This also gave the recorders a chance to learn the organization and skill required to record the results of the two-mile run.

The subjects were Oklahoma State University football players who lived in the athletic dormitory. This restriction was made because of the N.C.A.A. rule that stated the Athletic Department cannot pay for meals for the athlete unless he is on a room and board scholarship. The number of subjects tested was 76. All the subjects ranged in age from 18 to 21 years. They were divided into six blocks based on the position they played during the 1973 football season. The six blocks were receivers, offensive linemen, offensive backs, linebackers, defensive linemen and defensive backs. The subjects in each group were of similar size, body build and speed as a result of grouping the subjects by position. The groups had definite breaks between each position in their average speed in the pre-test (receivers - 13.38, offensive backs - 14.05, defensive secondary - 14.13, offensive line - 15.06, linebackers - 15.41, and defensive line - 16.15). For each position the subjects were placed in blocks of multiples of four subjects according to the pre-test times. Blocking by fours was based on the four different treatments (Appendix B, page 30). Seventy-six subjects were actually tested but subjects without a time in the pre-test were deemed alternates to be used in case one of the other 68 subjects was unable to take or to complete the test. No alternates were used and were eliminated from the results. A computer randomization of the four treatments was used to assign the subjects to the four treatments in each block. Out of each position the

subjects were numbered consecutively based on the time he ran in the pre-test--fastest subject to the slowest. The subjects in each position were randomly assigned one of the four treatments in the order of the first four fastest, second four fastest to the last four slowest. In each block all the subjects had a different treatment.

The subjects were fed a steak dinner the night before the testing. The meal consisted of a 10-ounce sirloin strip steak, French fries, green beans, hot rolls, butter, pie and milk. No one was allowed to leave the athletic dormitory the night before the test or to eat anything other than what was given to them at bed check. At 10:30 p.m. the subjects were put to bed and told for the first time what they were to eat the next morning. Each subject was given a candy bar and an apple, basically the same procedure as for a Friday night before a game.

The morning of the test the subjects were awakened approximately 15 minutes before they ate their pre-competition meal. The steak pre-competition meal was served at 7:00 a.m. (four hours before testing), the pancake meal was served at 7:15 a.m. (three hours and forty-five minutes before testing), and the oatmeal and eggs pre-competition meal was served at 8:30 a.m. (two and one-half hours before testing). The fourth treatment tested was no pre-competition meal. The subjects who had no pre-competition meal were not fed for 12½ hours after the aforementioned candy bar and apple. This groups of subjects acted as a control

group for this study. Water intake was not restricted in any of the four treatment groups.

The test was run in an operational setting on the Oklahoma State University 440-yard outdoor Tartan track at 11 a.m. on Saturday, March 23, 1974. At 11 a.m. on the testing date the temperature was 30° F. and the humidity was 90 percent. The data were recorded with a sling psychrometer at the location of the test.

The cold and high humidity on the testing date were limitations to this study and the assumption was made that the subjects did run the two miles with a maximal effort. It was also impossible to control the subjects' physical and psychological well being along with their attitudes and pre-conceived biases toward the different pre-competition meals.

This study was delimited in that it was a short term test with no re-testing being done and the subjects were all well-trained athletes and their pre-test times did not have a very wide range of variance. Also, only four treatments were tested. This made the design a mixed model in which treatments were fixed and blocks considered random.

The results of the test were recorded by three test assistants. Two test assistants using stop watches recorded the subject's finish time on tape recorders and the other assistant recorded the times on an audio-video camera. The audio-video camera was set up to photograph the subjects each time they crossed the starting line to record their number of laps. This film was used as a double check to

make sure all the subjects ran the required eight laps (two miles) on the 440-yard track. All three times were used in the results of this study. The results were recorded (Appendix A, page 27) and analyzed by a computer using the analysis of variance with a randomized complete block design. The Statistical Analysis System (S.A.S.) is a computer system developed at North Carolina State University (19) and was the computer program used in this study. The null hypothesis of this study was tested at the .05 level.

After completion of the testing each subject was asked to answer a short questionnaire (Appendix C, page 31) to determine how they felt about their pre-competition meal or the absence of one before running the two-mile run.

CHAPTER III

RESULTS

Appendix A (page 27) presents the scores for the two-mile run recorded for the subjects in this study. This data, when grouped by position x treatments (Table I, page 17) showed that the fastest average time was the receivers who ate pancakes (13.90 minutes) while the slowest average time was the defensive linemen who ate oatmeal (16.99 minutes). This resulted in having a position x treatment range of 3.09 minutes. The position x treatments response is illustrated in a line graph (Figure 1, page 18). Table I also showed that the average time by position for all treatments differed by 1.93 minutes (receivers - 14.29, fastest; defensive line - 16.22, slowest). The weighted average times by treatments ranged from 15.07 minutes (pancakes, fastest) to 15.61 minutes (no pre-competition meal, slowest), for a difference of 0.54 minutes. It should be noted that there was a larger difference among position times than there was among treatment times.

By applying the analysis of variance on the data in Appendix A (page 27), it was found that the F value of 1.06 for the treatment effects was not significant at the .05 probability level. The error term for making this test was

TABLE I

AVERAGE TIME IN MINUTES FOR EACH POSITION
TIMES PRE-COMPETITION MEAL

Position	Treatment None	Steak	Pancakes	Oatmeal	Average
D. Back	14.87 (6)*	15.11 (6)	15.47 (6)	14.18 (6)	14.91 (24)
D. Line	16.38 (9)	16.00 (9)	15.51 (9)	16.99 (9)	16.22 (36)
Linebacker	15.95 (6)	16.31 (6)	15.99 (6)	15.77 (6)	16.01 (24)
O. Back	15.01 (9)	14.78 (9)	14.30 (9)	13.97 (9)	14.53 (36)
O. Line	16.20 (15)	15.04 (15)	15.22 (15)	15.60 (15)	15.51 (60)
Receiver	14.21 (6)	14.55 (6)	13.90 (6)	14.51 (6)	14.29 (24)
WEIGHTED AVERAGE	15.61 (51)	15.27 (51)	15.07 (51)	15.28 (51)	15.31** (204)***

* The value in the parenthesis denotes the number of observations for this pre-competition meal.

** Overall Means

*** Total Observations

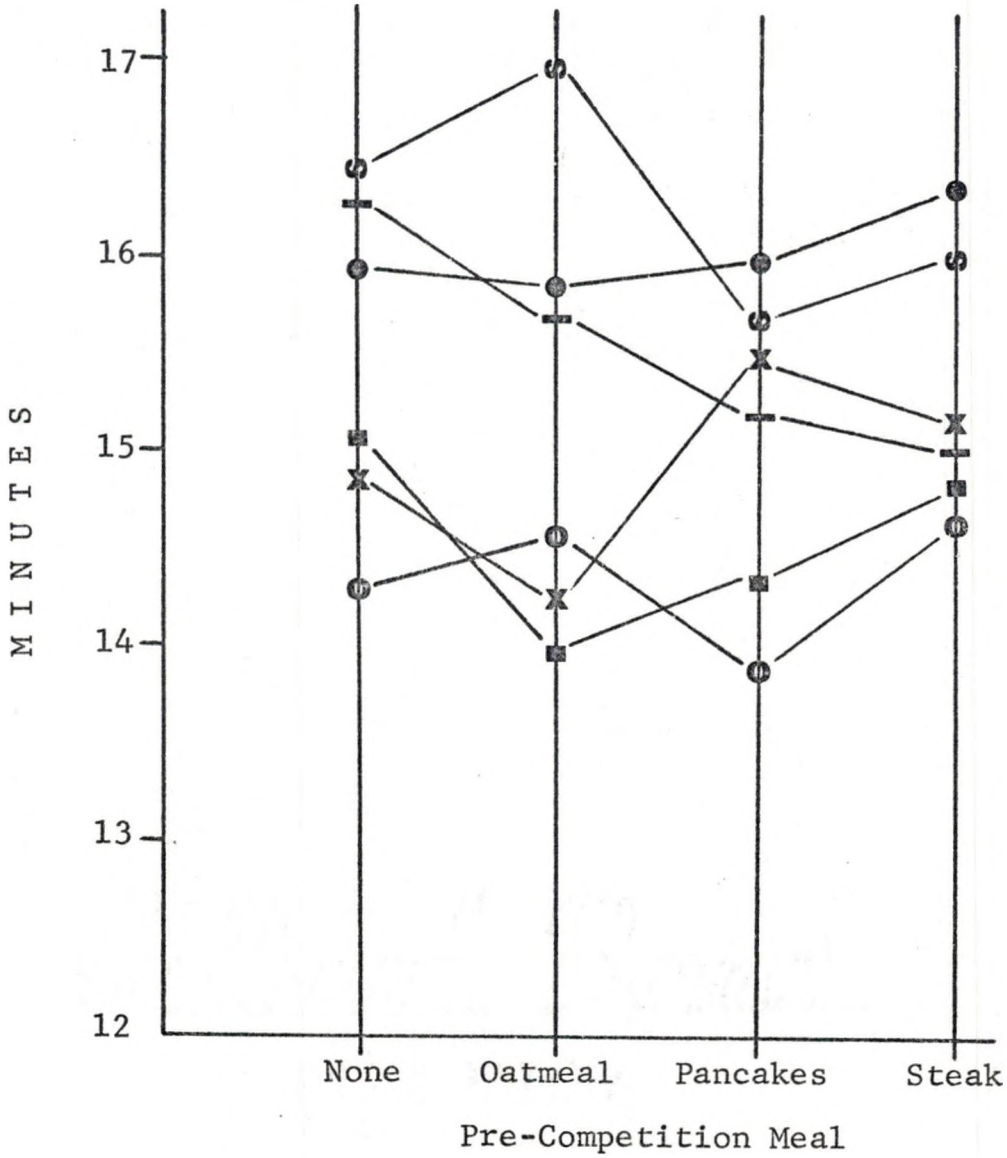

Figure 1. Average Times by Position in the Two-Mile Run

Code:

- O Receivers
- X D. Backs
- ■ O. Backs
- S D. Linemen
- — O. Linemen
- ● Linebackers

block x treatment in position with 33 degrees of freedom (Appendix D, page 32). The analysis also showed no position differences. The null hypothesis of no difference between performances based on the treatments was accepted. The alternate hypothesis, the tested pre-competition meals do have an effect on performance, was rejected.

The results of the questionnaire (Table II, page 20) indicated the greater number of players felt normal during the two-mile run after their individual pre-competition meals (Table II,A) and their pre-competition meal did not affect them during the two-mile run (Table II,B). This data also showed that the subjects who ate the steak pre-competition meal liked their meal, whereas the subjects who ate the other meals disliked or felt it did not matter what they ate (Table II,C).

TABLE II

RESULTS OF THE QUESTIONNAIRE

A During the two-mile run I felt...

	FULL	HUNGRY	SICK	NORMAL	BETTER THAN USUAL
NOTHING	0	7	1	9	0
STEAK	1	0	0	15	1
PANCAKES	0	1	2	12	2
OATMEAL	2	1	3	9	2

B The pre-competition meal I ate affected me...

	NOT AT ALL	ADVERSELY	HELPED ME
NOTHING	13	4	0
STEAK	11	2	4
PANCAKES	9	6	2
OATMEAL	12	5	0

C The pre-competition meal I had...

	I LIKED	I DISLIKED	DIDN'T MATTER
NOTHING	1	9	7
STEAK	15	0	2
PANCAKES	0	14	3
OATMEAL	1	12	4

CHAPTER IV

DISCUSSION

This study shows that the value of the pre-competition meal falls into two separate areas--physiological and psychological. The physiological area involves the effect of the contents of the pre-competition meal on performance, and the psychological area involves attitudes and individual preferences.

In this study the results have indicated that the four treatments had no effect on the performance of the subjects in the two-mile run. The data showed that there was a larger difference between position times than between treatment times. Thus, the treatments appeared to have less effect than grouping the subjects by position.

From the questionnaire, the frequencies showed that the individual subjects felt that their treatment did not adversely affect performance by making them ill during the two-mile run. White (9) discovered that in his study in feeding pre-game meals at different times there was no difference in performance nor were there any adverse effects noticed. Asprey, Alley, and Tuttle (13, 14, 15) found similar results in their study and stated that the pre-competition meal did not cause cramps, nausea, and vomiting.

Cooper et al. (8) found no nausea, vomiting, or cramping in their study of liquid meals. In a study cited by Rasch (10) the performance and blood sugar concentrations were not affected by a pre-competition meal. Fordtran and Saltin (11) took results one step further by stating that intestinal absorption remained unaffected by exercise while gastric emptying was slightly curtailed. It would appear that the data reported above agree with the basic result of this study--that pre-competition meals did not affect performance. It also approved the assumption that pre-competition meals seldom cause vomiting, nausea, or cramps.

From the above information, it could be hypothesized that it made little difference what a pre-competition meal contains as long as the foods included are familiar to the athlete and he likes them. Van Itallie et al. (2) agreed with the aforementioned statement because they believed that individual preferences of foods must be considered as long as the foods are readily digestible. The American Association for Health, Physical Education and Recreation (16) concurred with Van Itallie et al. when it stated that athletes should be allowed to choose their own pre-competition meal. The association went further to state "nutrition should not interfere with competitive performance, with its physical and psychological stresses (16)."

Astrand (17) believed that the meals the day before competition, if high in carbohydrates, would have a greater effect on performance than the pre-competition meal. Large

amounts of carbohydrates increased the glycogen content of the muscle which, in turn, increased the athlete's capacity for strenuous work the following day.

Since the results showed that the pre-competition meal did not have an effect on performance, one might assume that on the day this study was run the psychological factors affecting the athletic performance were of little consequence. Van Itallie et al. (2) felt that the food an athlete ingested just prior to competition may have a greater influence on competition than just the physiological and metabolic qualities. It also may have a psychological significance for the athlete. They continued by saying that the atmosphere of the pre-competition meal was often more important than the food itself. Pre-competition jitters, and other stresses, affect the gastric emptying rate. Fordtran and Saltin (11) showed this in their study which included no competition stress.

This study's results have shown that the psychological effects surrounding the pre-competition meal and the competition itself may be more important than the contents of the pre-competition meal.

CHAPTER V

CONCLUSIONS

Based on the results of this study, it can be concluded that:

1. the four treatments tested did not have an effect on the subjects' performance,
2. since the four treatments tested had no effect on performance, the athlete should be allowed to have his preference of one of the four treatments for pre-competition meal,
3. psychological factors involving the pre-competition meal and its setting may be of more importance than the contents.

RECOMMENDATIONS

For future studies of this type with a similar purpose, the following recommendations were made:

1. a longer duration study should be done with re-testing to establish if the results would be the same,
2. re-run the testing using different treatments,
3. use a population of untrained subjects so that there would be a larger difference in the pre-test

between the fastest and slowest times in the two-mile run.

APPENDICES

APPENDIX A

PRE-TREATMENT AND POST-TREATMENT TIMES (IN MINUTES)
IN THE TWO-MILE RUN

Subject No.	Position	Block No.	Meal	Pre-Treatment Time	Post-Treatment* Time 1	Time 2	Time 3
1	Receiver	02	Oatmeal	14:01	14:38	14:38	14:39
2	Receiver	01	Oatmeal	12:43	14:23	14:23	14:23
3	Receiver	01	Pancakes	12:09	12:26	12:27	12:27
4	Receiver	01	Steak	12:56	14:18	14:18	14:18
5	Receiver	02	Pancakes	14:34	15:20	15:20	15:24
6	Receiver	02	Steak	14:51	14:49	14:48	14:48
7	Receiver	02	Nothing	13:58	14:52	14:52	14:53
8	Receiver	01	Nothing	12:38	13:34	13:32	13:34
9	O. Back	03	Oatmeal	13:33	13:55	13:54	13:54
10	O. Back	04	Pancakes	14:10	14:31	14:31	14:31
11	O. Back	03	Steak	12:31	13:02	13:02	13:03
12	O. Back	03	Pancakes	12:41	13:15	13:14	13:15
13	O. Back	05	Nothing	15:23	15:27	15:27	15:28
14	O. Back	03	Nothing	13:45	14:50	14:50	14:48
15	O. Back	05	Pancakes	15:34	15:08	15:08	15:07
16	O. Back	04	Steak	14:14	14:30	14:30	14:30
17	O. Back	05	Steak	15:56	16:48	16:48	16:49
18	O. Back	05	Oatmeal	15:10	14:12	14:12	14:12
19	O. Back	04	Oatmeal	13:49	13:49	13:49	13:49
20	O. Back	04	Nothing	14:15	14:52	14:52	14:54
21	D. Back	06	Oatmeal	13:24	14:03	14:03	14:03
22	D. Back	07	Nothing	14:54	15:08	15:08	15:08
23	D. Back	07	Steak	15:32	15:24	15:24	15:24
24	D. Back	07	Pancakes	14:58	15:27	15:27	15:27
25	D. Back	07	Oatmeal	15:00	14:18	14:18	14:18
26	D. Back	06	Nothing	14:19	14:36	14:37	14:36

APPENDIX A
(continued)

Subject No.	Position	Block No.	Meal	Pre-Treatment Time	Post-Treatment* Time 1	Time 2	Time 3
27	D. Back	06	Steak	13:38	14:50	14:50	14:48
28	D. Back	06	Pancakes	14:20	15:30	15:31	15:26
29	O. Line	10	Nothing	15:21	15:24	15:26	15:26
30	O. Line	12	Steak	15:54	15:32	15:32	15:28
31	O. Line	10	Oatmeal	15:13	16:03	16:03	16:04
32	O. Line	08	Nothing	13:33	14:01	14:00	14:01
33	O. Line	11	Steak	15:40	14:24	14:24	14:24
34	O. Line	11	Oatmeal	15:35	14:42	14:42	14:03
35	O. Line	09	Nothing	14:53	14:56	14:56	14:55
36	O. Line	08	Oatmeal	14:32	13:29	13:28	13:29
37	O. Line	10	Steak	14:59	15:46	15:45	15:45
38	O. Line	11	Pancakes	15:33	15:43	15:43	15:46
39	O. Line	09	Pancakes	14:53	14:53	14:55	14:52
40	O. Line	12	Pancakes	16:25	17:22	17:21	17:22
41	O. Line	08	Pancakes	12:15	12:39	12:38	12:39
42	O. Line	11	Nothing	17:33	18:07	18:07	18:08
43	O. Line	09	Oatmeal	14:54	15:19	15:19	15:19
44	O. Line	12	Nothing	17:06	18:21	18:21	18:51
45	O. Line	08	Steak	14:21	14:34	14:34	14:36
46	O. Line	09	Steak	14:52	14:58	14:58	14:58
47	O. Line	12	Oatmeal	17:23	18:40	18:40	18:40
48	O. Line	10	Pancakes	15:17	15:27	15:27	15:27
49	Linebacker	14	Nothing	15:53	18:01	18:01	18:00
50	Linebacker	13	Pancakes	15:29	14:53	14:55	14:53
51	Linebacker	14	Pancakes	16:00	17:05	17:06	17:06
52	Linebacker	14	Oatmeal	17:45	16:25	16:26	16:25
53	Linebacker	13	Steak	15:24	14:52	14:52	14:53
54	Linebacker	13	Oatmeal	14:58	15:07	15:08	15:07
55	Linebacker	13	Nothing	13:00	13:53	13:53	13:53

APPENDIX A
(continued)

Subject No.	Position	Block No.	Meal	Pre-Treatment Time	Post-Treatment* Time 1	Time 2	Time 3
56	Linebacker	14	Steak	16:23	17:45	17:45	17:45
57	D. Line	17	Nothing	17:01	17:14	17:13	17:14
58	D. Line	15	Nothing	14:52	16:13	16:13	16:13
59	D. Line	16	Pancakes	16:11	15:54	15:56	15:54
60	D. Line	16	Steak	14:55	15:43	15:43	15:40
61	D. Line	16	Oatmeal	16:00	17:31	17:30	17:30
62	D. Line	15	Oatmeal	14:23	14:43	14:42	14:42
63	D. Line	16	Nothing	15:30	15:41	15:42	15:41
64	D. Line	17	Oatmeal	17:32	18:45	18:45	18:45
65	D. Line	17	Pancakes	16:35	16:17	16:17	16:17
66	D. Line	15	Pancakes	14:50	14:20	14:19	14:20
67	D. Line	15	Steak	14:39	15:09	15:09	15:08
68	D. Line	17	Steak	17:23	17:10	17:10	17:11
			ALTERNATES				
69	Receiver	30	Nothing		14:29	14:30	14:28
70	D. Back	30	Oatmeal		12:23	12:23	12:23
71	D. Back	29	Oatmeal		14:16	14:16	14:16
72	D. Back	29	Steak		14:52	14:48	14:52
73	D. Back	30	Steak				
74	O. Line	29	Pancakes		15:42	15:42	15:42
75	Linebacker	29	Steak		15:15	15:16	15:16
76	Linebacker	29	Nothing		16:13	16:12	16:13

* Time 1 - times recorded by first test assistant; Time 2 - times recorded by second test assistant; Time 3 - times recorded by third test assistant.

APPENDIX B

TREATMENTS

Steak Pre-Competition Meal - Approximately 893 Calories (20)

6 oz. orange juice
8 oz. steak (med.)
1 scrambled egg
plain jello mold (strawberry)
2 slices dry toast
hot tea
2 packets sugar
2 packets honey
1 pad of butter

Pancake Pre-Competition Meal - Approximately 1889 Calories (20)

6 oz. orange juice
4 6" diameter pancakes - hot syrup (4 oz. ladle)
plain jello mold (strawberry)
2 slices dry toast
hot tea
2 packets sugar
2 packets honey
1 glass of milk
3 pads of butter

Oatmeal Pre-Competition Meal - Approximately 1062 Calories (20)

6 oz. (bowl) oatmeal
1 scrambled egg
2 slices dry toast
2 glasses of milk
2 pads of butter
2 packets sugar

Control Pre-Competition Meal - 0 Calories

No food ingested

APPENDIX C

QUESTIONNAIRE

_____
Name

1. For pre-competition meal, I ate:
   _____ nothing
   _____ steak and eggs
   _____ pancakes
   _____ oatmeal and eggs
2. During the two-mile run I felt:
   _____ full
   _____ hungry
   _____ sick
   _____ normal
   _____ better than usual
3. The pre-competition meal I had:
   _____ I liked
   _____ I disliked
   _____ didn't matter what I ate
4. The pre-competition meal I ate affected me:
   _____ not at all
   _____ adversely
   _____ helped me

APPENDIX D

ANALYSIS OF VARIANCE OF THE TWO-MILE RUN

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB > F
Position	5	94.725773	18.9451546	1.09459	0.4165
Block (Position)	11	190.388573	17.3080521		
Pre-Competition Meal	3	7.597303	2.5324342	1.06592	0.3776
Block*Pre-Competition Meal (Position)	33	78.401843	2.3758134		
Position*Pre-Competition Meal	15	28.958146	1.9305430	0.81258	0.6576
Block*Pre-Competition Meal (Position)	33	78.401843	2.3758134		

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