

THE EFFECT OF PHOSPHATE SUPPLEMENTATION  
ON ANAEROBIC THRESHOLD  
DURING EXERCISE

By

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## PREFACE

The effects of Stim-O-Stam phosphate tablets were studied utilizing a Bruce treadmill stress test to near exhaustion. Maximum ventilation and recovery ventilation were recorded with the aid of a Sensormedics computerized Metabolic Measurement Cart. These values were analyzed to determine if any differences existed between the phosphate and placebo treatments. Since world class endurance athletes compete at or near their anaerobic threshold, any changes in ventilation due to an ergogenic aid would be of great importance to the athletes.

I wish to express my sincere gratitude to everyone who helped me through this project and my classwork at Oklahoma State University. Special thanks goes to my committee members; Dr. Steve Edwards, Dr. Frank Kulling, and Dr. Betty Edgley for their expertise. I could not have chosen better advisors.

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for their encouragement and understanding.

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## NOMENCLATURE

ADP	Adenosine Diphosphate
AT	Anaerobic Threshold
ATP	Adenosine Triphosphate
Ca	Calcium
CaCO <sub>3</sub>	Calcium Carbonate
CO <sub>2</sub>	Carbon Dioxide
CP	Creatine Phosphatase
kg	Kilograms
mg	milligrams
MMC	Metabolic Measurement Cart
mmol/l	Millimoles per liter
NaHCO <sub>3</sub>	Sodium Bicarbonate
NH <sub>3</sub> Cl	Ammonium Chloride
O <sub>2</sub>	Oxygen
PO <sub>4</sub>	Phosphate
R	Respiratory Quotient
VE	Ventilation
VCO <sub>2</sub>	Carbon Dioxide uptake
VO <sub>2</sub>	Oxygen uptake
VO <sub>2</sub> Max	Maximum amount of Oxygen uptake

## CHAPTER I

### INTRODUCTION

The concept of anaerobic threshold is not new, however its importance in athletic conditioning is continuously becoming more evident.<sup>29</sup> Coaches and athletes alike are utilizing the latest technology in hopes of increasing their aerobic capacities.

Energy utilized in exercise is derived from both aerobic and anaerobic metabolic pathways. Aerobic metabolism occurs in the presence of adequate  $O_2$  and yields  $CO_2$  and  $H_2O$  from the oxidation of foodstuffs. Soon after the onset of maximal effort, the  $O_2$  supply cannot meet the demands of the contracting muscles and the body must receive a larger proportion of its energy needs from anaerobic pathways. This point at which oxygen debt occurs is termed anaerobic threshold.<sup>1</sup>

The classical definition of anaerobic threshold (AT) is the level of work, or oxygen consumption ( $VO_2$ ) just below which metabolic acidosis and associated changes in gas exchange occur.<sup>28</sup> The responses up to AT are quite consistent. Prior to AT, ventilation increases linearly with  $VO_2$  but the arterial pH, lactic acid, and catecholamines change little if at all.<sup>17</sup>

Above AT blood lactate and catecholamines increase while pH decreases (acidosis).<sup>17</sup>

Mitchell and Blomqvist<sup>24</sup> reported that during increasingly harder work the capacity to take in oxygen reaches a limit and after this point lactic acid rises because there is not enough oxygen to metabolize glycogen completely. Since lactic acid has been found to play a major role in muscular fatigue, the significance of anaerobic threshold has become very important in the conditioning of athletes.<sup>10</sup> Anaerobic threshold is significant to endurance athletes because it represents the highest metabolic rate which can be maintained for long periods of time. Farrell<sup>10</sup> studied 13 marathon runners and found that their race pace had a high correlation ( $r=0.98$ ) with their velocity at AT. For this reason, many coaches strive to increase the percentage of  $\text{VO}_2$  max at which AT begins in their athletes.

It has been shown that the AT for sedentary individuals occurs at approximately 50-60% of  $\text{VO}_2$  max<sup>5</sup>, while AT for endurance trained athletes occurs at about 70-80% of  $\text{VO}_2$  max.<sup>11</sup>

Since many ergogenic aids claim to enhance endurance, their use has become an increasingly more important training tool. Many athletes are willing to try any new product in hopes of improving their

ventilatory capacities. Ergogenic aids have always been the focus of physiological as well as ethical doubt.

#### Purpose of the Study

The purpose of this study was to examine the effects of a phosphate rich compound (Stim-O-Stam tablets) on maximum and recovery ventilatory rates during heavy exercise.

#### Limitations

1. The sample size was limited to 10.
2. Motivation was limited to verbal encouragement.
3. Environmental factors such as eating and sleeping were not controlled.
4. The subjects were all physically conditioned volunteers from a fit population.

#### Delimitations

Subjects ranged from 19-25 years of age and were healthy, moderately conditioned male and female volunteers from Oklahoma State University. Both males and females were used.

#### Assumptions

1. It was assumed that all subjects exerted a maximum

effort.

2. Verbal encouragement from the researcher had the same effect on all subjects.
3. All subjects were healthy, moderately-conditioned college students.

### Hypothesis

The null hypothesis was employed to examine the following questions:

1. There will be no significant difference in maximum ventilation as a result of phosphate supplementation.
2. There will be no significant difference in recovery ventilation rates as a result of phosphate supplementation.

### Definitions

Adenosine Diphosphate (ADP)-A chemical substance which, when combined with inorganic phosphates, forms ATP.

Adenosine Triphosphate (ATP)-A chemical compound formed with the energy released from food and used in all cells.

Acid-A chemical compound which gives up hydrogen ions ( $H^+$ ) in solution. ( $<7$  on pH scale)

Acidosis-A state of being more acidic than normal.

Alkaline-Any substance which is basic. ( $>7$  on pH scale)

Anaerobic-The process of using energy in the absence of  $O_2$ .

Aerobic-The process of using energy with  $O_2$

Catecholamine-A neurotransmitter, either dopamine, epinephrine, or norepinephrine which conduct electrical impulses in the nervous system.

Creatine Phosphate (CP)-A chemical compound stored in muscle which, when broken down aids in manufacturing ATP.

Double Blind Study-An experiment procedure in which neither the researcher(s) nor the subjects know which group is receiving a placebo and which group the real drug.

Endurance-The length of work or exercise.

Energy-The capacity or ability to do work.

Ergogenic aid-Any factor which improves work or performance.

Ergometer-An instrument for measuring the amount of work done under controlled conditions.

Expiratory-Any expelled gases from the lungs.

Fatigue-A state of discomfort and decreased efficiency resulting from prolonged or excessive exertion.

Glycogen-The form in which glucose is stored in the body.

Glycolysis-The incomplete chemical breakdown of glycogen. In anaerobic glycolysis, the end product is

lactic acid.

Lactic Acid (Lactate)-A waste product of metabolism resulting from the incomplete breakdown of glucose.

Muscular Endurance-The ability of a muscle or muscle group to perform repeated contractions against a light load for an extended period of time.

Oxygen Debt-The amount of oxygen taken up in excess of the resting value during a recovery period.

pH-The power of the Hydrogen ion; the negative logarithm of the hydrogen ion concentration.

Phosphagen-A group of compounds including ATP and CP.

Placebo-An inert substance having identical physical characteristics of the real drug.

Supplementation-Any ergogenic aid added to a subjects diet.

Treadmill-An apparatus with continuously moving belts which can be adjusted for varying speeds and inclines.

Work-The application of a force through a distance.

## CHAPTER II

### LITERATURE REVIEW

#### Muscular Fatigue

Muscular fatigue during exercise has been studied in several cases. When muscles are no longer able to contract due to fatigue, circulation is reduced allowing for a build-up of lactic acid and an accumulation of metabolic products.<sup>27</sup>

Kostka and Cafarelli<sup>21</sup> claimed that the production of lactic acid in skeletal muscle and the capacity of the extracellular fluids to buffer dissociated hydrogen ions may limit endurance and lead to muscular fatigue during exercise. When fatigue does occur, sensory processes are altered so that a constant work output feels progressively harder.

Tesch<sup>27</sup> also studied muscular fatigue during intense exercise. He used 64 physically fit subjects to observe lactate,  $\text{VO}_2$ , and the electromyography of the working muscle. He found that lactate and metabolic changes in the contractile fibers was responsible for muscular fatigue.

In another study<sup>19</sup>, five male subjects performed



exercise at 33, 66, and 95% of their maximum power output on three occasions in random order. Prior to testing each subject ingested either  $\text{CaCO}_3$  (control),  $\text{NH}_4\text{Cl}$  (acidosis), or  $\text{NaHCO}_3$  (alkalosis) in doses of 0.3 g/kg body weight. The exercise was continuous and maintained for 20 minutes at the two lower power outputs and for as long as possible at the highest. It was found that endurance was highest with alkalosis and lowest with acidosis. Also, although changes in ventilation (VE) were small, in each subject VE was highest in acidosis and lowest in alkalosis. They concluded that acid-base changes have important effects on endurance and the metabolic responses to exercise.

In a similar study<sup>23</sup>, six healthy subjects performed four exercise tests in random order on separate days: a control study, metabolic acidosis induced by  $\text{NH}_4\text{Cl}$ , and metabolic alkalosis induced by  $\text{NaHCO}_3$ . The subjects used a cycle ergometer to calculate power. Arterialized venous blood was sampled and plasma lactate concentrations were measured immediately after and at two minute intervals for 10 minutes following the exercise. They concluded that blood acid-base alterations have only a small effect on short-term maximal performance.

Several other studies have been conducted to observe lactic acid and its role in fatigue.

Cheetham, Boobis, Brooks, and Williams<sup>9</sup> found that blood lactate increased slightly after a treadmill warm-up, and increased greatly after 30 seconds of maximal effort exercise. They measured lactate at three and five minutes post exercise and found lactate to increase from 0.73 mmol/l at rest, to 13.06 mmol/l five minutes following the exercise. Fox and Mathews<sup>13</sup> reported that during anaerobic work lactic acid concentrations increase while blood pH decreases. Gollnick, Bayly, and Hodgson<sup>14</sup> report that the normal pH of skeletal muscle is about 7.0 (neutral) at rest. When lactic acid is produced there is a associated generation of protons which lowers the pH of blood. The most commonly reported pH following severe exercise is between 6.4 and 6.5.<sup>14</sup>

Both increasing lactate and decreasing pH have been found to play a major role in muscular fatigue. From these facts, Denning, Tablott, Edwards, and Dill<sup>7</sup> reasoned that increasing the body's pH (making it more alkaline) prior to anaerobic exercise might delay the effects of AT and increase performance. This is the concept behind phosphate supplementation.

#### Phosphate and Stim-O-Stam Reviews

Many studies have been conducted which relates the role of phosphorus to muscular exhaustion.

Karlsson<sup>20</sup> studied lactate and phosphagen concentrations in muscles with increasing workloads. Forty nine subjects were tested on bicycle ergometers. Lactate concentrations were measured using an enzymatic method. It was found that phosphagen concentrations were inversely proportionate to lactate accumulations at all workloads. At intense workloads phosphagen was greatly reduced in the first 2-3 minutes. Phosphagen depletion and lactate concentrations were closely related to O<sub>2</sub> deficit. It was concluded that heavy exercise induced an increased utilization of blood-bone lactate.

Harris, Sahlin, and Hultman<sup>15</sup> also studied the relationship of phosphagen and lactate in human muscle following exercise. They determined that muscle pH played a major role in high-energy phosphate concentration.

Fox and Mathews<sup>13</sup> reported that the stores of ATP and CP in muscle can be depleted within 10 seconds following the onset of heavy exercise, resulting in a buildup of lactic acid and, therefore, causing a decrease in the ability to perform.

Phosphate supplementation has been studied in several cases. Jokyl<sup>18</sup> used a double blind procedure to study the effects of phosphates on endurance and muscle soreness. Significant results were found in favor of

the phosphate group.

Daylan<sup>6</sup> also used a double blind study to examine the effects of phosphate on lactic acid accumulation, VO<sub>2</sub> Max, and maximum heart rate. Significant gains were reported in each of these variables by phosphate supplementation.

Davenport<sup>4</sup> used two groups to determine the effects of Stim-O-Stam on 12 minute run tests. The experimental group took four Stim-O-Stam tablets each day for two weeks. Significant differences were observed in favor of the Stim-O-Stam group.

Richard Wood<sup>29</sup> at Abilene Christian College, performed a study to examine Stim-O-Stam effects on lactate, urinary phosphate, blood phosphate, blood pressure, respiratory rate, and heart rate. Nine subjects were tested on a treadmill at an 8 mph pace. The experimental group received four Stim-O-Stam tablets one hour prior to testing. Highly significant reductions in blood lactate, respiratory rate, and heart rate were observed with the phosphate supplementation. Wood states, "According to the data obtained in this research, Stim-O-Stam has been shown to be a very desirable dietary supplement for athletes and active individuals."

### Stim-O-Stam Tablets

Stim-O-Stam tablets are comprised only of inorganic salts. Each tablet contains 200mg dibasic sodium phosphate, 186.7mg monobasic sodium phosphate, 27.5mg potassium phosphate, and 30mg vitamin C.

In all Stim-O-Stam studies reviewed careful attention was given to the possibility of side effects. None were reported. Stim-O-Stam tablets are approved by the United States Food and Drug Administration as a food supplement. The National Collegiate Athletic Association reviews drugs and ergogenic aids of all types and currently has a list of approximately 90 substances which it has banned for use by its athletes. Phosphate salts are not on this list.<sup>25</sup>

The main problem associated with excessive amounts of dietary phosphate is that as phosphate increases body calcium decreases.<sup>1</sup> The amount of phosphate which is excessive varies from person to person. Malm<sup>22</sup> gave adult men high levels of phosphorus (up to 1000mg/day) for several weeks and no effect at all was seen on the calcium balance.

The Recommended Daily Dietary Intake of phosphorus is about 1000mg/day although this value differs slightly for different groups. Schofield<sup>26</sup> showed that with self-selected diets phosphorus intake was usually over 1gm/day.

## Measurement of Ventilation

In 1924, Hill, Long, and Lupton<sup>16</sup> reported that the study of gaseous exchanges could show the fluctuations in acid-base balance during exercise. Wasserman, Whipp, Koyal, and Beaver<sup>28</sup> used four common expiratory gas indices to determine AT. They found that AT occurred when there was:

- 1) a nonlinear increase in minute ventilation ( $V_E$ )
- 2) a nonlinear increase in carbon dioxide output ( $VCO_2$ )
- 3) an increase in the ventilatory equivalent ( $V_E/VO_2$ )
- 4) an increase in respiratory quotient (R).

In a similar study,<sup>2</sup> the four indices were tested to determine which gave the most accurate indications of AT. Sixteen subjects used a cycle ergometer after which the indices were plotted against blood lactate.  $V_E/VO_2$  was found to be the most desirable measure.

## Summary

The literature suggests that the buildup of lactic acid following Anaerobic Threshold is probably the main cause for muscular fatigue.

The onset of fatigue can definitely be altered with adjustments of blood pH by making it more basic or more acidic. Phosphates are an excellent source for blood alkalinity, therefore making improved endurance a

possibility.

Measurement of expiratory gases can be a valuable tool for predicting muscular fatigue.

## CHAPTER III

### METHODS AND PROCEDURES

#### Selection of the Subjects

The subjects for this study were all students at Oklahoma State University. Seven males and three females volunteered to participate. The subjects ranged in age from 20-25 years and all were physically fit individuals who exercised several times per week. The subjects were from varied athletic backgrounds including triathletes, swimmers, tennis players, and basketball players.

Each subject was briefed as to the intent of the research and asked to choose a time at which they could meet with the researcher on two consecutive days. By meeting at the same time on both days it was hoped that outside factors such as eating and sleeping could be held somewhat constant.

Upon arrival at the Oklahoma State University Physiology of Exercise Laboratory each subject was given three tablets, either starch placebos or Stim-O-Stam phosphate tablets. A double-blind procedure was used so



that neither the researcher nor the subject knew which pills were taken on each day. The alternate treatment was given on the second day. To offset the possibility of first day nervousness half the group took placebos on day one, while the other half consumed Stim-O-Stams.

After ingesting the pills, a half hour digestion period was allowed (on advice of Ralph Tate, Stim-O-Stam developer). During this time the subjects were asked to fill out a medical history form and a consent form (Appendix B).

After 30 minutes had passed, the subjects were connected to the MET Cart and the treadmill was started. The MET Cart is a computerized instrument which can be programmed to measure and/or calculate a wide variety of useful indices. For this research the MET Cart was programmed to measure total ventilation (VE). After doing a series of checks and calibrations, a subject need only begin breathing into the MET Cart mouthpiece to start the analyzer. The MET Cart has a communication link with the treadmill so that the Bruce Protocol could be programmed to run automatically. The Bruce Protocol was selected for this experiment because it allows for a proper warm-up, yet permits a rapid route to exhaustion. The treadmill is begun at 1.7 mph and a 10% grade and both speed and elevation are

increased every three minutes (see Appendix C).

When the subject reported muscular exhaustion (usually between 9-12 minutes), the treadmill speed and incline were lowered to 1.0 mph and 0% respectively so as to provide a three minute cool-down and recovery period. Following completion of the exercise the MET Cart printed a summary report showing ventilatory rates for each 30 seconds of the exercise and recovery.

#### Statistical Analysis

The maximum ventilation values for each test were recorded along with the previous two values and the following five values (see Table I). With these data points a 2 x 8 repeated measures analysis of variance could be administered to determine if significant differences existed between the phosphate and placebo treatments. Paired t-tests were also used to analyze the maximum values.

## CHAPTER IV

### RESULTS AND DISCUSSION

This research was intended to determine if any differences in ventilation during exercise occur due to supplementation with phosphates.

Ten subjects (7 males and 3 females) from Oklahoma State University conducted a Bruce Treadmill Protocol to approximately 85% of maximum heart rate. A Sensormedics Metabolic Measurement Cart was used to measure ventilatory rates. A 2 x 8 repeated measures analysis of variance was used to analyze the data at the 0.05 confidence interval.

Raw data are displayed in table 1 and all values are plotted in graphs I-IX. Graphs I and II are scattergraphs of the total values for both treatments, while Graph III shows the average values. Graph III shows that very little difference existed between treatments. The remaining graphs show the same measurements broken down into genders. These graphs also show little difference, indicating gender did not have an effect on the treatments.

From reviews of previous research done in this

area, it was expected that ventilation may be lowered during intense exercise due to less muscular fatigue caused by phosphate alkalosis. Neither maximum nor recovery ventilatory rates proved to be significantly improved due to phosphate supplementation.

This data somewhat supports the findings of Jones, Sutton, Taylor, and Toews <sup>19</sup> who tested several indices for effects caused by acidosis and alkilinosiis and found that although endurance was improved by alkilinosiis, ventilation was improved only minutely.

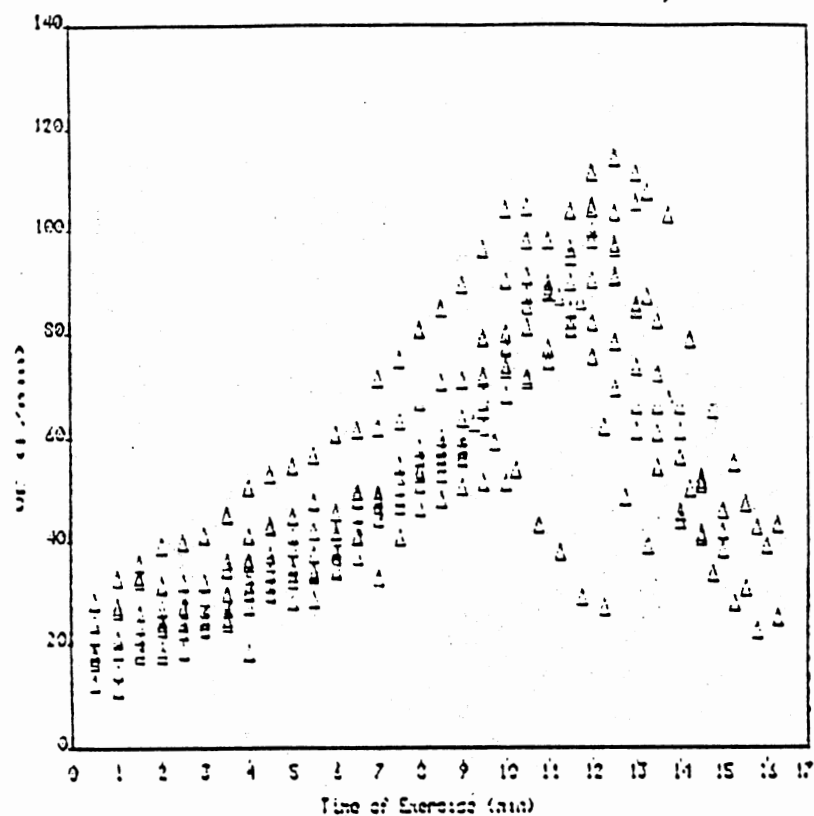
Although several indices seem to be altered by the use of a blood alkilinizier, ventilation is not a major improvement.

TABLE I  
RAW DATA FOR ALL SUBJECTS

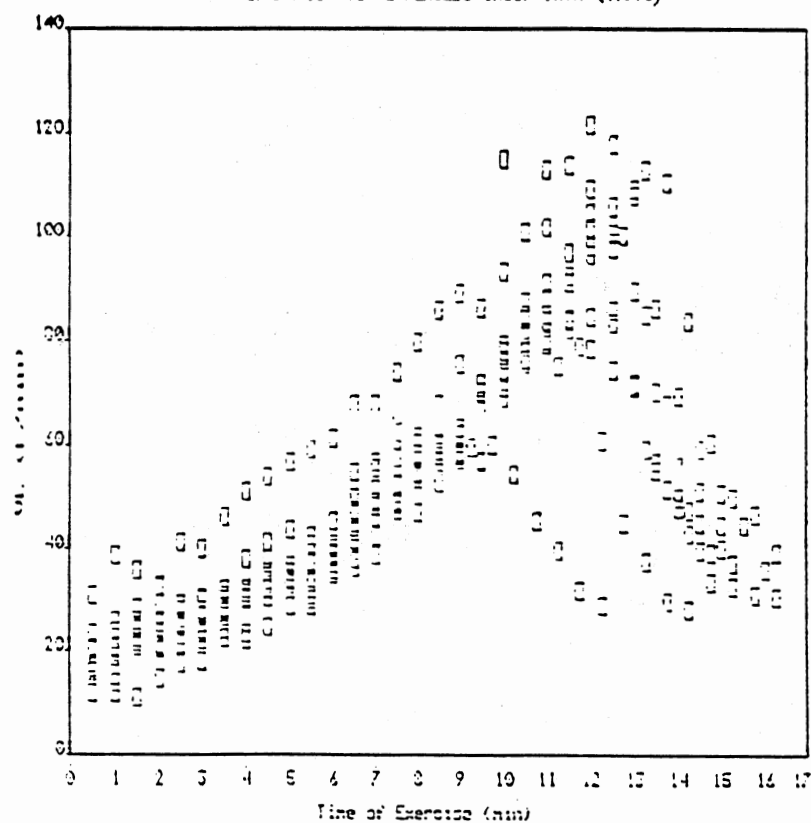
Subj.	Sex	Treatment		Subj.	Sex	Treatment	
		A	B			A	B
1	M	72.8	77.8	6	F	86.8	88.1
		71.0	75.5			95.4	91.1
		*86.7	78.9			*99.1	101.8
		85.9	74.8			89.9	83.1
		85.3	78.7			72.3	71.1
		61.4	60.9			60.0	56.9
		47.8	45.0			45.0	49.8
2	M	38.3	37.4	7	M	40.9	39.6
		95.4	89.1			87.9	91.1
		103.4	107.0			93.8	92.0
		*103.7	114.8			*103.3	104.4
		89.1	107.5			77.3	85.8
		83.6	101.7			65.4	71.7
		74.6	83.9			53.5	55.2
3	F	68.5	78.2	8	M	43.2	47.8
		60.4	74.1			39.8	44.7
		57.1	59.2			102.8	113.0
		56.9	59.9			110.5	113.7
		*62.1	60.3			*113.2	121.3
		58.3	54.4			83.6	102.2
		53.1	45.2			71.3	89.4
4	M	42.5	39.5	9	F	55.5	70.0
		37.0	31.7			50.2	55.9
		28.5	28.8			41.0	44.5
		104.1	97.8			79.7	83.6
		102.4	105.7			81.2	84.5
		*110.5	108.0			*90.1	97.7
		81.4	86.2			86.2	85.0
5	M	65.5	69.3	10	M	66.4	67.5
		51.7	59.4			49.4	47.4
		45.3	50.6			33.1	39.2
		46.4	44.4			27.0	37.2
		96.4	100.5			81.5	92.2
		104.7	109.1			97.2	109.2
		*106.6	112.9			*108.0	117.7
		102.3	110.5			84.8	80.0
		78.0	83.4			65.4	55.4
		64.5	60.5			60.4	46.7
		54.4	50.0			51.2	38.0
		42.1	46.7			37.4	33.0

\*Maximum readings with preceeding two and following five values.

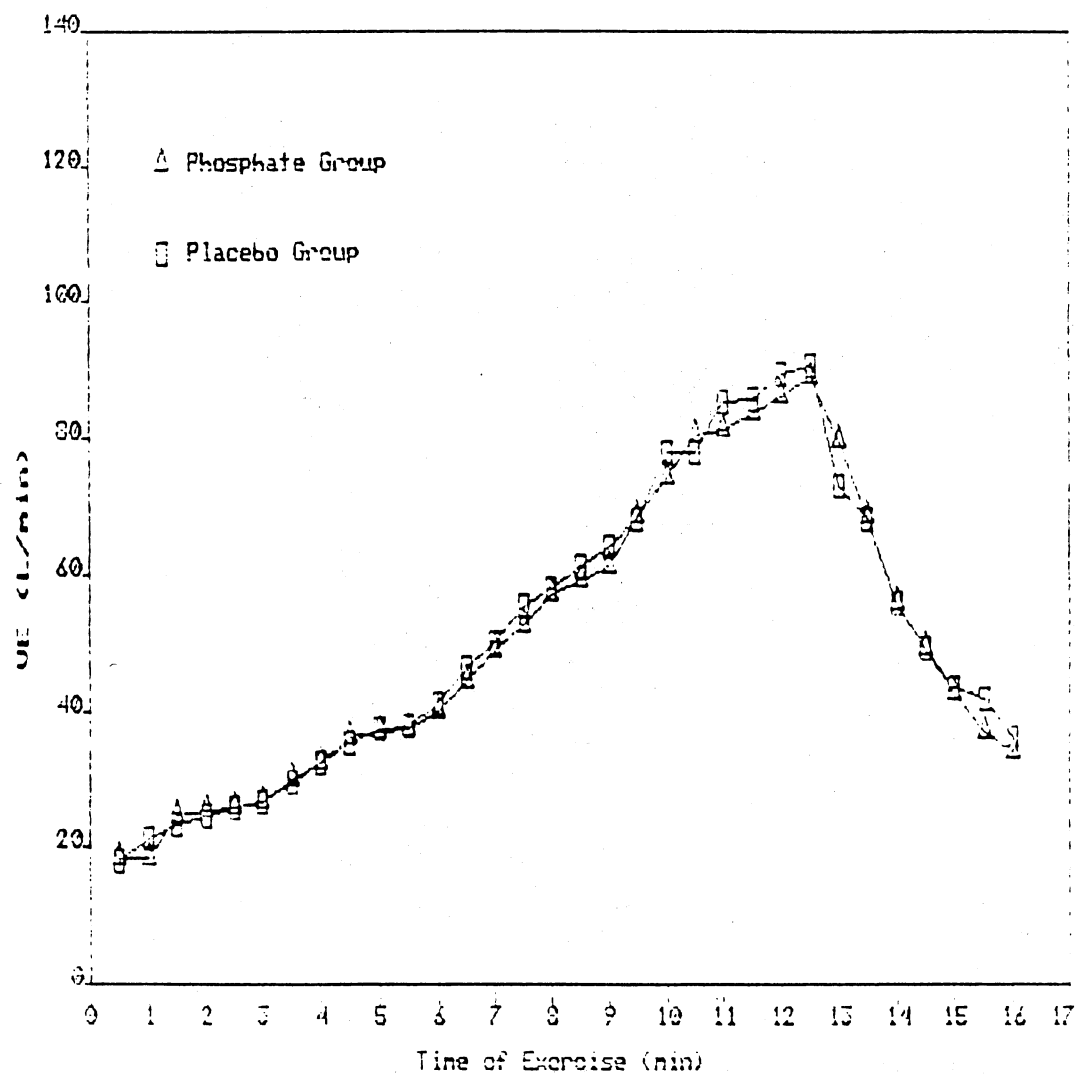
GRAPH I TOTAL PHOSPHATE GROUP DATA (n=10)



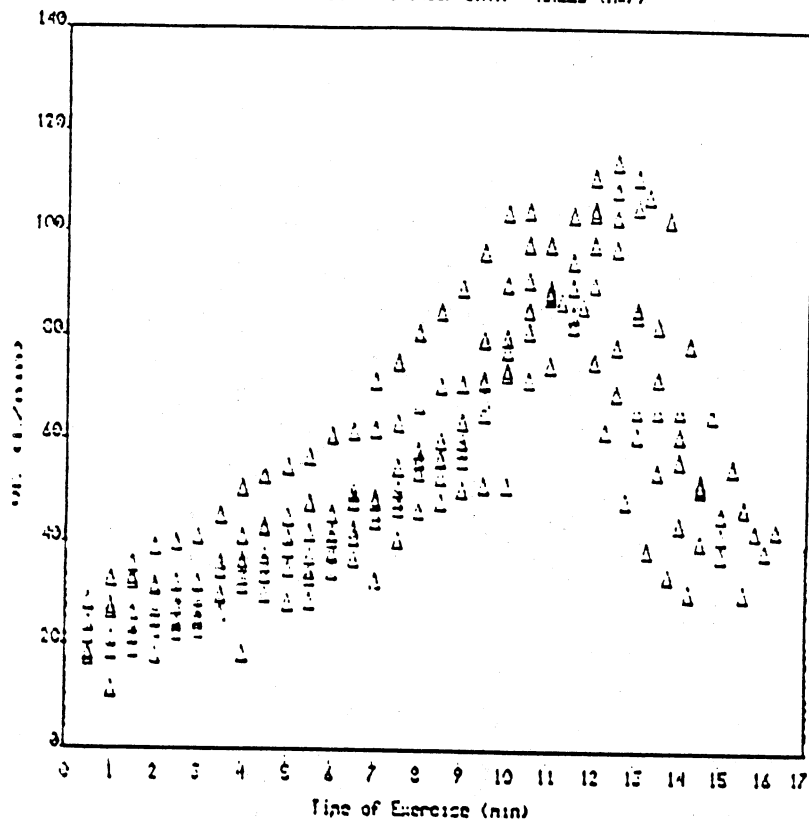
GRAPH II TOTAL PLACEBO GROUP DATA (n=10)



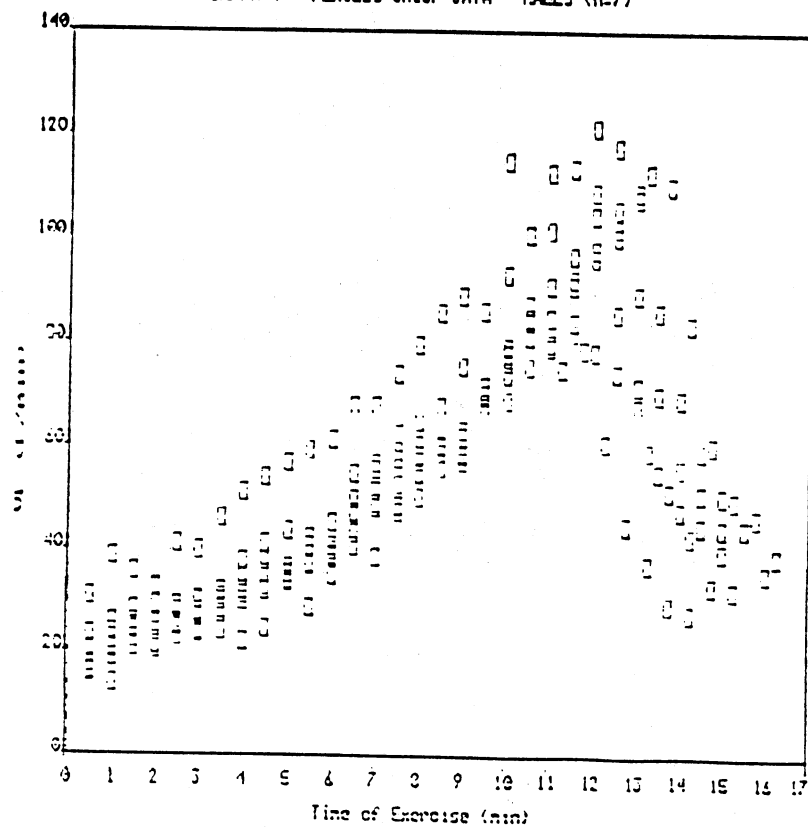
GRAPH III AVERAGE DATA - TOTAL (n=10)



GRAPH IV PHOSPHATE GROUP DATA - MALES (n=7)

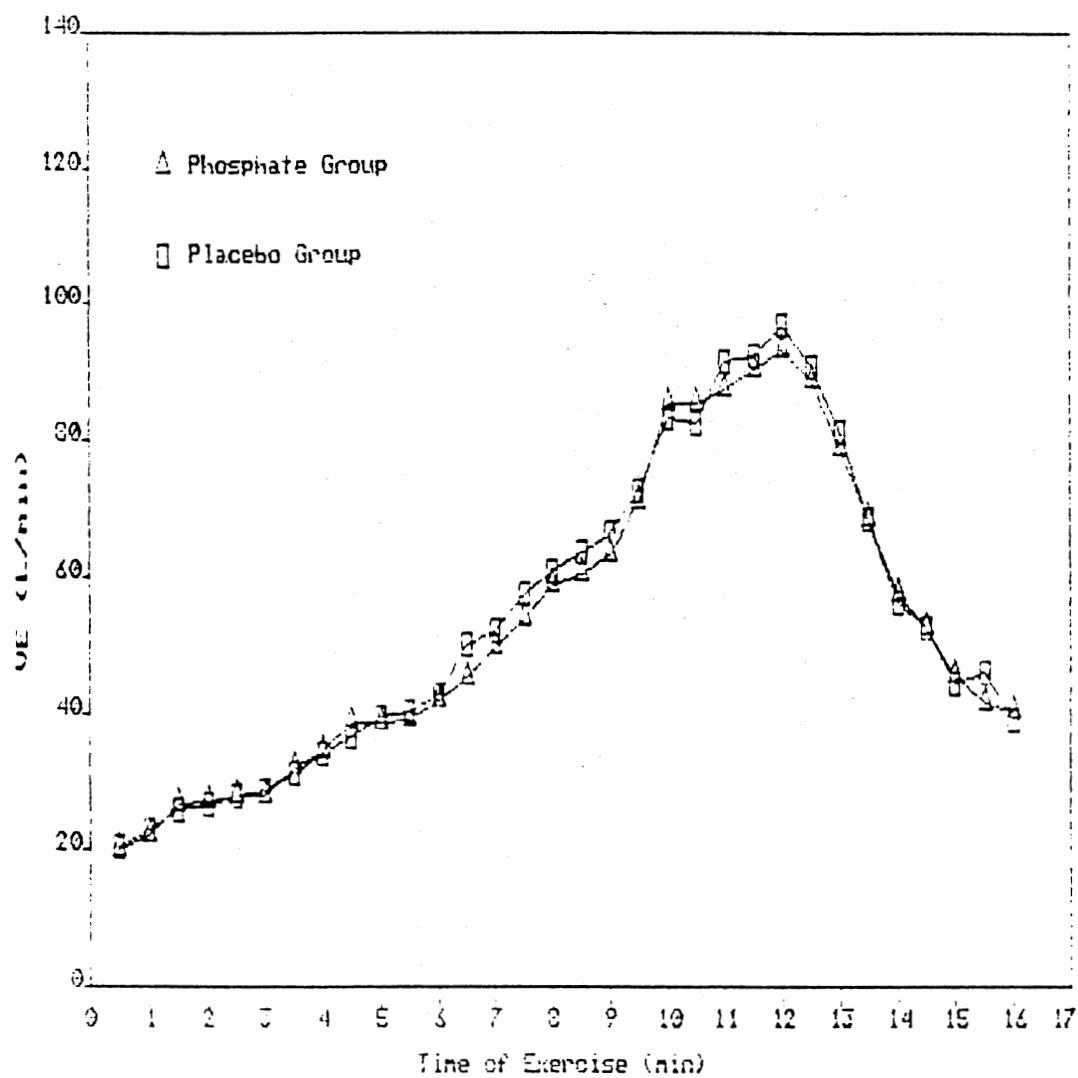


GRAPH V PLACED GROUP DATA - MALES (n=7)

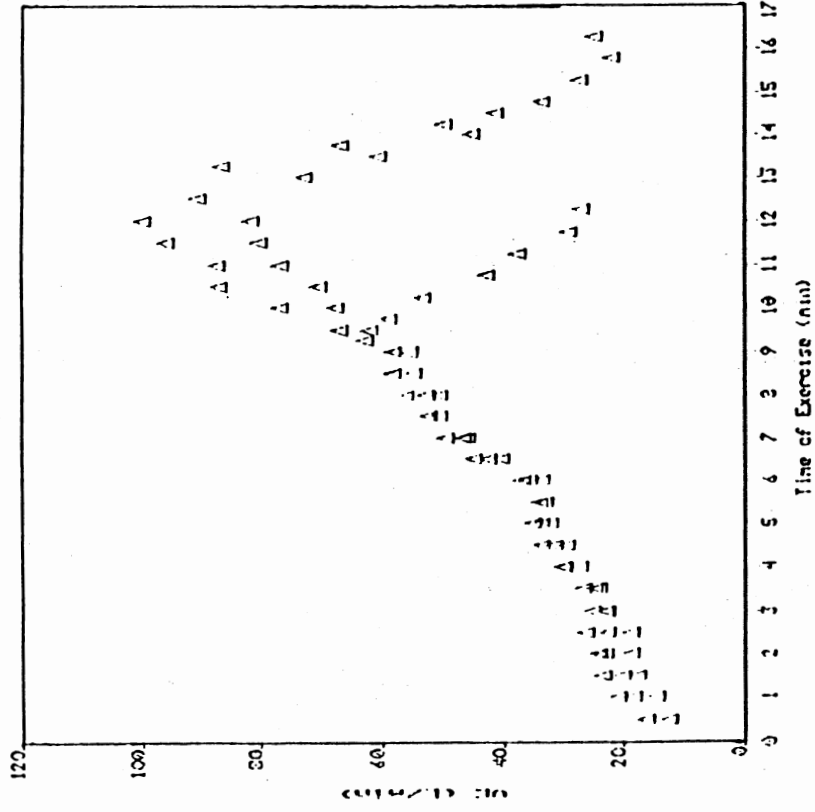




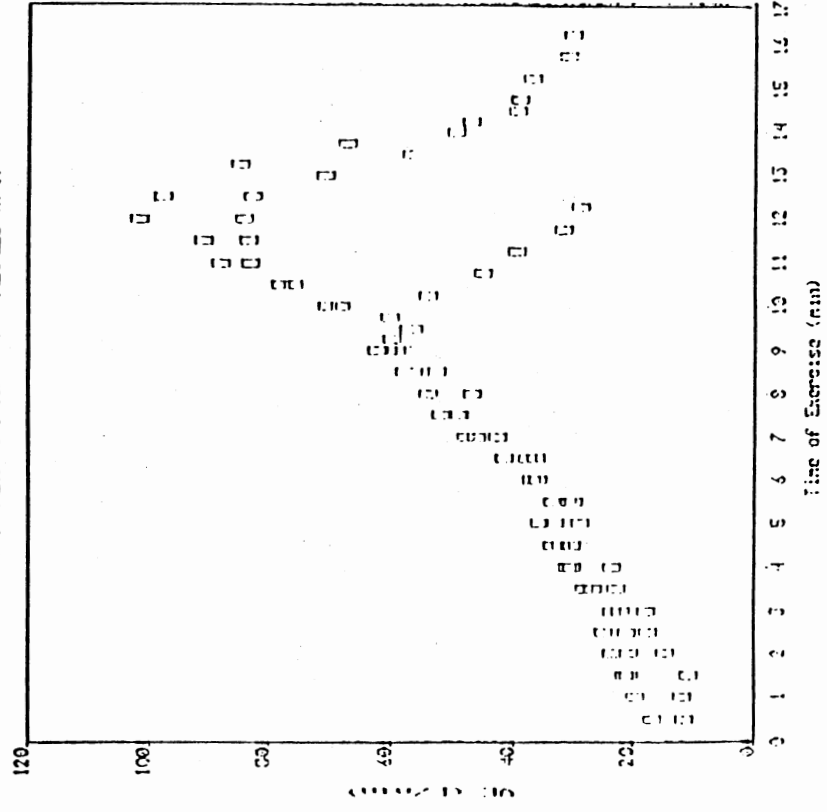
GRAPH VI AVERAGE DATA - MALES (n=7)



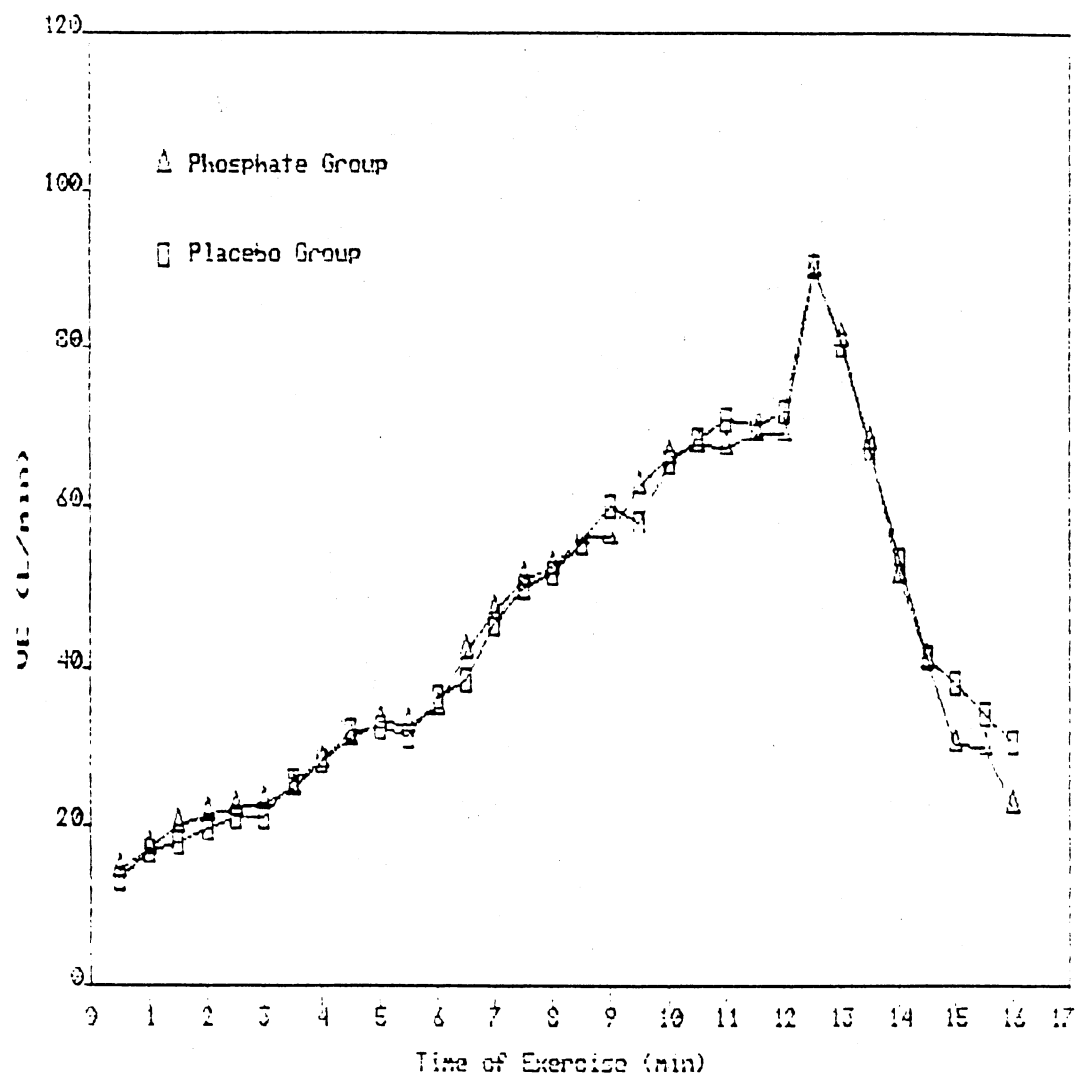
GRAPH VII PHOSPHATE GROUP DATA - FEMALES (n=3)



GRAPH VIII PLACEBO GROUP DATA - FEMALES (n=3)



GRAPH IX AVERAGE DATA - FEMALES (n=3)



## CHAPTER V

### SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

#### Summary

In recent years ergogenic aids have become a very significant part of athletics. Since many endurance orientated competitions today are won by fractions of a second, coaches and athletes strive to gain any kind of winning advantage.

The purpose of this study was to determine if a phosphate-rich compound marketed under the commercial name of Stim-O-Stam could reduce ventilation and therefore possibly offset anaerobic threshold during increasingly harder exercise. It had already been proven that Stim-O-Stam tablets could lower heart rates, blood lactate, and  $\text{VO}_2\text{Max}$ .<sup>6,18</sup>

A double blind study was conducted on 10 physically fit Oklahoma State University students. Each subject was tested twice; once 30 minutes after ingesting Stim-O-Stam tablets, and once 30 minutes after ingesting placebos.

### Findings

A repeated measures analysis of variance was used to analyze the data for any differences in maximum and recovery ventilation.

Although some differences were observed in favor of the Stim-O-Stam treatment, these were not found to be statistically significant.

The data collected led to the following findings:

1.  $H_0$  There is no significant difference in maximum ventilation as a result of phosphate supplementation.

This hypothesis was accepted since no significant differences were observed between the phosphate and placebo groups.

2.  $H_0$  There is no significant difference in recovery ventilation rates as a result of phosphate supplementation.

This hypothesis was also accepted since no results suggested otherwise.

During this research careful attention was given to the possibility of any side effects caused by the Stim-O-Stam tablets; none were reported.

### Conclusions

It was concluded that although phosphates and blood alkalinizers in general effect many of the indices

commonly used for determination of Anaerobic Threshold, ventilation does not seem to be effected.

### Recommendations

Blood alkalinizers may be the answer to improved endurance in the near future. Much more work needs to be done to determine the exact physiological functions which are affected by changes in blood pH.

For future research it is strongly recommended that more subjects be used and that each subject be tested several times to eliminate chance results. Also more athletes should be used as subjects since these individuals tend to have a more regular exercise and diet schedule.

Future research should also utilize blood acidosis as an experimental treatment along with alkalosis so that any negative effects can be observed. The results of this type of research may have an impact on suggested pre-competition diets in the future.

In summary, future testing of similar parameters should utilize athletes of equal caliber, each being tested and re-tested several times, and at least three treatments should be given (control, acidosis, and alkalosis).

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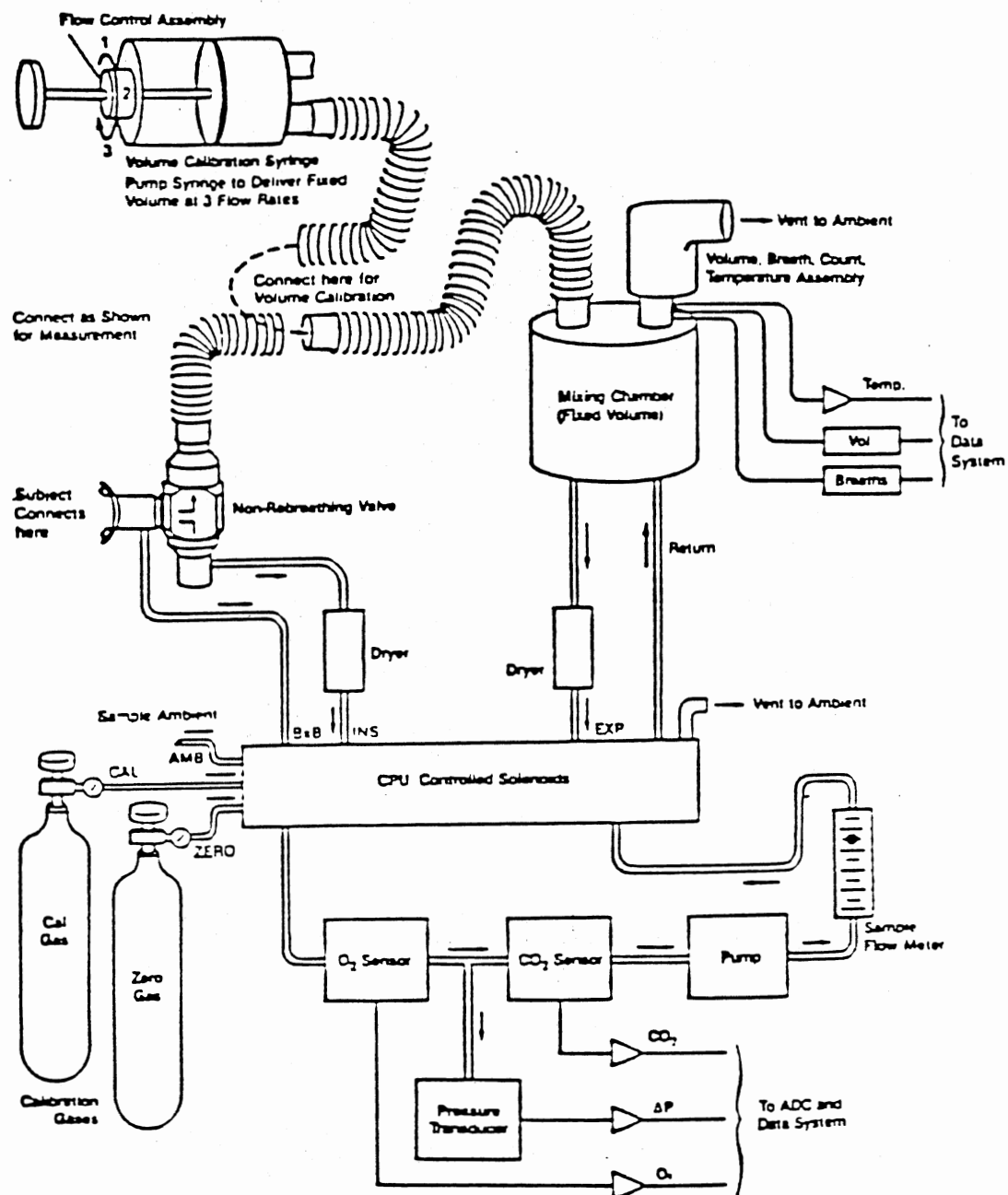
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## APPENDIXES

# APPENIX A MPC Schematic



**APPENDIX B**  
**Medical History and Consent Form**

*Medical History and Questionnaire*

Name \_\_\_\_\_ Age \_\_\_\_\_ Ht \_\_\_\_\_ Wt \_\_\_\_\_

Sex \_\_\_\_\_ Ph# \_\_\_\_\_

Number of hours spent each day exercising \_\_\_\_\_

Do you smoke \_\_\_\_\_ If yes, \_\_\_\_\_ times/wk no. of years \_\_\_\_\_

Do you drink \_\_\_\_\_ If yes, \_\_\_\_\_ times/wk

Number of relatives (parents, grandparents, siblings) that  
have been diagnosed as having heart disease \_\_\_\_\_

Have you ever been told you have heart disease? \_\_\_\_\_

Have you ever been told you have diabetes? \_\_\_\_\_

Any other medical conditions which might affect exercise?

Please list \_\_\_\_\_

Are you currently taking any medications? \_\_\_\_\_

Resting Blood Pressure \_\_\_\_\_ / \_\_\_\_\_

Time at which you can meet for approximately one hour on two  
consecutive days \_\_\_\_\_ Beginning date \_\_\_\_\_

OKLAHOMA STATE UNIVERSITY  
Individual Consent for Participation in Research

I, \_\_\_\_\_, voluntarily agree to  
(SUBJECT'S NAME)

participate in this study entitled: *The Effect's of Phosphate Supplementation on Anaerobic Threshold During Exercise*, conducted by Dean Ekeren at the Oklahoma State University Physiology of Exercise Laboratory.

This study involves consumption of Stim-O-Stam phosphate tablets. These tablets contain 200mg of Dibasic Sodium Phosphate, 185.7mg of Monobasic Sodium Phosphate, 27.5mg of Potassium Phosphate, and 30mg of Vitamin C.

The purpose of this research is to determine if dietary phosphate (Stim-O-Stam tablets) can inhibit the onset of anaerobic threshold and lower the heart rates during exercise. Several studies have been performed using these tablets with exercise and most have proven the product to be successful. However, the influence of phosphates on anaerobic threshold has not been documented. This product is not a drug; it is an inorganic salt which is found in many performance enhancing products such as Gatorade. Phosphate salts are not on the NCAA's prohibited substances list. There are no known hazards or side effects caused by this product, however the study will require the subject to exercise to approximately 85% of maximal heart rate. No person should volunteer who is not physically fit or who has any type of cardiac risk factor (see attachment on medical history). Sweating, muscle soreness, and shortness of breath may all be expected. During the testing a physician will be on call via the O.S.U. student health center.

During this study each subject will meet with the investigator on two consecutive days for approximately one hour each day. The subject will alternate as to use the phosphate tablets one day and a placebo the other day. Each subject will be given three tablets, do a warm-up of their choice (which will be the same for both days), and perform a treadmill stress test. Heart rates will be recorded and expiratory gases will be collected with the aid of a metabolic measurement cart.

By signing this consent form, I acknowledge that my participation in this study is voluntary. I also acknowledge that I have not waived my legal rights or released Oklahoma State University from liability for negligence. I recognize that the primary risk is the possibility of some side effects. If I experience any side effects I agree to report

them immediately to my physician. If I have any questions about my rights as a research subject, I may take them to the Office of University Research Services, Oklahoma State University. I also realize that I may revoke my consent and withdraw from this study at any time and that records of this study shall be kept confidential making it impossible to identify me individually.

I have read this informed consent document and I understand its contents and freely consent to participate in this study under the conditions described in this document. I understand that I may receive a copy of this signed consent form.

\_\_\_\_\_  
Signature of Research Subject

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Witness

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Representative

\_\_\_\_\_  
Date

If you have any problems or questions  
please contact me at:

Dean M. Eleren  
407 S. Duncan  
Stillwater, OK 74074  
(405) 372-0281

Or:

Dr. Steve Edwards  
Calvin Center 101  
624-5500

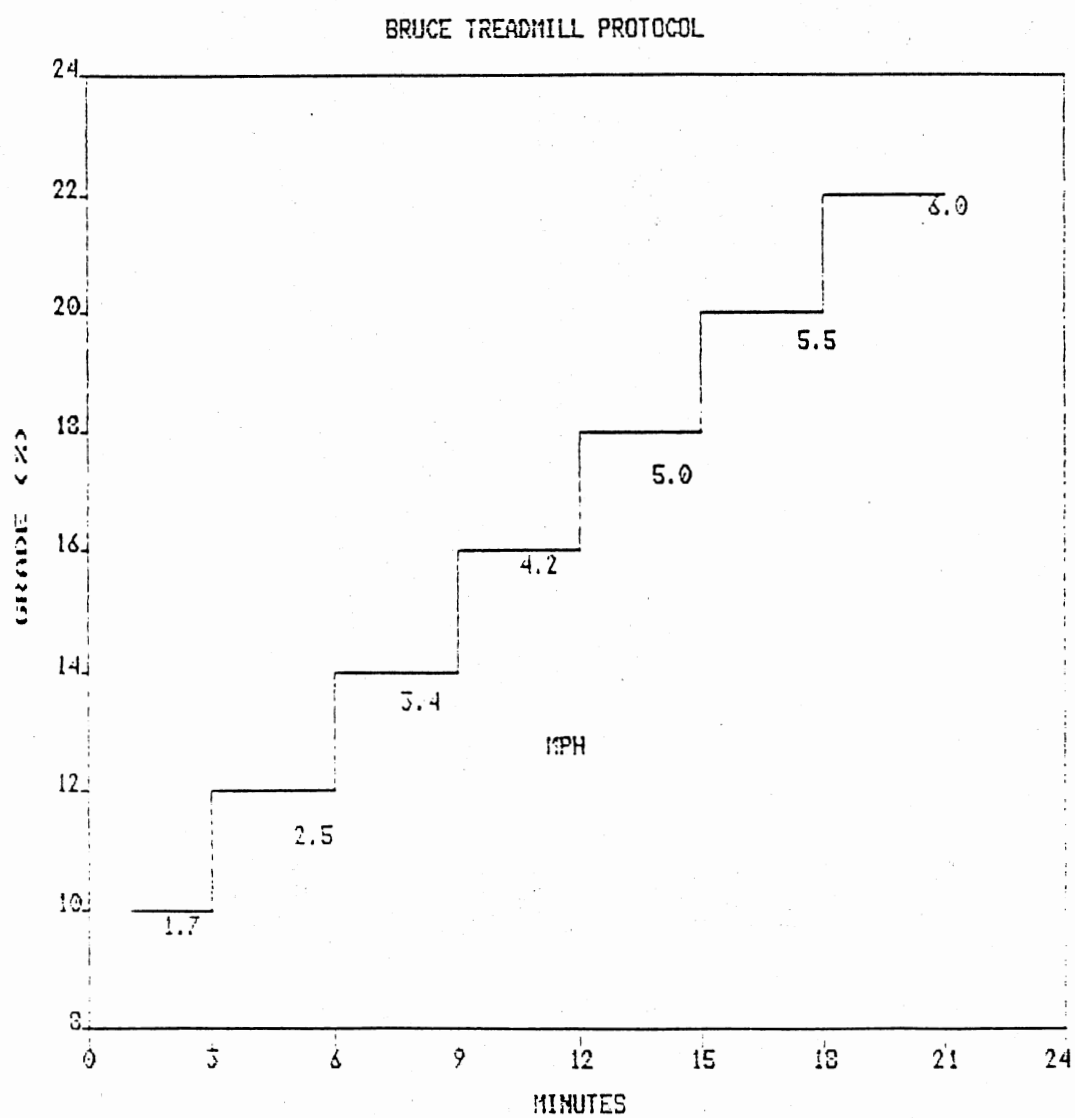
Office of University Research Services  
001 Life Science East  
624-5991

**MEDICAL HISTORY**  
**American College of Sports Medicine Guidelines**

- A. Heart attack, coronary bypass, or other cardiac surgery
- B. Chest discomfort-especially with exertion
- C. High blood pressure
- D. Extra, skipped, or rapid heart beats/palpitations
- E. Heart murmurs, clicks, or unusual cardiac findings
- F. Rheumatic fever
- G. Ankle swelling
- H. Peripheral vascular disease
- I. Phlebitis, emboli
- J. Unusual shortness of breath
- K. Lightheadedness or fainting
- L. Pulmonary disease including asthma, emphysema and bronchitis
- M. Abnormal blood lipids
- N. Diabetes
- O. Stroke
- P. Emotional disorders
- Q. Medications of all types
- R. Recent illness, hospitalization or surgical procedure
- S. Drug allergies
- T. Orthopedic problems, arthritis
- U. Family\* history should be explored for the following:
  - 1. Coronary disease-at what age
  - 2. Sudden death-at what age
  - 3. Congenital heart disease
- V. Other habits
  - 1. Caffeine including cola drinks
  - 2. Alcohol
  - 3. Tobacco
  - 4. Other unusual habits or dieting
  - 5. Exercise history with information on habitual level of activity: type of exercise, frequency, duration, and intensity.

\*Family means grandparents, parents, aunts, uncles and siblings

APPENDIX C  
Treadmill Protocol





VITA <sup>2</sup>

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Thesis: THE EFFECTS OF PHOSPHATE SUPPLEMENTATION ON  
ANAEROBIC THRESHOLD DURING EXERCISE

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