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THE EFFECT OF WHEAT GERM OIL ON
ATHLETIC PERFORMANCE

Thesis for the Degree of M. A.
MICHIGAN STATE UNIVERSITY
Leon Norman Fox
1961



**THE EFFECT OF WHEAT GERM OIL
ON ATHLETIC PERFORMANCE**

by

Leon Norman Fox

An Abstract of a Thesis

**Submitted to the School of Education of Michigan
State University of Agriculture and Applied
Science in Partial Fulfillment of the
Requirements for the Degree of**

Master of Arts

**Department of Health, Physical Education
and Recreation for Men**

1961

Statement of the Problem:

This experiment was designed to determine the effects, if any, of a daily oral supplement of wheat germ oil on athletic performance. The effect of wheat germ oil upon selected tests of cardiac function was also studied.

Need for the Study:

There is at present a widespread belief that physical performance can be improved by the use of special food supplements. Where real deficiencies exist there is little question that physical performance is hindered; the real problem is what can be done by dietary measures to improve the performance of persons who are not clearly underfed or malnourished. Many coaches and athletes seem to think that wheat germ is such an energy food. Studies throughout the world are being conducted to determine whether or not wheat germ enables the body to build up glycogen (Muscle fuel) reserve. The concrete facts which can be adduced are few, the relevant literature is voluminous, but frequently unsatisfactory. The many questions that can be raised to wheat germ indicate the need for a great amount of work to be done in the area.

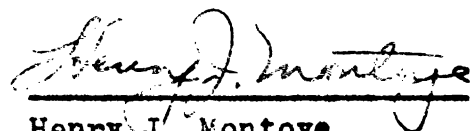
Methods and Procedure:

Twenty-two subjects, all untrained college freshmen volunteered for the experiment. Of these twenty-two subjects,

eleven formed the experimental group and received the wheat germ capsule, while the remaining eleven subjects received the placebo (blank) capsule. Half mile run scores were used to pair the subjects. Each week throughout the seven weeks experimental period the subjects were tested for their best time in the half mile run. Electrocardiograms were taken on each subject at the beginning and end of the seven weeks experimental period. The analysis of variance was employed to statistically analyze the data collected on the half mile run. The "t" test was employed to analyze the electrocardiogram data.

Conclusions:

1. No significant differences were found in the half mile run times of the two groups.
2. In analyzing the electrocardiogram data the only significant differences were found when comparing the vectors of the two groups.
3. Both groups showed a significant drop in pulse rate and it was concluded to be due to conditioning.


Henry J. Montoya
Major Advisor

The first of these is the fact that the $\mathbb{Z}_2$ -action on $\mathbb{R}^n$ is not free. The fixed points of this action are the points $x \in \mathbb{R}^n$ such that $x = -x$, i.e. the origin. The second fact is that the action is not transitive. The orbit of the origin is just the origin itself, while the orbit of any other point $x \neq 0$ is the set $\{x, -x\}$. The third fact is that the action is not effective. The identity element of $\mathbb{Z}_2$ acts trivially on all of $\mathbb{R}^n$, while the non-identity element acts non-trivially on all of $\mathbb{R}^n$ except at the origin.

The fourth fact is that the action is not faithful. The identity element of $\mathbb{Z}_2$ acts trivially on all of $\mathbb{R}^n$, while the non-identity element acts non-trivially on all of $\mathbb{R}^n$ except at the origin. The fifth fact is that the action is not free. The fixed points of this action are the points $x \in \mathbb{R}^n$ such that $x = -x$, i.e. the origin. The sixth fact is that the action is not transitive. The orbit of the origin is just the origin itself, while the orbit of any other point $x \neq 0$ is the set $\{x, -x\}$. The seventh fact is that the action is not effective. The identity element of $\mathbb{Z}_2$ acts trivially on all of $\mathbb{R}^n$, while the non-identity element acts non-trivially on all of $\mathbb{R}^n$ except at the origin.

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1. The first part of the paper discusses the importance of understanding the underlying mechanisms of the observed phenomena. This section highlights the need for a comprehensive theoretical framework that can account for the complex interactions between various factors. The authors argue that a purely descriptive approach is insufficient and that a more mechanistic understanding is required to develop effective interventions.

2. In the second part, the authors present a detailed analysis of the data collected from the study. They use a combination of statistical methods and qualitative insights to explore the patterns and trends in the data. The results suggest that there are significant differences in the outcomes across different groups, which may be attributed to the varying levels of exposure to the intervention.

3. The third part of the paper focuses on the implications of the findings for future research and practice. The authors emphasize the need for further studies to validate the results and to explore the long-term effects of the intervention. They also discuss the potential for scaling up the intervention to reach a larger population, while maintaining its effectiveness and sustainability.

4. Finally, the authors conclude by summarizing the key points of the paper and reiterating the importance of the research. They express their confidence in the findings and their belief that the study has contributed valuable insights into the field. The authors also acknowledge the limitations of the study and suggest areas for future research to address these limitations.

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4. The fourth part of the document discusses the consequences of failing to comply with the record-keeping requirements. It states that any individual or organization that fails to comply with these requirements may be subject to disciplinary action, including fines and imprisonment. The document also notes that the consequences may be more severe if the failure to comply results in a significant loss or damage to the financial system.

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CHAPTER I

INTRODUCTION

Purpose of the study. There is at present a widespread belief that physical performance can be improved by better diets and the use of special foods and food concentrates. Where real deficiencies exist there is little question that physical performance is hindered; the real problem is what can be done by dietary measures to improve the performance of persons who are not clearly underfed or malnourished. The concrete facts which can be adduced are few, the relevant literature is voluminous, but frequently unsatisfactory. On the other hand, most of the current extravagant claims for various dietary measures have some real or supposed theoretical basis.¹

The provision of food for the support of physical work is obviously primarily for the purpose of supplying fuel to the working muscles. The belief that the kind and relative amounts of foods supplied makes an important difference is basic to all theories about diet and muscular performance.²

¹Ansel Keys, "Physical Performance in Relations to Diet," Federation Proceedings, Vol. 2, p. 164, Sept. 1943.

²Ibid., p. 165

Is wheat germ oil an energy food--that is, does it give an athlete more power and endurance? New concepts in physical training and coaching methods include adding wheat derivatives to the athletes' diet for endurance. The athletic journals and coaches magazines are including wheat germ in their advertisements. Coaches across our continent are spending huge sums of money on wheat germ in various forms.

Are these coaches right or wrong? Are they spending money needlessly? If they are right in their thinking, shouldn't all athletes take advantage of this new found wonder fuel?

Many coaches and athletes seem to think that wheat germ is such an energy food, and studies throughout the world are being conducted to determine whether or not wheat germ oil enables the body to build up glycogen (muscle fuel) reserve.

"Meanwhile, many athletes who've made wheat germ oil a daily diet additive have turned in spectacular performances, especially in track and field, and swimming."³

In recent years great advancements have contributed much to our knowledge of the nutritional needs of our body. Medical researchers are interested in all the claims made about Vitamin E. Wheat germ oil is considered one of the

³Thomas K. Cureton, "What about Wheat Germ," Scholastic Coach, November 1959, p. 24.

Is what goes on in the mind of the athlete
give an athlete more or less of an advantage in
physical training and competition? The athlete's
behaviour to the extent of his physical condition.
Athletic training and competition are both
more in their educational value. The athlete's
and a number of other factors which are
forms.

The time of day when the athlete
works is also a factor. The athlete's
at all times of the day. The athlete's
working time.

Long periods of rest and training
are in such an order, and the athlete's
and better condition to perform. The athlete's
practice the body to build up (physical fitness) results.

"The athlete, who, at first, gives up a great deal of
a daily life of the athlete have found a great deal of
especially in the case of the athlete and athlete."

In recent years, the athlete's
and to the athlete of the athlete's
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The athlete's and the athlete's
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richest sources of alpha-tocopherol, one of Vitamin E's most active compounds.⁴

Therefore, if wheat germ oil does build up muscle fuel in the body, it could be the Vitamin E content that deserves the credit, or possibly wheat germ oil contains additional ergogenic aids to performance.

The idea that underlies all athletic training is that increased muscular efficiency, cardiac or skeletal, or both can be achieved through training. After suitable exercises muscles hypertrophy contract more powerfully and rapidly, and respiration and circulation are improved. It follows therefore that the muscles used for average activity possess unused reserves that can be called on in case of emergency. These same mechanisms must operate in subnormal muscles, in muscles weakened by disease, which often possess unsuspected reserves too. A drug which improves the efficiency of a diseased muscle may not have much to offer so called normal heart or skeletal muscle. But what helps the normal muscle must benefit the subnormal.⁵

To the average doctor by increasing the muscular efficiency of a normal man to make him a champion athlete is

⁴The Encyclopedia Americana, Vol. 23, American Corporation, New York, Chicago and Washington, p. 508.

⁵The Summary, "Editorial-The Struggling Heart," Vol. 8, by the Shute Foundation for Medical Research, London & Canada, p. 23.

not very important. But to do as much for a damaged heart muscle has created a lot of interest among medical men.⁶

Many men in the field of vitamin research feel that we are lacking Vitamin E in our diets. One of the things that has held back recognition of Vitamin E deficiency in man is the difficulty in applying quantitative chemical methods to the analysis of tissues or tissue fluid. There are several methods available which are reliably accurate when applied to pure preparations, but difficulties arise from interfering substance when the same methods are used with blood tissues or complex food stuffs. Much work needs to be done in this field, but until such accurate biochemical methods have been developed and become clinically applicable, one cannot expect our knowledge of vitamin deficiency in humans to be more than inferential. Therefore, until such biochemical methods are developed, studies are needed to make our inferences as reliable as possible.⁷

The many questions that can be raised to wheat germ indicate the need for a great amount of work to be done in the area, and the author only hopes to be able to contribute something to the broad picture.

Statement of the problem. This experiment was designed to determine the effects, if any, of a daily oral supplement

⁶Ibid., p. 23.

⁷Alvin M. Foppenheimer, On Certain Aspects of Vitamin E Deficiency, Charles C. Thomas Publisher, 1948, p. 4.

1. The following information was obtained from the records of the Department of the Interior, Bureau of Land Management, regarding the land owned by the United States in the State of Nevada:

[illegible]

of wheat germ oil on athletic performance. The effect of wheat germ oil upon selected tests of cardiac function was also studied.

Limitations of the Study.

1. As in most experimental studies, there is the human element to consider in this study. Even though the testing was carried on in as scientific a manner as possible, "Human fallability can never be completely eliminated from any human effort."⁸

2. The length of the experimental period and the number of subjects represent other possible limitations.

3. The inability to completely control the diet and manner of living of the subjects is another serious limitation. None of their activities were controlled other than the actual training program.

4. Time limitations hindered the study in many respects, especially in not being able to put the subjects through a good conditioning program before pairing them off into groups.

5. The small amount of daily doses by each subject is another limitation. However, it was felt by the author that

⁸ Steering Committee of the Research Section and the Research Council of the Research Section of the American Association for Health, Physical Education and Recreation, Research Methods Applied to Health, Physical Education and Recreation, (Revised edition; Washington: American Association for Health, Physical Education and Recreation, 1952), p. 302.

four capsules would be about the limit that an athlete would take in one day.

DEFINITIONS OF TERMS USED

Placebo. A placebo was a blank capsule which looks exactly like a real wheat germ pill, only it was composed of gelatin instead of wheat germ oil.

Group "A". Refers to the experimental group supplied with wheat germ oil capsules.

Group "B". Refers to the control group supplied with placebos.

Lead One. This shows the electrical activity of the heart with the leads connected to the left arm and the right arm.

Lead Two. This shows the electrical activity of the heart with the leads connected to the right arm and the left leg, (or a point at the pubis).

Heart Rate. The heart rate was determined by counting the number of complete cycles for six seconds, (each second is marked at the bottom of the ECG) and multiplying the total by ten. This gave the heart rate prior to exercise. The same method was employed to gain the heart rate after exercising, except that the cycles were counted for thirty seconds and multiplied by two.

Vector. This refers to the direction of the electrical axis for leads one and three using the R and S waves of each.

1. The first step is to identify the problem or goal. This involves understanding the current situation, identifying the key issues, and determining the desired outcome.

[illegible]

Phragmites australis, *Spartina patens*, *Spartina alterniflora*, *Spartina cynosuroides*, *Spartina anglica*, *Spartina foliosa*, *Spartina densa*, *Spartina rigida*, *Spartina pectinata*, *Spartina rostrata*, *Spartina gracilis*, *Spartina serotina*, *Spartina angustata*, *Spartina tenuifolia*, *Spartina virginica*, *Spartina horridula*, *Spartina robusta*, *Spartina arundinacea*, *Spartina patens*, *Spartina alterniflora*, *Spartina cynosuroides*, *Spartina anglica*, *Spartina foliosa*, *Spartina densa*, *Spartina rigida*, *Spartina pectinata*, *Spartina rostrata*, *Spartina gracilis*, *Spartina serotina*, *Spartina angustata*, *Spartina tenuifolia*, *Spartina virginica*, *Spartina horridula*, *Spartina robusta*.

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...and the other is the fact that the ...

addition, the authors also found that the effect of the intervention was moderated by the level of baseline self-efficacy. The authors concluded that the intervention was most effective for individuals with low baseline self-efficacy.

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of the 1970s and 1980s, the use of the term "cognitive" in the title of the book is a bit of a misnomer. The book is not a cognitive psychology text, nor is it a cognitive linguistics text. It is a text about the cognitive aspects of language, and it is a text about the cognitive aspects of language that is written for a general audience. The book is a text about the cognitive aspects of language that is written for a general audience.

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that will have a greater effect on the economy - and the other that
will have a smaller effect on the economy, and

... ..

2004年12月10日 星期四

Source: *Report of the Special Committee on the Status of the Negro in the United States*, 1944.

Initial investigation of the fire revealed that the fire started in the kitchen area of the residence. The fire spread rapidly, consuming the kitchen area and the adjacent living room. The fire was extinguished by the fire department, and the cause of the fire was determined to be an electrical fault in the kitchen area.

Q. 11. $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$ and $\frac{1}{6} \times \frac{1}{2} = \frac{1}{6}$ and $\frac{1}{6} \times \frac{1}{3} = \frac{1}{18}$ and $\frac{1}{18} \times \frac{1}{2} = \frac{1}{36}$ and $\frac{1}{36} \times \frac{1}{3} = \frac{1}{108}$ and $\frac{1}{108} \times \frac{1}{2} = \frac{1}{216}$ and $\frac{1}{216} \times \frac{1}{3} = \frac{1}{648}$ and $\frac{1}{648} \times \frac{1}{2} = \frac{1}{1296}$ and $\frac{1}{1296} \times \frac{1}{3} = \frac{1}{3888}$ and $\frac{1}{3888} \times \frac{1}{2} = \frac{1}{7776}$ and $\frac{1}{7776} \times \frac{1}{3} = \frac{1}{23328}$ and $\frac{1}{23328} \times \frac{1}{2} = \frac{1}{46656}$ and $\frac{1}{46656} \times \frac{1}{3} = \frac{1}{139968}$ and $\frac{1}{139968} \times \frac{1}{2} = \frac{1}{279936}$ and $\frac{1}{279936} \times \frac{1}{3} = \frac{1}{839808}$ and $\frac{1}{839808} \times \frac{1}{2} = \frac{1}{1679616}$ and $\frac{1}{1679616} \times \frac{1}{3} = \frac{1}{5038848}$ and $\frac{1}{5038848} \times \frac{1}{2} = \frac{1}{10077696}$ and $\frac{1}{10077696} \times \frac{1}{3} = \frac{1}{30233088}$ and $\frac{1}{30233088} \times \frac{1}{2} = \frac{1}{60466176}$ and $\frac{1}{60466176} \times \frac{1}{3} = \frac{1}{181398528}$ and $\frac{1}{181398528} \times \frac{1}{2} = \frac{1}{362797056}$ and $\frac{1}{362797056} \times \frac{1}{3} = \frac{1}{1088391168}$ and $\frac{1}{1088391168} \times \frac{1}{2} = \frac{1}{2176782336}$ and $\frac{1}{2176782336} \times \frac{1}{3} = \frac{1}{6530347008}$ and $\frac{1}{6530347008} \times \frac{1}{2} = \frac{1}{13060694016}$ and $\frac{1}{13060694016} \times \frac{1}{3} = \frac{1}{39182082048}$ and $\frac{1}{39182082048} \times \frac{1}{2} = \frac{1}{78364164096}$ and $\frac{1}{78364164096} \times \frac{1}{3} = \frac{1}{235092492288}$ and $\frac{1}{235092492288} \times \frac{1}{2} = \frac{1}{470184984576}$ and $\frac{1}{470184984576} \times \frac{1}{3} = \frac{1}{1410554953728}$ and $\frac{1}{1410554953728} \times \frac{1}{2} = \frac{1}{2821109907456}$ and $\frac{1}{2821109907456} \times \frac{1}{3} = \frac{1}{8463329722368}$ and $\frac{1}{8463329722368} \times \frac{1}{2} = \frac{1}{16926659444736}$ and $\frac{1}{16926659444736} \times \frac{1}{3} = \frac{1}{50779978334208}$ and $\frac{1}{50779978334208} \times \frac{1}{2} = \frac{1}{101559956668416}$ and $\frac{1}{101559956668416} \times \frac{1}{3} = \frac{1}{304679870005248}$ and $\frac{1}{304679870005248} \times \frac{1}{2} = \frac{1}{609359740010496}$ and $\frac{1}{609359740010496} \times \frac{1}{3} = \frac{1}{1828079220031488}$ and $\frac{1}{1828079220031488} \times \frac{1}{2} = \frac{1}{3656158440062976}$ and $\frac{1}{3656158440062976} \times \frac{1}{3} = \frac{1}{10968475320188928}$ and $\frac{1}{10968475320188928} \times \frac{1}{2} = \frac{1}{21936950640377856}$ and $\frac{1}{21936950640377856} \times \frac{1}{3} = \frac{1}{65810851921133568}$ and $\frac{1}{65810851921133568} \times \frac{1}{2} = \frac{1}{131621703842267136}$ and $\frac{1}{131621703842267136} \times \frac{1}{3} = \frac{1}{394865111526801408}$ and $\frac{1}{394865111526801408} \times \frac{1}{2} = \frac{1}{789730223053602816}$ and $\frac{1}{789730223053602816} \times \frac{1}{3} = \frac{1}{2369190669160808448}$ and $\frac{1}{2369190669160808448} \times \frac{1}{2} = \frac{1}{4738381338321616896}$ and $\frac{1}{4738381338321616896} \times \frac{1}{3} = \frac{1}{14215144014964850688}$ and $\frac{1}{14215144014964850688} \times \frac{1}{2} = \frac{1}{28430288029929701376}$ and $\frac{1}{28430288029929701376} \times \frac{1}{3} = \frac{1}{85290864089789104128}$ and $\frac{1}{85290864089789104128} \times \frac{1}{2} = \frac{1}{170581728179578208256}$ and $\frac{1}{170581728179578208256} \times \frac{1}{3} = \frac{1}{511745184538734624768}$ and $\frac{1}{511745184538734624768} \times \frac{1}{2} = \frac{1}{1023490369077469249536}$ and $\frac{1}{1023490369077469249536} \times \frac{1}{3} = \frac{1}{3070471107232407748608}$ and $\frac{1}{3070471107232407748608} \times \frac{1}{2} = \frac{1}{6140942214464815497216}$ and $\frac{1}{6140942214464815497216} \times \frac{1}{3} = \frac{1}{18422826643394446491648}$ and $\frac{1}{18422826643394446491648} \times \frac{1}{2} = \frac{1}{36845653286788892983296}$ and $\frac{1}{36845653286788892983296} \times \frac{1}{3} = \frac{1}{110536959860366678949888}$ and $\frac{1}{110536959860366678949888} \times \frac{1}{2} = \frac{1}{221073919720733357899776}$ and $\frac{1}{221073919720733357899776} \times \frac{1}{3} = \frac{1}{663221759162199073699328}$ and $\frac{1}{663221759162199073699328} \times \frac{1}{2} = \frac{1}{1326443518324398147398656}$ and $\frac{1}{1326443518324398147398656} \times \frac{1}{3} = \frac{1}{3979330554973194442195968}$ and $\frac{1}{3979330554973194442195968} \times \frac{1}{2} = \frac{1}{7958661109946388884391936}$ and $\frac{1}{7958661109946388884391936} \times \frac{1}{3} = \frac{1}{23875983329839166653175808}$ and $\frac{1}{23875983329839166653175808} \times \frac{1}{2} = \frac{1}{47751966659678333306351616}$ and $\frac{1}{47751966659678333306351616} \times \frac{1}{3} = \frac{1}{143255899979034999919054848}$ and $\frac{1}{143255899979034999919054848} \times \frac{1}{2} = \frac{1}{286511799958069999838109696}$ and $\frac{1}{286511799958069999838109696} \times \frac{1}{3} = \frac{1}{859535399874209999514329088}$ and $\frac{1}{859535399874209999514329088} \times \frac{1}{2} = \frac{1}{1719070799748419999028658176}$ and $\frac{1}{1719070799748419999028658176} \times \frac{1}{3} = \frac{1}{5157212399245259997085974528}$ and $\frac{1}{5157212399245259997085974528} \times \frac{1}{2} = \frac{1}{10314424798490519994171949056}$ and $\frac{1}{10314424798490519994171949056} \times \frac{1}{$

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1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

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The Einthoven method used here is shown in the Appendix.

Length of Impulse. This gives the electrical potential of the heart and was gained by measuring the length of the arrow on the electrical axis.

"P" Wave. This wave occurs during the depolarization of the auricles. The amplitude of the "P" wave was measured to the nearest .1 mm.

"T" Wave. This wave occurs during the repolarization of the ventricles. The amplitude of the "T" wave was measured to the nearest .1 mm.

"QRS" Wave. This wave occurs during the depolarization of the ventricles. The measurement was obtained by measuring the amplitude of the "Q" and "S" wave and subtracting their total from the amplitude of the "R" wave. This measurement was also to the nearest .1 mm.

"PR", "QT" and "QRS" Intervals. The intervals of the gram indicate the amount of time the electrical current takes to pass from the left to the right side of the heart and were also measured to the nearest .1 mm.

*A complete ECG cycle is shown in the Appendix.

The following notes were taken in the laboratory.

Experiment 1. The effect of the position of the head on the electrical activity of the brain.

of the head and the position of the head on the electrical activity of the brain.

error on the electrical activity.

"The effect of the position of the head on the electrical activity of the brain." The following notes were taken in the laboratory.

of the head and the position of the head on the electrical activity of the brain.

to the nearest 1 mm.

"The effect of the position of the head on the electrical activity of the brain." The following notes were taken in the laboratory.

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"The effect of the position of the head on the electrical activity of the brain." The following notes were taken in the laboratory.

of the head and the position of the head on the electrical activity of the brain.

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"The effect of the position of the head on the electrical activity of the brain." The following notes were taken in the laboratory.

greatly affected the electrical activity of the brain." The following notes were taken in the laboratory.

to note from the left to the right side of the brain." The following notes were taken in the laboratory.

also referred to the nearest 1 mm.

CHAPTER II

REVIEW OF THE LITERATURE

"The fuel supply of all bodily energy is obtained from the food we eat. Muscles obtain their energy of motion from the combustion of substances supplied by the food. Specific dieting is a problem in any form of athletic training."⁹

Is wheat germ oil an energy food--that is, does it give an athlete more power and endurance? Research in physical fitness has included many studies to investigate food supplements in an effort to increase physical performance. Long documents on this line of research have been published by such men as Hellebrandt and Karpovich,¹⁰ Karpovich,¹¹ Henschel,¹² and Keys.¹³

⁹G. E. Dupain, "Specific Diets and Athletic Performance," Research Quarterly, Vol. 10, pp. 33-40 (December 1939.)

¹⁰F. A. Hellebrandt and P. V. Karpovich, "Fitness, Fatigue and Recuperation," War Medicine, Vol. 1, pp. 745-762, (November 1941.)

¹¹P. V. Karpovich, "Ergogenic Aids in Work & Sport," Supplement to the Research Quarterly, Vol. 12, pp. 432-450, (May 1941.)

¹²Austin Henschel, "Vitamins and Physical Performance," The Journal Lancet (Minneapolis), Vol. 63, pp. 355-357, (November 1943.)

¹³Angel Keys, "Physical Performance in Relation to Diet," Federation Proceedings, Vol. 2, pp. 164-187 (September 1943.)

1. The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

2. The second part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

3. The third part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

4. The fourth part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

5. The fifth part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

6. The sixth part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

The subject of Vitamin E deficiency is rather scantily treated in current textbooks on pathology. Our knowledge of Vitamin E dates back to 1923, when Evans and Bishop showed that wheat germ oil contains a factor necessary for the successful completion of pregnancy in female rats, and for the preservation of spermatogenesis in the male.¹⁴

Vitamin E is synthesized solely in plants, so that it is found mainly in plant products, concentrated in the seeds. There are several recognized forms of Vitamin E, but one, alpha-tocopherol, is the most active compound. The richest sources of this vitamin are the vegetable oils, such as wheat germ oil, cottonseed oil, peanut oil, and soybean oil. Most green leafy vegetables, such as lettuce, are good sources. Most animal products are poor sources. Since Vitamin E is so widespread, some workers believe it is unlikely that any animal or human diet will be lacking in this factor.¹⁵

There are many men in the field of vitamin research who strongly disagree with the theory that Vitamin E deficiency is rare. That the average American diet is often inadequate in available Vitamin E has been clearly demonstrated

¹⁴H. M. Evans and K. S. Bishop, Journal of Metabolic Research, Vol. 3, p. 233, (1923).

¹⁵The Encyclopedia Americana, Vol. 28, American Corporation, New York, Chicago, and Washington, p. 150B.

which is sufficient to show that the result is true.

Let α be a cardinal number, and let β be a cardinal number.

Suppose that $\alpha < \beta$. Then α is a cardinal number.

Let γ be a cardinal number, and let δ be a cardinal number.

Suppose that $\gamma < \delta$. Then γ is a cardinal number.

Let ϵ be a cardinal number, and let ζ be a cardinal number.

Suppose that $\epsilon < \zeta$. Then ϵ is a cardinal number.

Let η be a cardinal number, and let θ be a cardinal number.

Suppose that $\eta < \theta$. Then η is a cardinal number.

Let ι be a cardinal number, and let κ be a cardinal number.

Suppose that $\iota < \kappa$. Then ι is a cardinal number.

Let λ be a cardinal number, and let μ be a cardinal number.

Suppose that $\lambda < \mu$. Then λ is a cardinal number.

Let ν be a cardinal number, and let ξ be a cardinal number.

Suppose that $\nu < \xi$. Then ν is a cardinal number.

Let $\omicron$ be a cardinal number, and let π be a cardinal number.

Suppose that $\omicron < \pi$. Then $\omicron$ is a cardinal number.

Let ρ be a cardinal number, and let σ be a cardinal number.

Suppose that $\rho < \sigma$. Then ρ is a cardinal number.

Let τ be a cardinal number, and let υ be a cardinal number.

Suppose that $\tau < \upsilon$. Then τ is a cardinal number.

Let ϕ be a cardinal number, and let χ be a cardinal number.

Suppose that $\phi < \chi$. Then ϕ is a cardinal number.

Let ψ be a cardinal number, and let ω be a cardinal number.

Suppose that $\psi < \omega$. Then ψ is a cardinal number.

by careful calculations of such men as Harris, Hickman, Jensen and Spies.¹⁶

Hickman reports that the average American industrial worker gets from 10 to 90 per cent of his daily requirements of tocopherols. He goes on and explains that this deficiency is further aggravated by large intakes of milk, butter, white bread and root vegetables, as well as of rancid and unsaturated fats.¹⁷

Engel in Holland found closely comparable figures for Vitamin E in Dutch diets, both during and since World War II.¹⁸

A physiological action of Vitamin E is concerned with preventing muscular weakness in young animals. Vitamin E is an antioxidant and, as such, helps to preserve the readily oxidized Vitamin A, and to increase its biological activity.¹⁹

For a number of years interest was focused on; (1) The effects of Vitamin E on reproduction, (2) Its occurrence in plant and animal tissues, and (3) Its chemical constitution,

¹⁶p. L. Harris, K. C. Hickman, J. L. Jensen and T. O. Spies, American Journal of Public Health, Vol. 36, p. 155, 1946.

¹⁷K. C. D. Hickman, letter, Lancet, Vol. 1, p. 652, 1948.

¹⁸C. Engel, Proceedings Second International Conference on Vitamin E, New York, 1949.

¹⁹Colliers Encyclopedia, Vol. 19, 1955, P. F. Colliers and Son Corporation, New York, p. 279.

by several of the members of the committee, and
 10-1-1914

The committee has the honor to acknowledge the
 receipt of your letter of the 27th inst. and in reply
 to inform you that the same has been forwarded to the
 proper authorities for their consideration. The
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 authorities for their consideration.

identification, and synthesis.²⁰ Only recently has the interest focused on its relation to physical performance.

The leader in this country in attempting to show that wheat germ oil is an energenic aid to men trying to improve their physical fitness is Thomas Cureton of the University of Illinois. Cureton has sponsored several studies on the subject and states that "Repetitive studies at the University of Illinois physical fitness research laboratory indicate that wheat germ or its derivative, wheat germ oil, aids those who consume it under proper conditions and over a long enough time to enable the body to build up its glycogen (muscle fuel) reserve."²¹

The first of a long series of experiments at the University of Illinois was in 1949, and the results are given in a thesis by William A. Farr. Three sub-groups of young men living in a fraternity house were tested, matched, and then fed over a period of twelve weeks. One group took a daily dosage of wheat germ oil capsules; another group took synthetic Vitamin E (alpha tocopherol acetate) capsulated in corn oil and calculated to balance the Vitamin E in the wheat germ oil; and the third group took placebos containing

²⁰Alvin M. Poppenheimer, On Certain Aspects of Vitamin E Deficiency, Charles C. Thomas Publisher, 1948, pp. 3-4.

²¹Thomas K. Cureton, "What About Wheat Germ," Scholastic Coach, November 1959, p. 24.

by several of the members of the committee, and the following
was adopted:

Resolved, That the committee be authorized to prepare a report
on the subject of the proposed amendment to the constitution
of the State, and to submit the same to the next session of the
General Assembly, and to the people of the State, and to the
people of the United States, and to the people of the world.

Section IV.

Resolved, That the committee be authorized to prepare a report
on the subject of the proposed amendment to the constitution
of the State, and to submit the same to the next session of the
General Assembly, and to the people of the State, and to the
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²¹Thomas K. Cureton, "What About Wheat Germ," Scholastic Coach, November 1959, p. 24.

cottonseed oil. None of the boys knew exactly what they were taking.

The T-Wave of the wheat germ oil group increased twice as much as in the cottonseed oil group, while no positive effect was noticed in the synthetic Vitamin E group. Visual reaction time was improved four times as much in the wheat germ oil and cottonseed oil groups than in the synthetic Vitamin E group.²²

A swimming group composed of three sub-groups of nine men each was simultaneously studied and there were no differences found between the wheat germ oil and the cotton seed oil groups.²³

Two years later, 1950-51, another experiment was conducted under Cureton's guidance. A total of nine subjects was used; six experimental and three control subjects. The six experimental subjects were trained hard for twelve weeks until they were no longer improving, or had reached a plateau on three tests; the all out bicycle ride, the brachial pulse wave test and the Schneider Test. For the next six weeks these six experimental subjects were fed wheat germ oil in the capsule form, and then were re-tested. The three control subjects did not take the intensive physical conditioning program.

²²William A. Farr, "The Effects of Wheat Germ Oil and Vitamin E on Physical Fitness," M. S. Thesis, Physical Education, University of Illinois, 1950, p. 92.

²³Ibid.

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1. The first of the three main points of the report is that the Government has failed to provide adequate housing for the people of the country. This is a serious problem which has caused much suffering and hardship. The Government should take immediate steps to provide adequate housing for all its citizens.

only to say again that it is a very good thing that a
- this on every point and that the government has done
- a great deal to help the people and that the people
- all over the world.

Two years later, 1977-78, I was again in the
hospital after a fall from a tree while
working in the forest. This time I was
in the hospital for a long time and
was very weak. I was in the hospital
for a long time and was very weak.
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1990

On the all out bicycle ergometer test the experimental groups' initial riding times averaged 247.8 seconds, improved to 309.2 seconds over the twelve weeks of hard training, during which time a definite plateau was reached, and then improved to 365.3 seconds during the six weeks that wheat germ oil was fed.

The control subjects scores were 165.6 seconds on the initial test, 136.8 seconds at the end of twelve weeks and 172.8 by the end of the entire eighteen weeks. The control subjects improved just 3.74% from the first to the last tests, whereas the experimental subjects on the training program improved 24.8% during the twelve preliminary weeks of training, and an additional 22.6% during the final six weeks when the subjects were fed wheat germ oil.²⁴

In the other two categories of the experiment, the Schneider Test and the T-Wave of the ECG conducted by White and Susic very similar results for wheat germ oil were shown on the naive standardized cardiovascular tests.^{25, 26}

²⁴William A. Smiley, "Variations on a Bicycle Ergometer Test with Altitude, Training, and a Dietary Supplement," M. S. Thesis, Physical Education, University of Illinois, 1951, p. 91.

²⁵C. H. White, "The Effect of Physical Training and a Dietary Supplement on the Schneider Index," M. S. Thesis, Physical Education, University of Illinois, 1951, p. 96.

²⁶Steve Susic, "The Effects of Training and a Dietary Supplement on the T-Wave of the ECG," M. S. Thesis, Physical Education, University of Illinois, 1953, p. 53.

Careton's experiments did not stop here. Encouraged by the findings in the earlier experiments, he went ahead and conducted experiments with athletic teams. Marx studied the effect of a dietary of wheat germ oil on varsity swimmers. He matched two groups of seven men each, one fed wheat germ oil and the other cottonseed oil. The wheat germ oil group raised their basic metabolic rate 14.5% while the cottonseed oil group significantly reduced the basal-metabolic rate by 14.5%. In the 100 yard drop off test for swimming endurance, the wheat germ oil group gained 5.15% compared to a loss of 1.60% by the cottonseed oil group.²⁷

A similar study was run by Vohaska with varsity wrestlers in three groups. The control group, received neither a dietary supplement nor training; the second group was fed wheat germ oil daily for four weeks; and the third group was fed synthetic Vitamin E in cottonseed oil. Both experimental groups were pre-trained for six weeks to eliminate effects of physical training. While the results weren't strongly in favor of wheat germ oil, they weren't against it either. Both the wheat germ oil group and the cottonseed oil group improved more than the control group without supplement or training. They were tested in the following

²⁷Elzer I. Marx, "The Effect of a Dietary Supplement on Varsity Swimmers," Urbana, M. S. Thesis, Physical Education, 1952, p. 40.

9. *Chlorophyll a* and *Chlorophyll b* were determined by the method of Arar and Collins (1971).

1. The first of these is the fact that the United States has a large and growing population of people who are of Mexican descent. This population is concentrated in the southwestern United States, particularly in California, Arizona, and New Mexico. It is estimated that there are over 10 million people of Mexican descent in the United States, and this number is expected to increase significantly in the future.

$\Delta \text{H}_{\text{f}}^{\circ}(\text{aq}) = -80.9$ kcal/mole; $\Delta \text{G}_{\text{f}}^{\circ}(\text{aq}) = -77.6$ kcal/mole; $\log K_{\text{f}}^{\circ} = 14.4$

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

1. The first part of the report, "The Situation in the Country," is a general survey of the country's political, economic, and social conditions. It is a very good summary of the situation in the country, and it is very well written. It is a very good summary of the situation in the country, and it is very well written.

[illegible]

At 10:00 AM, the ship was sighted by the crew of the ship and was
located at 10° 10' N, 156° 10' W. The ship was seen to be a small, white, motor
boat.

1. The above information was obtained from a confidential source who has provided reliable information in the past.

[illegible]

categories; (1) Schneider Test; (2) all out treadmill run; (3) breathholding test; (4) cardiovascular tests; (5) the heartograph.

The wheat germ oil group improved 23.6% in the five minute step test compared to the cottonseed oil groups score of 21.0% and the loss of 2.83% for the controls. In the all out treadmill run the wheat germ oil group gained 6.12%, which was lower than the cottonseed oil group gain of 25.25%, but much higher than the loss of 25.72% shown by the controls. In the breathholding test the wheat germ oil group gained 68.1%, the cottonseed group 75.5% and the controls a negative 54.9%. In the composite score 5-item cardiovascular test, the gains were 18.6% for the wheat germ oil, 66.0% for the cottonseed oil, compared to a negative 19.63% for the controls. In the heartograph, the gains were slightly in favor of the wheat germ oil with a gain of 10.07%, the cottonseed oil 9.67%, and the controls had a loss of 12.38%.²²

In these studies on athletic teams, Cureton reasoned that competitive fatigue developed in some of the men on both the swimming and wrestling teams which tended to depress the results and minimize the changes. He therefore concluded

²²William J. Vohaska, "The Effects of Wheat Germ Oil on the Cardiovascular Fitness of Varsity Wrestlers, M. S. Thesis, Physical Education, University of Illinois, 1952, p. 43.

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1. The first of these is the fact that the Commission has not yet received any information from the Government of the United Kingdom regarding the progress of the investigation into the activities of the British Security Organisation (BSO) in the United States.

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1. The first step in the process of identifying and assessing the needs of the community is to conduct a thorough assessment of the community's current situation. This involves gathering data on the community's demographics, economic conditions, and social issues. This data is then used to identify the community's most pressing needs and to develop a plan of action to address them.

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that these types of competitive sports are not very suitable to show the effects of a dietary supplement. However, in spite of these difficulties, the wheat germ oil was judged to be helpful.²⁹

Two other studies performed at the University of Illinois in 1952 failed to support the wheat germ to any great extent. Arner, conducted an experiment using three groups of adult men, hoping that wheat germ would have an effect on their physical fitness. Group A consisted of nine subjects who took capsules containing the wheat germ oil and participated in various physical activities. Group B also consisted of nine subjects, who in addition to their training activities took capsules containing cottonseed oil with equivalent amounts of Vitamin E as contained in the wheat germ oil capsules. The third group, consisting of five subjects served as a control group. They did not participate in a training program, and took no dietary supplement. Of the fifteen test items, the experimental group produced significant changes in five. From the statistical analysis all of the significant changes were attributed to training excepting the measures composed wholly or in part of visual reaction time. Visual reaction time is the

²⁹Thomas K. Cureton and Richard H. Pahndorf, "Influence of Wheat Germ Oil as a Dietary Supplement in a Program of Conditioning Exercises with Middle Aged Subjects," Research Quarterly, December 1955, p. 393.

1. The first of these is the fact that the majority of the population of the United States is now living in urban areas. This is a result of the process of urbanization, which has been going on since the beginning of the 20th century. The process of urbanization is the movement of people from rural areas to urban areas. This is a result of the fact that urban areas offer more opportunities for employment and education than rural areas do. The process of urbanization has led to the growth of large cities and the decline of small towns and villages. This has had a number of effects on the economy and society. One of the main effects has been the concentration of wealth and power in the hands of a small group of people living in the cities. This has led to the development of a class system, in which the wealthy few control the lives of the poor many. The process of urbanization has also led to the development of a new culture, which is based on the values and customs of the cities. This culture is different from the culture of the rural areas, and it has led to the decline of many traditional customs and values. The process of urbanization is still going on, and it is likely to continue for many years to come. This will have a number of effects on the economy and society, and it is important to be aware of these effects and to take steps to deal with them.

only variable having significant gains which appear to be due to the feeding of the wheat germ oil.³⁰

The same year, Constantino conducted a study very similar to Armer's. The purpose of this study was to investigate the effects of physical training and wheat germ oil on the cardiovascular system as measured by the heart-ograph. His conclusions were that ten weeks of physical training significantly improved the brachial pulse wave to the peak of performance, but an additional six weeks of physical training plus a dietary supplement did not significantly affect the brachial pulse wave.³¹

In 1953 Cureton conducted a staff experiment as a follow-up to the preliminary experiments carried on by his graduate students. The problem in this experiment was to determine whether wheat germ oil, administered as a dietary supplement for eight weeks in connection with a course in physical conditioning would significantly differentiate the experimental wheat germ oil group from another matched group on equal size and equal calorie content placebos of devitam-

³⁰Elden Wayne Armer, "An Experimental Study of the Effects of Training and Dietary Supplement on Motor Fitness Tests Items of Adult Men," Urbana: M. S. Thesis, Physical Education, University of Illinois, 1952, p. 59.

³¹Henry Franklin Constantino, "The Effects of Training with a Dietary Supplement on the Heartograph at Ground Level and Altitude," Urbana: M. S. Thesis, Physical Education, University of Illinois, 1952, p. 76.

ized lard, with both groups taking the same program of exercise. The subjects were adult men, 26-60 years of age, mainly sedentary, volunteers from the non-physical education staff.³²

The tests used were: (1) All-out treadmill run; (2) Brachial pulse wave; (3) Illinois Vertical jump reaction time test; (4) The T-Wave of the ECG; (5) Standing systolic blood pressure; (6) Schneider test; (7) Basal metabolic rate.³³

The following summer of 1954 the same program was run, only this time the groups were reversed.³⁴

"The preliminary studies as well as the staff experiment of 1953 and the reversal experiment of 1954 all showed some advantage for supplementary feedings of wheat germ oil administered during or immediately following physical conditioning periods of conditioning exercises and swimming in an outdoor pool with water temperature 74-76°F. The group results show significant advantage for the experimental subjects who took wheat germ oil over those who did not in both performance (will power dominated) tests and in naive (non-will power) tests. The physiological advantage is shown in terms of running endurance in all out treadmill runs, T-Wave of the ECG, lower systolic blood pressure, the Schneider Index and the Illinois total body reaction - time test in response to light, sound, and combined signals."³⁵

³²Thomas K. Cureton, "Influence of Wheat Germ Oil as a Dietary Supplement in a Program of Conditioning Exercises with Middle Aged Subjects," University of Illinois, Urbana Illinois, Research Quarterly, December 1955, p. 391.

³³Ibid., p. 394.

³⁴Ibid., p. 393.

³⁵Ibid., p. 391.

Cureton's latest and most complete study concerning wheat germ was conducted in 1959. The problem here was whether dietary supplements to the normal diet will affect young boys who are under stress in a strenuous physical education program. In this experiment, 60 boys were used, and they were split into four groups. Group one was fed wheat germ cereal; Group two, wheat germ oil; Group three, wheat germ crystals; and Group four took cottonseed oil placebos.³⁶

The groups were tested on the following items:

(1) 600 yard run; (2) Schneider test; (3) Amplitude of the brachial pulse wave; (4) area of the brachial pulse wave; (5) Change in pulse rate from lying to standing; (6) Change in pulse pressure; (7) Pulse rate recuperation; (8) Terminal pulse rate after 5 minute step test; (9) All out treadmill run.³⁷

The overall results indicate a trend of advantage for the wheat germ cereal type of supplementation, but all three groups of wheat germ totaled a better final score

³⁵Ibid., p. 391.

³⁶Thomas K. Cureton and F. B. Roby, "Physical Fitness Improvements Made by Four Matched Groups of Boys in the University of Illinois Sports Fitness School on Different Dietary Supplements," Prepared for the Research Section, Mid-West Convention, A.A.H.P.E. & R., Indianapolis, Indiana, April 1959, p. 1

³⁷Ibid., p. 3.

than did the placebos of cottonseed oil. The standard scores were as follows: Wheat germ cereal had an overall gain of 3.25 S. S.; Crystals of wheat germ oil 2.04 S. S.; Wheat germ oil had a standard score of 1.30; and the cottonseed oil group a low of 0.49 S. S.³⁸ These differences are not statistically significant but the trends are thought to be helpful.

In discussing the results of this study Cureton mentions a transient type of fatigue which caused a rise in pulse rates, drop in Schneider Index, and a drop in the amplitude and area of the brachial pulse wave. He goes on and states:

"Improvements over and above the fatigue effects are due to fitness sufficient to resist the fatigue, and this seems to be fostered by supplements (wheat derivatives) given to the diet."³⁹

Dr. Shute, head of the Shute Foundation for Medical Research in Canada has made great claims for the effect of Vitamin E on our daily lives. He states that our average intake of alpha tocopherol is only 10 mgm. per day, when it should be at least 3 to 12 times as much. He goes on however, and condemns the use of wheat germ oil as a good source of Vitamin E. There has long been a belief amongst veterinarians and others that wheat germ oil was a good

³⁸Ibid., p. 6

³⁹Thomas E. Cureton, "Wheat Germ Oil and Vitamin E," *Proceedings of the Nutrition Society*, Vol. 179, p. 638, (December 1959).

source of Vitamin E. Shute claims this is grossly inaccurate. He indicates in his writings that soya bean oil or cotton-seed oil, peanut oil and even margarine have as much right as wheat germ oil to be labelled Vitamin E.⁴⁰

Cureton answers Shutes criticism of the use of wheat germ oil as a dietary supplement in a report in the American Journal of Physiology on the effect of wheat germ oil and Vitamin E on normal human subjects in physical training programs.⁴¹ According to this report wheat germ oil contains additional ergogenic aids other than Vitamin E. This is partially confirmed in terms of evidence which shows higher relative metabolism, higher cardiovascular condition and better endurance work performances for comparative matched groups and individuals fed wheat germ oil while in training experiments. While the evidence is very strong of training having a major influence during the first 8-10 weeks of a physical training program; there is also impressive evidence that the dietary supplements (Vitamin E and wheat germ oil) have a positive influence in making possible even higher endurance work performances, and raising such performances above the plateaus after 8-10 weeks of training. In one

⁴⁰Evan Shute, "General Aspects of Alpha Tocopherol as a Therapeutic Agent," The Summary, Vol. 9, Published by The Shute Foundation for Medical Research, Canada, p. 5.

⁴¹Thomas K. Cureton, "Effect of Wheat Germ Oil and Vitamin E on Normal Human Subjects in Physical Training Programs," American Journal of Physiology, (Abstract) Vol. 179, p. 628, (December 1954).

of his experiments, with two matched groups of middle aged subjects, eight in each, the effect of a dietary supplement of wheat germ oil was effective only in the group which took the physical training parallel with the feeding.

"While the control groups virtually did not change, the experimental groups on wheat germ oil improved more than the parallel matched group on placebos in treadmill run time, brachial pulse wave, auditory vertical jump reaction time, Schneider Index, and the T-Wave of the ECG."⁴²

In a report to the Research Quarterly, Cureton again points out that wheat germ oil contains some unidentified factor which improves endurance.⁴³

Another study bringing out this unidentified factor in wheat germ oil was conducted by Ershoff and Levin. They performed an experiment on guinea pigs, feeding various groups wheat germ oil, corn oil or a natural food ration (Purina Rabbit Pellets). After 23 days of feeding, swimming tests were conducted on all the guinea pigs. All the animals fed the natural food ration drowned within 10 minutes. From 25% to 33.3% of the guinea pigs fed the corn oil rations swam for 60 minutes, whereas over 60% of the guinea pigs

⁴²Ibid.

⁴³Thomas K. Cureton, "Influence of Wheat Germ Oil as a Dietary Supplement in a Program of Conditioning Exercises with Middle-Aged Subjects," The Research Quarterly, December 1955, p. 403.

fed the wheat germ oil were still swimming after 60 minutes.⁴⁴

In light of this, concerning the effects of Vitamin E, and the additional effects of wheat germ oil on physical performance of individuals and groups in training is the purpose of this study.

This pretty well completes our review on the effects of Vitamin E and wheat germ on performance; and now just briefly we will review their effects on the electrocardiogram.

There have been many electrocardiographic studies of the effects of exercise, but most of them have dealt with either the acute or chronic effects.

Lepeschkin has reviewed several studies on the effects of athletic training on the electrocardiogram. Following is a summary of his findings.

The resting heart rate is usually slow in persons engaged in athletic training, the P waves may be low and the P-R Interval is prolonged beyond 0.19 seconds in 5-20% of the cases, especially in persons engaged in athletics for a long period of time. The duration of the QRS axis in a large group of athletes had an average of 50°, and that the duration of the QRS ranged from 0.07 to 0.11 seconds,

⁴⁴B. H. Ershoff and E. Levin, "Beneficial Effect of an Unidentified Factor in Wheat Germ Oil on the Swimming Performance of Guinea Pigs," Federation Proceedings, (American Institute of Nutrition) March 1955, pp. 431-432.

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and exceeded 0.10 seconds in 1.4% of the cases; the average being 0.087 seconds.⁴⁵

The voltage of the T-Waves in athletes was found elevated in the great majority of cases, especially in long distance track men and in champions. On the average, the T-Wave was found to be about 36% of R; with the values greater in young persons and at low heart rates. An inversion of T_{II} and T_{III} in athletes was ascribed to excessive training or to focal infection.⁴⁶

The Q-T duration in athletes was found elevated relatively, and in outstanding performers and long distance runners it may reach as high as +30%. The increase of this Q-T could be observed during the course of training. Lepeschkin, however, also reports a couple of studies where the relative Q-T was found shortened in athletes, especially at heart rates below 60.⁴⁷

Tuttle and Korns in their study of electrocardiographic changes which might be brought about by an entire season of physical training and athletic competition found slight changes in 4, or 8.3% of a group of forty-eight healthy young athletes. In forty three of their cases there was no

⁴⁵Eugene Lepeschkin, Modern Electrocardiography, Volume I, The Williams & Wilkins Company, 1951, p. 264.

⁴⁶Ibid., p. 265.

⁴⁷Ibid., p. 265.

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difference between the electrocardiograms which were made at the beginning of the training period and those obtained when the men were at their peak. However, physical training did decrease the resting heart rate.⁴⁸

Messerle reported that training not only caused the T-Wave to become higher, but lowered the ventricular peaks, and greatly increased the duration of QRS.⁴⁹

In several of Cureton's sponsored studies the T-Wave of subjects fed wheat germ oil improved more than the one's fed cottonseed oil. In Farr's study, the T-Wave of the wheat germ oil group improved twice as much as in the cottonseed oil group.⁵⁰

In another study at the University of Illinois the T-Wave during 12 weeks of pre-training improved 1.12 mm., then during the six weeks of wheat germ oil feeding improved 2.90 mm. In contrast to this improvement by the wheat germ oil group, the controls averaged a loss of 0.13 mm. in the

⁴⁸W. W. Tuttle and Horace M. Korn, "Electrocardiographic Observations on Athletes Before and After a Season of Physical Training," American Heart Journal, 21, January-June 1941, p. 105.

⁴⁹N. Messerle, "Die Veränderungen im Elektrokardiogramm bei Körperarbeit," Med 60, p. 490, 1928.

⁵⁰William A. Farr, "The Effects of Wheat Germ Oil and Vitamin E on Physical Fitness," M. S. Thesis, Physical Education, University of Illinois, 1950, p. 92.

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1. The first part of the document is a letter from the author to the editor of the journal. The letter is dated 1954 and is addressed to the editor of the journal. The letter is written in a formal and polite manner. The author expresses his appreciation for the editor's work and his interest in the journal. He also mentions that he has received the journal and is looking forward to reading it. The letter is signed by the author and is dated 1954.

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first 12 weeks and a further loss of 1.54 mm. during the last six weeks.⁵¹

In Vohaska's study the T-Wave of the ECG lost somewhat compared to the non exercised controls. This was credited as possibly being due to a type of nervous fatigue.⁵²

The results of the T-Wave of the electrocardiogram in Cureton's work on middle aged subjects shows a trend of evidence favoring the exercised group which took wheat germ oil. The mean gain of this group was from 9.84 mm. to 11.04 mm., a gain of 12.20%, and a significant change of ($t=2.80$). The two groups were insignificantly different, so the gains were attributed wholly to exercise.⁵³

Cureton has established some interesting figures on various types of subjects in regards to their T-Waves. Many debilitated subjects had $T_{IV} - V$ waves as low as 2 to 3 mm., and most of those could hardly walk on the treadmill; the average student at the University of Illinois score is 9.5 mm., Olympic swimming and diving men averaged 17.0 mm.;

⁵¹Steve Susic, "The Effects of Training and a Dietary Supplement on the T-Wave of the ECG," M. S. Thesis, Physical Education, University of Illinois, 1953, p. 53.

⁵²William J. Vohaska, "The Effects of Wheat Germ Oil on the Cardiovascular Fitness of Varsity Wrestlers," Urbana, M. S. Thesis, Physical Education, 1952, p. 43.

⁵³Thomas K. Cureton, "Influence of Wheat Germ Oil as a Dietary Supplement in a Program of Conditioning Exercises with Middle-Aged Subjects," The Research Quarterly, December 1955, p. 400.

a collection of top track and field stars averaged 15.9 mm.; John Marshall measured 18.7 mm., and shortly afterward broke five world's records in swimming; and Roger Bannister, just prior to breaking the four-minute mile had a T-Wave of 27.5 mm.⁵⁴

"Many of our other experiments have shown the gain in this important measurement as associated with improvements in endurance.⁵⁵

Summary. In recent years great advancements have contributed much to our knowledge of the nutritional needs of our body. The value of wheat germ oil as a dietary supplement is still unanswered. Many experiments seem to favor wheat germ oil as being beneficial to athletic performance, but so far there is no satisfactory evidence to prove it so.

Cureton firmly believes that wheat germ oil aids those who consume it under proper conditions. In most of the experiments conducted by Cureton he has attempted to bring out the point that wheat germ improves the endurance of the athlete.

Dr. Shute has made great claims for the effect of Vitamin E on our health. For years it was generally accepted that the average human was not lacking in Vitamin E. However, recent studies indicate that the average American diet is lacking in Vitamin E.

⁵⁴Ibid., pp. 402-403.

⁵⁵Ibid., p. 403.

There seems to be some disagreement as to whether or not wheat germ oil is a good source of Vitamin E. Regardless of the Vitamin E content, there is the possibility of some other substance in wheat germ oil to aid performance.

Athletic training seems to affect the electrocardiogram data to a large extent. The pulse rate slows down, P-Waves lowered, P-R Interval prolonged, QRS duration prolonged, and the T-Waves elevated.

Cureton has performed many studies on the effect of wheat germ oil on the T-Wave. In several studies the results indicate that the T-Wave of the wheat germ oil group's improved more than the T-Waves of the control group's. Several of Cureton's experiments indicate that a high T-Wave is related to endurance.

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CHAPTER III

METHODOLOGY

One of the first and most pertinent considerations in a study of this type is the grouping of the subjects. Twenty two subjects, all untrained college freshmen volunteered for the experiment. Two groups were needed for the experiment, Group A, the experimental group and Group B, the control group.

The formation of groups for experimental purposes can be accomplished (1) by random sampling--the random assigning of individuals to the groups, (2) by pairing, (3) using sibs or littermates, (4) by matching distributions, (5) by using the same person under all aspects of the experimental design. Greater precision is obtainable by using method 2, 3 or 5 than in method 1 (random assignment).⁵⁶

Experimental design. Prior to the initial training period, all subjects ran a half mile and their times were recorded to the nearest half second. The subjects were then paired, on the basis of their scores in the half mile run. Very close pairings were possible with eighteen of the

⁵⁶Quinn McNemar, Psychological Statistics, (second edition, John Wiley & Sons, Inc., New York, Chapman & Hall Limited, London), pp. 363-364.

subjects, which resulted in nine pairs. The remaining four were kept as reserves, two in the A group, and two in the B group. During the second week of training, one of the subjects had to drop out of school due to an emergency, and fortunately one of the reserves had a time score within a half second of the drop out. This left a total of nine pairs in each group, two reserves in Group B, and one reserve in Group A.

Using mean scores, the A groups times totaled two minutes, forty nine and eighty eight hundredths seconds (2:49.88) as compared to the B groups mean of two minutes, forty nine and seventy seven hundredths seconds, (2:49.77), or .11 of a second higher for the A group.

Training program. The subjects of both groups trained three days a week for seven weeks with the objective of improving their times in the half mile run. The Michigan State University Track coach assisted in setting up the training program, and the program consisted primarily of stretching exercises, sprints and overload training, (running farther each time than the actual distance for record). Half mile times were recorded each week throughout the experiment. Including the initial run, seven tests were made in all.

During the experiment the subjects reported on Monday, Wednesday and Friday for one hour. They took their pills in class on these three days and were also issued pills for the

1. The first step in the process of the investigation is to identify the problem. This is done by the investigator, who is usually a member of the research team. The investigator will then conduct a literature review to determine what has been done in the past and what gaps exist in the current knowledge.

2. The second step is to develop a research plan. This plan will outline the objectives of the study, the methods to be used, and the timeline for the project. The investigator will also need to obtain approval from the appropriate ethical review board.

3. The third step is to collect data. This can be done through a variety of methods, including interviews, surveys, and experiments. The investigator will need to ensure that the data is collected in a systematic and unbiased manner.

4. The fourth step is to analyze the data. This involves using statistical methods to identify patterns and trends in the data. The investigator will also need to consider the limitations of the study and the potential for bias.

5. The final step is to write a report. This report will summarize the findings of the study and provide recommendations for future research. The investigator will also need to present the findings to the research team and the wider community.

[illegible]

THE FOLLOWING INFORMATION IS FOR YOUR INFORMATION ONLY. IT IS NOT TO BE USED FOR ANY OTHER PURPOSE. IT IS NOT TO BE DISCLOSED TO ANY OTHER PERSON OR ENTITY. IT IS NOT TO BE USED FOR ANY OTHER PURPOSE. IT IS NOT TO BE DISCLOSED TO ANY OTHER PERSON OR ENTITY.

[illegible]

1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the situation.

following day. Each subject was given a reserve bottle of pills in case of absences. Over the seven week period there were only 14 absents out of a possible 420. None of the subjects was absent more than one day per week, and no one missed more than two days for the entire seven weeks of training.

On Monday and Wednesday the entire period was spent exercising and running (primarily overload). Each subject was given the same amount of exercise and training each day. On Friday of each week the subjects were tested for their best time in the half mile run. The entire program of feeding, exercising, and running was supervised by the author.

Half Mile Run. The half mile run was selected as the test for endurance. It was thought that the test would not be so severe that the subjects would not finish because of lack of training, nor was it so easy that the endurance of each subject would not be taxed. The method used in the first running, which included the bulk of the subjects, was the dividing of the subjects into two groups with each subject in each group having a partner in the opposite group. Thus by running one group at a time, and with the author calling the time to the closest half second as the runners crossed the finish mark, the times were recorded for the subjects by each one's partner who was not running. These times were recorded immediately. The second group was then timed in the same manner.

In subsequent testings, the subjects were split into four groups according to their previous times, which served to put some competition into the run.

Controls. The constants in the experiment were the method of training, the uniform, which was gym shorts and rubber soled tennis shoes, the indoor 1/8 mile track, the hour of training being Monday, Wednesday and Friday from 9-10 A.M., the amount and type of training, and the ingestion of four gelatin capsules daily between 9-10 A.M.

Variable. - The variable was the contents of the capsules consumed by Group A, the experimental group, which contained 6 minum (0.37 ml.) of fresh wheat germ oil. The controls or B group, consumed four capsules of the same size which were placebos containing cottonseed oil which provided approximately the same number of calories per capsule and duplicated the fatty acid distribution.

It was impossible to control the diet completely, but the subjects were advised to rely on the food served to them in their dormitories as much as possible, and to take no other dietary supplement during the course of the experiment. The subjects were also requested to refrain from any other type of physical activity other than their training which might increase their endurance over the seven weeks period.

It is the duty of the Government to protect the rights of its citizens and to ensure that the law is enforced. The Government has a responsibility to maintain law and order and to provide a safe and secure environment for its citizens. The Government has a duty to protect the rights of its citizens and to ensure that the law is enforced. The Government has a responsibility to maintain law and order and to provide a safe and secure environment for its citizens.

of your refusal to accept the offer of \$100,000. I am sorry that I cannot do more for you at present.

I am, Sir, very respectfully,
Your obedient servant,
J. M. Smith

1. The following are the names of the persons who have been identified as having been in contact with the subject of this investigation, and who have been identified as having been in contact with the subject of this investigation, and who have been identified as having been in contact with the subject of this investigation.

It was intended to be a small, intimate gathering, but the weather was so bad that only a few people could attend. The speaker, Mr. J. H. Smith, was a well-known figure in the community and his address was well received. The meeting was held in the town hall and the speaker was assisted by Mr. J. H. Smith. The meeting was held in the town hall and the speaker was assisted by Mr. J. H. Smith. The meeting was held in the town hall and the speaker was assisted by Mr. J. H. Smith.

Electrocardiogram. Electrocardiograms were taken just prior to the seven weeks training period. Standard leads 1 & 2 were recorded for one minute and then standard leads 1 & 3 for one minute prior to exercise. Then the subjects ran on a powered treadmill at a rate of six miles per hour for five minutes, (1/2 mile). Immediately upon completion of the run the subjects lay down and after a one minute interval ECG's were taken on leads one and two for one minute. This same process was repeated at the end of the seven weeks training period so comparisons could be made between the two groups. Again the 1/2 mile distance was decided upon as a proper distance to insure that everyone would complete the test.

The half mile was run on the treadmill with the leads connected to the subject so as to insure proper connections on the ECG after a one minute interval.

It should also be noted here that two ECG's were taken prior to the seven weeks of training, the first one to merely familiarize the subjects and the author with the method of testing and running on the powered treadmill, etc. It was felt that this helped relieve some of the tension that accompanies running on the treadmill for the first time. Then the second ECG was taken the following day, and these were regarded as official records.

Care was also taken not to take the tests within one hour of a major meal. Also, in order to avoid emotional

influences of apprehension and excitement, the tests were given in as relaxed an atmosphere as was possible.

Organization and analysis. An individual data sheet was kept on each subject throughout the experiment. Each time the subjects was tested on the 1/2 mile the results were recorded on a tabulation sheet. (See Table VI) The mean scores of each group were also tabulated each week. (See Table I.)

The analysis of variance was employed to statistically analyze the data collected on the half mile run.

The "t" test was employed to analyze the electrocardiogram data. All 21 of the subjects were used in the "t" test. Following is a breakdown of the various "t" scores tabulated.

1. The differences between Group A's before conditioning before exercise scores vs. Group B's before conditioning before exercise scores. This included measurements of the pulse rate, the vector, the length of the impulse, the amplitudes of the "P" wave; the "T" wave; and the "QRS" wave, the "PR" interval, and the "QT" interval for lead one, and the amplitudes of the "P" wave, the "T" wave and "RS" wave for lead two.

2. The same method was repeated for before conditioning, after exercise vs. after conditioning after exercise of the groups.

influence of a number of factors, and the results are given in a table as follows:

Table 1. Results of the investigation

The first part of the investigation was devoted to the study of the influence of the temperature of the water on the rate of the reaction. It was found that the rate of the reaction increases with the increase of the temperature of the water. The results are given in Table 1.

The second part of the investigation was devoted to the study of the influence of the concentration of the reactants on the rate of the reaction. It was found that the rate of the reaction increases with the increase of the concentration of the reactants. The results are given in Table 1.

The third part of the investigation was devoted to the study of the influence of the catalyst on the rate of the reaction. It was found that the rate of the reaction increases with the addition of the catalyst. The results are given in Table 1.

The fourth part of the investigation was devoted to the study of the influence of the solvent on the rate of the reaction. It was found that the rate of the reaction increases with the change of the solvent. The results are given in Table 1.

3. "t" scores were ran on the same factors by combining the data of both groups to determine the effect of conditioning on the ECG data. To find the level of significance regular "t" tables were used.

and the other two are in the same position as the first.

In 1933, the first of these was found to be in the same position as the first, and the other two were found to be in the same position as the first.

CHAPTER IV

RESULTS AND DISCUSSION

Analysis of data of the half mile run. Both groups improved in their ability to run the half mile. This fact is demonstrated in the mean weekly scores of each group. (See Table I and Figure I.)

The analysis of variance used to statistically analyze the data collected on the half mile run revealed the following:

1. Analysis of Variance--Group A (7 runs)

This gave an "F" ratio of 1.64 which was below the 2.28 needed to be significant at the .05 level. A breakdown of the final computations is given in Table II.

2. Analysis of Variance--Group B (7 runs)

This gave an "F" ratio of 1.33 which was below the 2.28 needed to be significant at the .05 level. A breakdown of the final computations is given in Table III.

3. Analysis of Variance--Group A vs. Group B

When comparing the difference in improvement between the two groups an "F" of .11 was found. This was not statistically significant, as an "F" of 3.93 was needed to be significant at the .05 level. A breakdown of the final computations is given in Table IV.

Introduction

1. The purpose of this report is to

provide a summary of the results of the

investigation conducted by the

Department of the Interior, Bureau of

Geological Survey, in the

study of the geology of the

area of the State of California, and

to present a summary of the

results of the investigation.

2. The results of the investigation

are presented in the following

sections of the report:

3. The first section is a

summary of the geology of the

area of the State of California,

and the second section is a

summary of the results of the

investigation conducted by the

Department of the Interior, Bureau of

Geological Survey, in the

study of the geology of the

TABLE I
RUNNING WEEKLY MEAN SCORES FOR GROUPS A AND B

| | Group A | Group B |
|--------|---------|---------|
| Week 1 | 2.832 | 2.830 |
| 2 | 2.786 | 2.792 |
| 3 | 2.679 | 2.746 |
| 4 | 2.658 | 2.706 |
| 5 | 2.790 | 2.627 |
| 6 | 2.586 | 2.660 |
| 7 | 2.560 | 2.604 |
| | 2.700* | 2.714* |

* Total mean score

THEORY OF THE EARTH

1. The Earth is a sphere of radius R .

2. The Earth is composed of a uniform material of density ρ .

3. The Earth is in a state of equilibrium.

4. The Earth is in a state of equilibrium.

5. The Earth is in a state of equilibrium.

6. The Earth is in a state of equilibrium.

7. The Earth is in a state of equilibrium.

8. The Earth is in a state of equilibrium.

9. The Earth is in a state of equilibrium.

10. The Earth is in a state of equilibrium.

11. The Earth is in a state of equilibrium.

12. The Earth is in a state of equilibrium.

13. The Earth is in a state of equilibrium.

14. The Earth is in a state of equilibrium.

15. The Earth is in a state of equilibrium.

16. The Earth is in a state of equilibrium.

17. The Earth is in a state of equilibrium.

18. The Earth is in a state of equilibrium.

19. The Earth is in a state of equilibrium.

TABLE I

RUNNING WEEKLY MEAN SCORES FOR GROUPS A AND B

| | Group A | Group B |
|--------|---------|---------|
| Week 1 | 2.832 | 2.830 |
| 2 | 2.786 | 2.792 |
| 3 | 2.679 | 2.746 |
| 4 | 2.658 | 2.706 |
| 5 | 2.790 | 2.627 |
| 6 | 2.586 | 2.660 |
| 7 | 2.560 | 2.604 |
| | 2.700* | 2.714* |

* Total mean score

TABLE II

ANALYSIS OF VARIANCE - GROUP A (7 runs)

| Source | SS | DF | MS | F | F.05 |
|---------|----------|----|---------|-------|------|
| Between | .583570 | 6 | .097262 | 1.64* | 2.28 |
| Within | 3.078436 | 52 | .059201 | | |
| Total | 3.662006 | 58 | | | |

*This "F" ratio of 1.64 is lower than the 2.28 needed to be significant at the .05 level

TABLE III
ANALYSIS OF VARIANCE - GROUP B (7 runs)

| Source | SS | DF | MS | F | F.05 |
|---------|----------|----|---------|-------|------|
| Between | .349078 | 6 | .058180 | 1.33* | 2.28 |
| Within | 2.189638 | 50 | .043793 | | |
| Total | 2.538716 | 56 | | | |

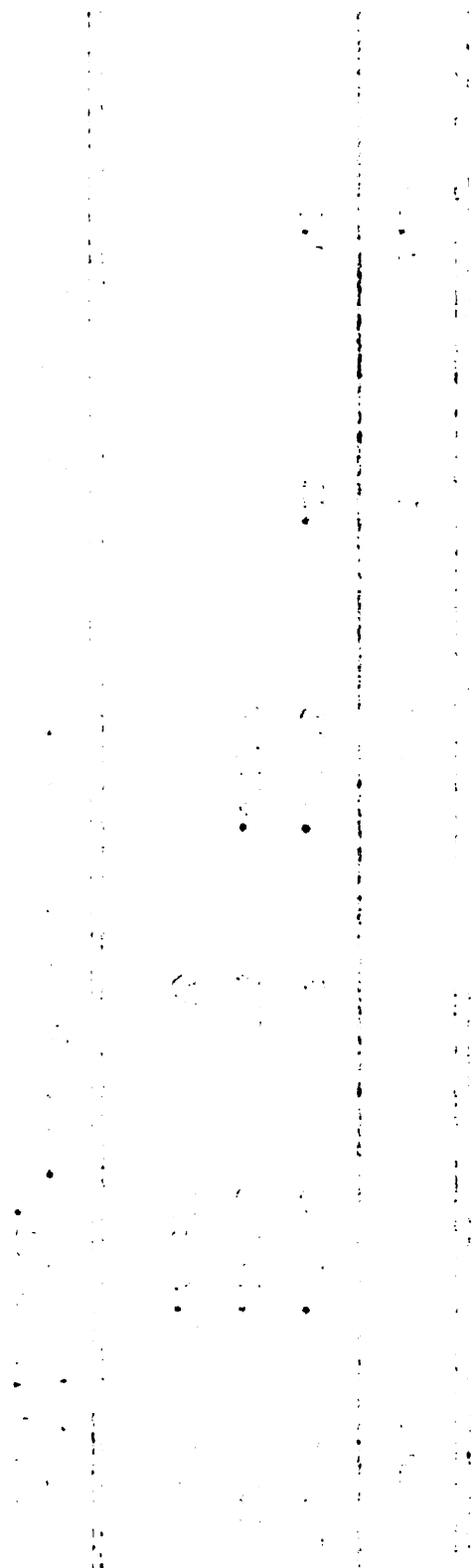
*This "F" ratio of 1.33 is lower than the 2.28 needed to be significant at the .05 level.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|-----|------|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 | 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 | 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 | 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 | 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 | 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 | 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 | 537 | 538 | 539 | 540 | 541 | 542 | 543 | 544 | 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 | 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 | 561 | 562 | 563 | 564 | 565 | 566 | 567 | 568 | 569 | 570 | 571 | 572 | 573 | 574 | 575 | 576 | 577 | 578 | 579 | 580 | 581 | 582 | 583 | 584 | 585 | 586 | 587 | 588 | 589 | 590 | 591 | 592 | 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 | 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 | 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 | 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 | 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 | 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 | 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 | 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 | 657 | 658 | 659 | 660 | 661 | 662 | 663 | 664 | 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 | 673 | 674 | 675 | 676 | 677 | 678 | 679 | 680 | 681 | 682 | 683 | 684 | 685 | 686 | 687 | 688 | 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 | 697 | 698 | 699 | 700 | 701 | 702 | 703 | 704 | 705 | 706 | 707 | 708 | 709 | 710 | 711 | 712 | 713 | 714 | 715 | 716 | 717 | 718 | 719 | 720 | 721 | 722 | 723 | 724 | 725 | 726 | 727 | 728 | 729 | 730 | 731 | 732 | 733 | 734 | 735 | 736 | 737 | 738 | 739 | 740 | 741 | 742 | 743 | 744 | 745 | 746 | 747 | 748 | 749 | 750 | 751 | 752 | 753 | 754 | 755 | 756 | 757 | 758 | 759 | 760 | 761 | 762 | 763 | 764 | 765 | 766 | 767 | 768 | 769 | 770 | 771 | 772 | 773 | 774 | 775 | 776 | 777 | 778 | 779 | 780 | 781 | 782 | 783 | 784 | 785 | 786 | 787 | 788 | 789 | 790 | 791 | 792 | 793 | 794 | 795 | 796 | 797 | 798 | 799 | 800 | 801 | 802 | 803 | 804 | 805 | 806 | 807 | 808 | 809 | 810 | 811 | 812 | 813 | 814 | 815 | 816 | 817 | 818 | 819 | 820 | 821 | 822 | 823 | 824 | 825 | 826 | 827 | 828 | 829 | 830 | 831 | 832 | 833 | 834 | 835 | 836 | 837 | 838 | 839 | 840 | 841 | 842 | 843 | 844 | 845 | 846 | 847 | 848 | 849 | 850 | 851 | 852 | 853 | 854 | 855 | 856 | 857 | 858 | 859 | 860 | 861 | 862 | 863 | 864 | 865 | 866 | 867 | 868 | 869 | 870 | 871 | 872 | 873 | 874 | 875 | 876 | 877 | 878 | 879 | 880 | 881 | 882 | 883 | 884 | 885 | 886 | 887 | 888 | 889 | 890 | 891 | 892 | 893 | 894 | 895 | 896 | 897 | 898 | 899 | 900 | 901 | 902 | 903 | 904 | 905 | 906 | 907 | 908 | 909 | 910 | 911 | 912 | 913 | 914 | 915 | 916 | 917 | 918 | 919 | 920 | 921 | 922 | 923 | 924 | 925 | 926 | 927 | 928 | 929 | 930 | 931 | 932 | 933 | 934 | 935 | 936 | 937 | 938 | 939 | 940 | 941 | 942 | 943 | 944 | 945 | 946 | 947 | 948 | 949 | 950 | 951 | 952 | 953 | 954 | 955 | 956 | 957 | 958 | 959 | 960 | 961 | 962 | 963 | 964 | 965 | 966 | 967 | 968 | 969 | 970 | 971 | 972 | 973 | 974 | 975 | 976 | 977 | 978 | 979 | 980 | 981 | 982 | 983 | 984 | 985 | 986 | 987 | 988 | 989 | 990 | 991 | 992 | 993 | 994 | 995 | 996 | 997 | 998 | 999 | 1000 | 1001 | 1002 | 1003 | 1004 | 1005 | 1006 | 1007 | 1008 | 1009 | 1010 | 1011 | 1012 | 1013 | 1014 | 1015 | 1016 | 1017 | 1018 | 1019 | 1020 | 1021 | 1022 | 1023 | 1024 | 1025 | 1026 | 1027 | 1028 | 1029 | 1030 | 1031 | 1032 | 1033 | 1034 | 1035 | 1036 | 1037 | 1038 | 1039 | 1040 | 1041 | 1042 | 1043 | 1044 | 1045 | 1046 | 1047 | 1048 | 1049 | 1050 | 1051 | 1052 | 1053 | 1054 | 1055 | 1056 | 1057 | 1058 | 1059 | 1060 | 1061 | 1062 | 1063 | 1064 | 1065 | 1066 | 1067 | 1068 | 1069 | 1070 | 1071 | 1072 | 1073 | 1074 | 1075 | 1076 | 1077 | 1078 | 1079 | 1080 | 1081 | 1082 | 1083 | 1084 | 1085 | 1086 | 1087 | 1088 | 1089 | 1090 | 1091 | 1092 | 1093 | 1094 | 1095 | 1096 | 1097 | 1098 | 1099 | 1100 | 1101 | 1102 | 1103 | 1104 | 1105 | 1106 | 1107 | 1108 | 1109 | 1110 | 1111 | 1112 | 1113 | 1114 | 1115 | 1116 | 1117 | 1118 | 1119 | 1120 | 1121 | 1122 | 1123 | 1124 | 1125 | 1126 | 1127 | 1128 | 1129 | 1130 | 1131 | 1132 | 1133 | 1134 | 1135 | 1136 | 1137 | 1138 | 1139 | 1140 | 1141 | 1142 | 1143 | 1144 | 1145 | 1146 | 1147 | 1148 | 1149 | 1150 | 1151 | 1152 | 1153 | 1154 | 1155 | 1156 | 1157 | 1158 | 1159 | 1160 | 1161 | 1162 | 1163 | 1164 | 1165 | 1166 | 1167 | 1168 | 1169 | 1170 | 1171 | 1172 | 1173 | 1174 | 1175 | 1176 | 1177 | 1178 | 1179 | 1180 | 1181 | 1182 | 1183 | 1184 | 1185 | 1186 | 1187 | 1188 | 1189 | 1190 | 1191 | 1192 | 1193 | 1194 | 1195 | 1196 | 1197 | 1198 | 1199 | 1200 | 1201 | 1202 | 1203 | 1204 | 1205 | 1206 | 1207 | 1208 | 1209 | 1210 | 1211 | 1212 | 1213 | 1214 | 1215 | 1216 | 1217 | 1218 | 1219 | 1220 | 1221 | 1222 | 1223 | 1224 | 1225 | 1226 | 1227 | 1228 | 1229 | 1230 | 1231 | 1232 | 1233 | 1234 | 1235 | 1236 | 1237 | 1238 | 1239 | 1240 | 1241 | 1242 | 1243 | 1244 | 1245 | 1246 | 1247 | 1248 | 1249 | 1250 | 1251 | 1252 | 1253 | 1254 | 1255 | 1256 | 1257 | 1258 | 1259 | 1260 | 1261 | 1262 | 1263 | 1264 | 1265 | 1266 | 1267 | 1268 | 1269 | 1270 | 1271 | 1272 | 1273 | 1274 | 1275 | 1276 | 1277 | 1278 | 1279 | 1280 | 1281 | 1282 | 1283 | 1284 | 1285 | 1286 | 1287 | 1288 | 1289 | 1290 | 1291 | 1292 | 1293 | 1294 | 1295 | 1296 | 1297 | 1298 | 1299 | 1300 | 1301 | 1302 | 1303 | 1304 | 1305 | 1306 | 1307 | 1308 | 1309 | 1310 | 1311 | 1312 | 1313 | 1314 | 1315 | 1316 | 1317 | 1318 | 1319 | 1320 | 1321 | 1322 | 1323 | 1324 | 1325 | 1326 | 1327 | 1328 | 1329 | 1330 | 1331 | 1332 | 1333 | 1334 | 1335 | 1336 | 1337 | 1338 | 1339 | 1340 | 1341 | 1342 | 1343 | 1344 | 1345 | 1346 | 1347 | 1348 | 1349 | 1350 | 1351 | 1352 | 1353 | 1354 | 1355 | 1356 | 1357 | 1358 | 1359 | 1360 | 1361 | 1362 | 1363 | 1364 | 1365 | 1366 | 1367 | 1368 | 1369 | 1370 | 1371 | 1372 | 1373 | 1374 | 1375 | 1376 | 1377 | 1378 | 1379 | 1380 | 1381 | 1382 | 1383 | 1384 | 1385 | 1386 | 1387 | 1388 | 1389 | 1390 | 1391 | 1392 | 1393 | 1394 | 1395 | 1396 | 1397 | 1398 | 1399 | 1400 | 1401 | 1402 | 1403 | 1404 | 1405 | 1406 | 1407 | 1408 | 1409 | 1410 | 1411 | 1412 | 1413 | 1414 | 1415 | 1416 | 1417 | 1418 | 1419 | 1420 | 1421 | 1422 | 1423 | 1424 | 1425 | 1426 | 1427 | 1428 | 1429 | 1430 | 1431 | 1432 | 1433 | 1434 | 1435 | 1436 | 1437 | 1438 | 1439 | 1440 | 1441 | 1442 | 1443 | 1444 | 1445 | 1446 | 1447 | 1448 | 1449 | 1450 | 1451 | 1452 | 1453 | 1454 | 1455 | 1456 | 1457 | 1458 | 1459 | 1460 | 1461 | 1462 | 1463 | 1464 | 1465 | 1466 | 1467 | 1468 | 1469 | 1470 | 1471 | 1472 | 1473 | 1474 | 1475 | 1476 | 1477 | 1478 | 1479 | 1480 | 1481 | 1482 | 1483 | 1484 | 1485 | 1486 | 1487 | 1488 | 1489 | 1490 | 1491 | 1492 | 1493 | 1494 | 1495 | 1 |
|---|---|---|---|---|---|---|---|---|-----|------|---|

TABLE IV
ANALYSIS OF VARIANCE - GROUP "A" VS. GROUP "B"

| Source | SS | DF | MS | F | F.05 |
|---------|----------|-----|---------|------|------|
| Between | .005315 | 1 | .005315 | .11* | 3.93 |
| Within | 6.200723 | 114 | .054392 | | |
| Total | 6.206538 | 115 | | | |

*This "F" ratio of .11 is lower than the 3.93 needed to be significant at the .05 level.



Analysis of the data of the ECG. The "t" test employed to statistically analyze the electrocardiogram data found very few significant differences. The "t" values are presented on Table V.

Significant differences.

1. When comparing the pulse rates of the combined "A" and "B" Groups of before conditioning before exercise Vs. after conditioning before exercise, a t of 3.76 was found. This is significant at $P=.001$ For a "t" to be significant at this level with 40 degrees of freedom a "t" of 3.55 was necessary.*
2. When comparing the pulse rates of the combined "A" and "B" Groups of before conditioning after exercise vs. the after conditioning after exercise, a "t" of 3.46 was found. This is significant at $P=.01$. To be significant at this level with 40 degrees of freedom a "t" of 2.71* was necessary.
3. When comparing differences of the vectors of lead one for Group "A" before exercise vs. the Group "B" before exercise a "t" of 2.71 was found, which was significant at $P=.02$. For a $P=.02$ with

*As the improvements in pulse rate were only significant after combining Groups "A" and "B" it is concluded that the differences are due to conditioning and not due to the variable of the wheat germ oil.

...of the

to statistically analyze the
very few significant differences were
found on Table V.

Statistical Analysis

1. When comparing the
... ..
... ..
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2. When comparing the
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The
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19 degrees of freedom a "t" of at least 2.54 was necessary.*

4. When comparing the vector differences of Group "A" and Group "B" after exercise another significant "t" of 2.96 was found. This is significant at $P=.01$. To be significant at this level with 19 degrees of freedom a "t" of 2.86 was needed.*

*As the significant changes in the vectors were found only when Group "A"'s differences were compared to Group "B"'s differences it is considered by the author to be due to the feeding of the variable of wheat germ oil.

TABLE V

"t" VALUES OF ECG DATA

| E C G
Measurements
Recorded | Group A
vs.
Group B
at rest | Group A
vs.
Group B
after exercise | Groups
Combined
at
rest | Groups
Combined
after
exercise |
|-----------------------------------|--------------------------------------|---|----------------------------------|---|
| Lead One | | | | |
| Pulse rate | -.22 | .25 | 3.76*** | 3.46**** |
| Vector | -2.71* | -2.96** | -18.00 | -.66 |
| Length | -.71 | 2.04 | -38.00 | -.19 |
| P Wave | .47 | .05 | .04 | -.08 |
| T wave | .18 | .50 | -.18 | -.08 |
| 2RS Wave | 1.08 | -.33 | -.03 | .23 |
| PR Interval | .15 | .05 | -.05 | .02 |
| 2RS Interval | .10 | .09 | .08 | .19 |
| 2T Interval | 1.70 | .09 | -.16 | -.06 |
| Lead Two | | | | |
| P Wave | .36 | .05 | .37 | -.28 |
| T wave | .08 | .04 | .12 | .31 |
| 2RS Wave | .16 | 1.95 | -.68 | -.28 |

*Significant at the .02 level

**Significant at the .01 level

***Significant at the .001 level

****Significant at the .01 level

DISCUSSION OF THE RESULTS

Half mile run data. The hypothesis upon which this experiment was formulated was based on the theory that the daily ingestion of four six-minum (0.27 ml) capsules of fresh wheat germ oil would improve the ability of untrained college freshmen to run the half mile. It was also hypothesized that the wheat germ oil would have beneficial effects upon selected areas of the cardiac function.

The final analysis of the half mile run data indicated no significant changes that could be attributed to the wheat germ supplement. However, a closer look at the data reveals that the wheat germ group did improve more than the placebo group in several factors. A glance at the figure showing the times in minutes and seconds for the two groups quickly reveals that the wheat germ oil group bettered the placebo group by .044 or 2.6 seconds.⁵⁷

The experimental group had better scores in each trial run except the fifth week. The rise in the curve at this time was due almost entirely to one subjects time. (See Figure I.) This one individual's score jumped from 2:41 in the fourth trial to 3:34.5 in the fifth trial. (See Table VI.) This was an increase of 43.5 seconds. The subject had no explanation for his poor showing other than he just didn't feel like running. Had this subject matched his time of the previous week the mean score would have been

⁵⁷See Figure I.

THE EFFECT OF PRACTICE ON THE

PERFORMANCE OF A SKILL

The purpose of this experiment was to determine the effect of practice on the performance of a skill. The subjects were 10 college students who were given a series of trials of a task. The results showed that the performance improved as the number of trials increased. This is consistent with the theory of skill acquisition, which states that practice leads to improvement in performance.

The first trial was the most difficult.

As the number of trials increased, the performance improved. This is consistent with the theory of skill acquisition, which states that practice leads to improvement in performance. The results of this experiment support the theory of skill acquisition.

See Table I.

The results of the experiment are shown in Table I.

run except the fifth week. The time in the course of this

time was also related to the subject's time. (See

Table I.) This was a significant result for the first

the fourth trial to 2:25.5 in the fifth trial. (See Table I.)

This was an increase of 48.5 seconds. The subject had no

experience for his own record after he had the

first time running. The time subject needed for the

of the practice week the mean score would have been

TABLE VI
WEEKLY HALF MILE RECORDINGS

| Subject | GROUP A | | | | | | |
|---------|---------|--------|--------|--------|--------|--------|--------|
| | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Test 7 |
| 1 | 2:27 | 2:29 | 2:28 | 2:24 | 2:24 | 2:24 | 2:19 |
| 2 | 2:39 | 2:44.5 | 2:32 | 2:33 | 2:30 | 2:29 | 2:25 |
| 3 | 2:40 | 2:34 | 2:39 | 2:41 | 3:34.5 | 2:38 | 2:35 |
| 4 | 2:42 | --- | --- | 2:32 | 2:40 | 2:39 | 2:30 |
| 5 | 2:43 | 2:39 | 2:30 | 2:32 | 2:32.5 | 2:30 | 2:29 |
| 6 | 2:43 | 2:45 | 2:42 | 2:41 | 2:36 | 2:32.5 | 2:29 |
| 7 | 3:03 | 2:59 | 2:49 | 2:46 | 2:59 | 2:46 | 2:44.5 |
| 8 | 3:02 | 2:56.5 | 2:50 | --- | 2:49.5 | 2:43 | 2:41 |
| 9 | 3:30 | 3:10 | 2:56 | 3:07 | 3:01 | --- | 2:50 |

| Subject | GROUP B | | | | | | |
|---------|---------|--------|--------|--------|--------|--------|--------|
| | Test 1 | Test 2 | Test 3 | Test 4 | Test 5 | Test 6 | Test 7 |
| 1 | 2:32 | 2:36 | 2:42 | 2:31.5 | 2:30 | 2:30 | 2:27 |
| 2 | 2:37 | 2:35 | 2:39 | 2:40 | --- | 2:40 | 2:34 |
| 3 | 2:39 | 2:45 | 2:31.5 | 2:30 | 2:29 | 2:25 | 2:27 |
| 4 | 2:41 | 2:44 | 2:52 | 2:42 | 2:42.5 | 2:46 | 2:39 |
| 5 | 2:41 | 2:39 | 2:34 | 2:35 | --- | 2:30 | 2:27 |
| 6 | 2:45 | 2:46 | 2:32 | 2:36 | 2:31 | 2:44 | 2:33 |
| 7 | 3:01 | --- | 2:57 | 2:52.5 | --- | 2:52 | 2:50 |
| 8 | 3:02 | 2:58 | 2:54 | 2:52.5 | --- | 2:50 | 2:43 |
| 9 | 3:30 | 3:17 | 3:01.5 | 3:01.5 | 2:55.5 | --- | 2:46 |

*Recorded to the nearest $\frac{1}{2}$ second.

Table 1

Summary of the data for the first part of the experiment

| Run | Time (min) | Temperature (°C) | Pressure (mm Hg) | Flow rate (ml/min) | Concentration (%) | Yield (%) |
|-----|------------|------------------|------------------|--------------------|-------------------|-----------|
| 1 | 10 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 2 | 20 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 3 | 30 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 4 | 40 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 5 | 50 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 6 | 60 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 7 | 70 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 8 | 80 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 9 | 90 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 10 | 100 | 100 | 100 | 1.0 | 1.0 | 1.0 |

| Run | Time (min) | Temperature (°C) | Pressure (mm Hg) | Flow rate (ml/min) | Concentration (%) | Yield (%) |
|-----|------------|------------------|------------------|--------------------|-------------------|-----------|
| 11 | 110 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 12 | 120 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 13 | 130 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 14 | 140 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 15 | 150 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 16 | 160 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 17 | 170 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 18 | 180 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 19 | 190 | 100 | 100 | 1.0 | 1.0 | 1.0 |
| 20 | 200 | 100 | 100 | 1.0 | 1.0 | 1.0 |

very close to the previous week. This fifth week run is the only time that the control group bettered the experimental group.

In the discussion of the limitations of the study, it was mentioned that the lack of time was a serious handicap to the study. A close analysis of the half mile run further points this out. The greatest percent of improvement was gained by those subjects with poor times to begin with, and it's quite likely these boys were in poor physical shape and would have benefited a great deal by a couple of weeks of conditioning before beginning the testing.

Electrocardiogram data. Two of the four significant differences found when employing the "t" analysis to the ECG data were gained by combining the experimental and control groups data to get the effect of conditioning on cardiac function. These differences were in the pulse rates of the subjects. A "t" of 3.76 was satisfactory at the .001 level for the data on the Before Conditioning vs. After Conditioning prior to exercise. A "t" of 3.46, significant at the .01 level was found when comparing the same data after exercise.

When these same comparisons were made on the differences between the groups instead of the combined scores very small "t" scores were obtained, and were not close to being statistically significant. (See Table V.)

1. The first step in the process of the investigation of the case was the identification of the person who was the subject of the investigation. This was done by the use of the name of the person who was the subject of the investigation.

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

[illegible]

Figure 1. The effect of the concentration of the *Agrobacterium* suspension on the transformation efficiency of *Agrobacterium* strains. The *Agrobacterium* strains were grown in YEA medium for 24 h at 28 °C. The cell concentration was adjusted to 10⁸ cells/ml. The cell suspension was mixed with the plant tissue and incubated for 24 h at 28 °C. The plant tissue was then cultured on the selective medium. The transformation efficiency was determined as the number of transformants per 100 mg of plant tissue. The data are the mean ± SD of three independent experiments. * indicates a significant difference from the control (p < 0.05).

1. The first step in the process of identifying a problem is to define the problem clearly. This involves identifying the symptoms of the problem and determining the scope of the problem. Once the problem has been defined, the next step is to identify the causes of the problem. This involves identifying the factors that are contributing to the problem and determining the underlying causes. Once the causes have been identified, the next step is to develop a plan to address the problem. This involves identifying the actions that need to be taken to address the problem and determining the resources that will be needed to implement the plan. Finally, the last step in the process is to implement the plan and monitor the results. This involves putting the plan into action and tracking the progress of the plan to ensure that the problem is being addressed effectively.

Therefore, it is concluded that the drop in pulse rate was due to the conditioning program and not to the effect of the wheat germ oil.

The other two significant differences were found in the vectors of the two groups. When running a "t" on Group "A"'s differences vs. Group "B"'s differences before exercise a "t" of 2.71 was found which is significant at the .02 level. Likewise, when comparing the same differences after exercise a "t" of 2.96 was obtained which is significant at the .01 level. These differences were found only when comparing the groups separately. A very small insignificant "t" was found when combining the groups data. Therefore, it seems quite possible that changes in vectors are due to the variable wheat germ oil.

From a review of the literature we had expected a possible increase in the T wave for the experimental group over the control group, or at least an increase when combining the two groups to get the effect of conditioning on the T wave. However, there was definitely no improvement pointing in favor of a higher T wave due to either the variable of wheat germ oil or the effects of conditioning.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary. Twenty-two subjects, all untrained college freshmen volunteered as subjects for this experiment. Prior to the initial training period all the subjects ran a half mile and their times were recorded to the nearest half second. Also, before training was begun, two electrocardiogram records were taken, using the three standard leads, first at rest and the second after running a half mile on a powered treadmill at six miles an hour.

The subjects were then grouped, on the basis of their times in the half mile run, into two matched groups. Each subject was paired as closely as possible to another subject in his opposing group. Four subjects were not grouped, but continued to train. After two weeks of training one subject in Group A dropped from school. One of the reserves times was very close so he was installed into the experimental group. This left a total of nine matched groups, two reserves in the control group and one reserve in the experimental group to complete the experiment. The subjects were then given four capsules of wheat germ oil (0.37 ml) daily for the remainder of the seven weeks program. During the seven weeks of training the subjects were tested once each week for their best time in the half mile run. Including the initial run seven tests

Section 1

1. The first part of the document is a list of the

names of the persons who have been named in the

document. The names are listed in alphabetical order of the last name. The names are listed in the order in which they appear in the document.

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were made in all. Upon completion of the final week of training and testing for the half mile run, the electrocardiogram and treadmill tests were repeated. The measurements were then tabulated for further use in computing and comparing the results.

Conclusions. The following conclusions can be drawn on the basis of a statistical analysis of the data:

1. There was no significant differences in the half mile run times between the Wheat Germ Oil Group and the Placebo Group. Both groups, however, improved in their ability to run the half mile.

2. The final mean scores of the experimental group were .044 of a minute better than the control group, but this was not enough to be statistically significant. The "F" ratio of only .11 was found whereas a ratio of 3.93 was needed to be significant at the 5% level.

3. In analyzing the electrocardiogram data the only significant differences were found when comparing the vectors of Group "A" to Group "B".

4. Both groups showed a significant drop in pulse rate and it was concluded that this is due to conditioning.

Recommendations. Even though the results of this experiment did not show a significant effect of wheat germ oil, there is the need of more research in the field, using

There is a certain amount of evidence to suggest that the
 results of the study are not entirely reliable. The
 authors of the study have not provided any information
 about the reliability of the data. The data were
 collected from a small number of subjects and the
 results are therefore not generalizable.

Conclusion: The study has not provided any reliable

on the basis of a small number of subjects. The
 results are therefore not generalizable.

The study has not provided any reliable
 results. The authors of the study have not provided
 any information about the reliability of the data.
 The data were collected from a small number of
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 subjects and the results are therefore not
 generalizable.

Conclusion: The study has not provided any reliable
 results. The authors of the study have not provided
 any information about the reliability of the data.
 The data were collected from a small number of
 subjects and the results are therefore not
 generalizable.

a greater number of subjects, more controls, and a longer training period.

A pre-training program prior to the initial trial run is strongly recommended. This would eliminate the chance of the subjects having poor initial run times because of poor condition.

The number of constants in this study were limited. There were no controls on the subjects' diet other than to take no additional dietary supplement. The amount of sleep was not controlled at all.

If at all possible, further experiments should be run where subjects are under strict institutional control.

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MEMORANDUM

The following is a summary of the discussion held at the meeting on the subject of the proposed new policy.

The first point discussed was the need for a new policy to deal with the increasing number of cases.

The second point discussed was the need for a new policy to deal with the increasing number of cases.

The third point discussed was the need for a new policy to deal with the increasing number of cases.

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1.

2. The first part of the report is devoted to a general description of the project and its objectives. It also includes a brief history of the project and a list of the people involved.

3. The second part of the report describes the methods used in the project. It includes a detailed description of the experimental setup and the procedures used to collect and analyze the data.

4. The third part of the report presents the results of the project. It includes a detailed description of the data and a discussion of the findings. It also includes a list of the conclusions drawn from the results.

5. The fourth part of the report discusses the implications of the project. It includes a discussion of the potential applications of the results and a list of the recommendations for future work.

6. The fifth part of the report is a conclusion. It summarizes the main findings of the project and provides a final list of recommendations.

7. The sixth part of the report is a list of references. It includes a list of the books, articles, and other sources used in the project.

8. The seventh part of the report is a list of figures. It includes a list of the figures and tables used in the project.

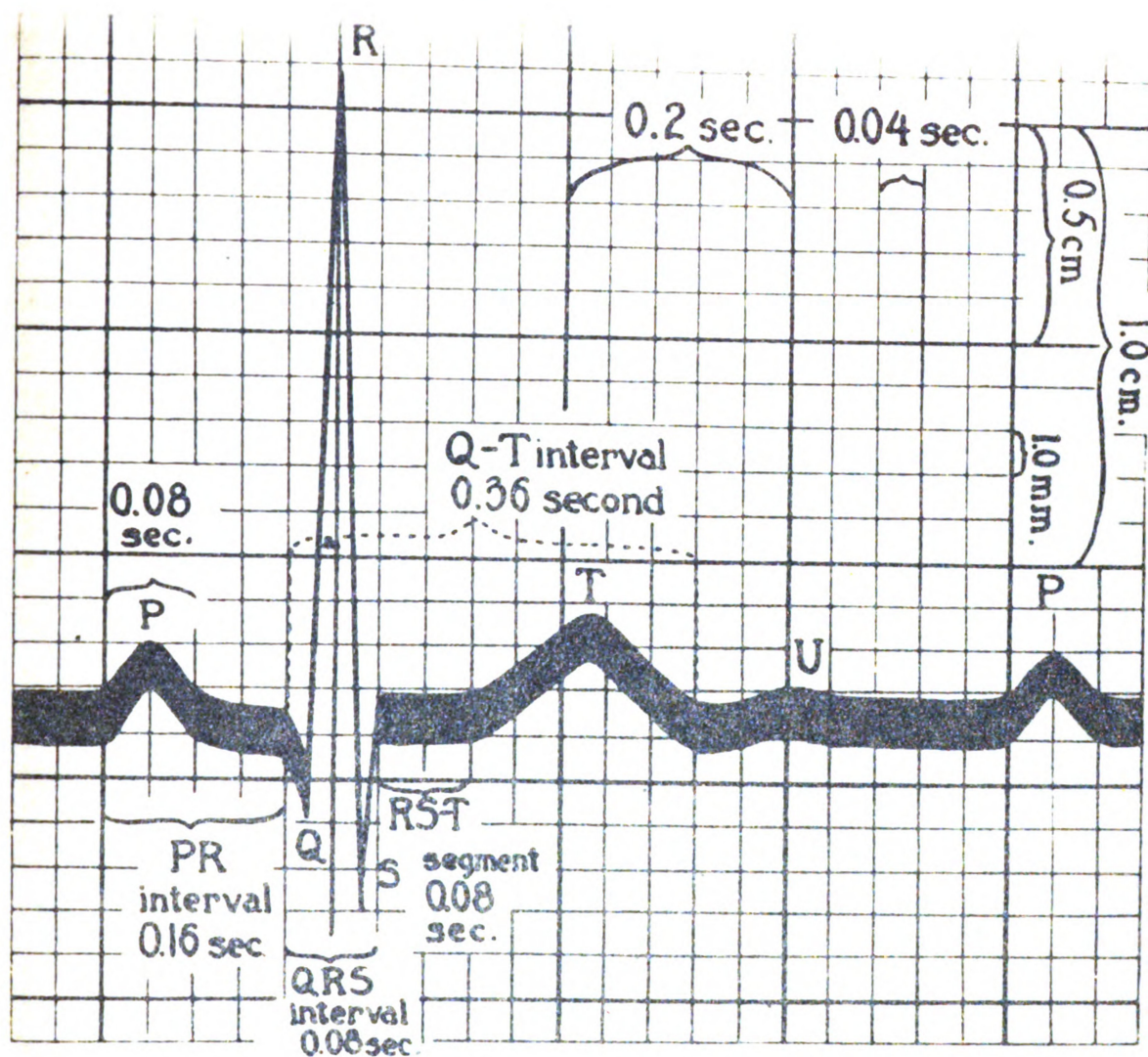
9. The eighth part of the report is a list of tables. It includes a list of the tables used in the project.

10. The ninth part of the report is a list of appendices. It includes a list of the appendices used in the project.

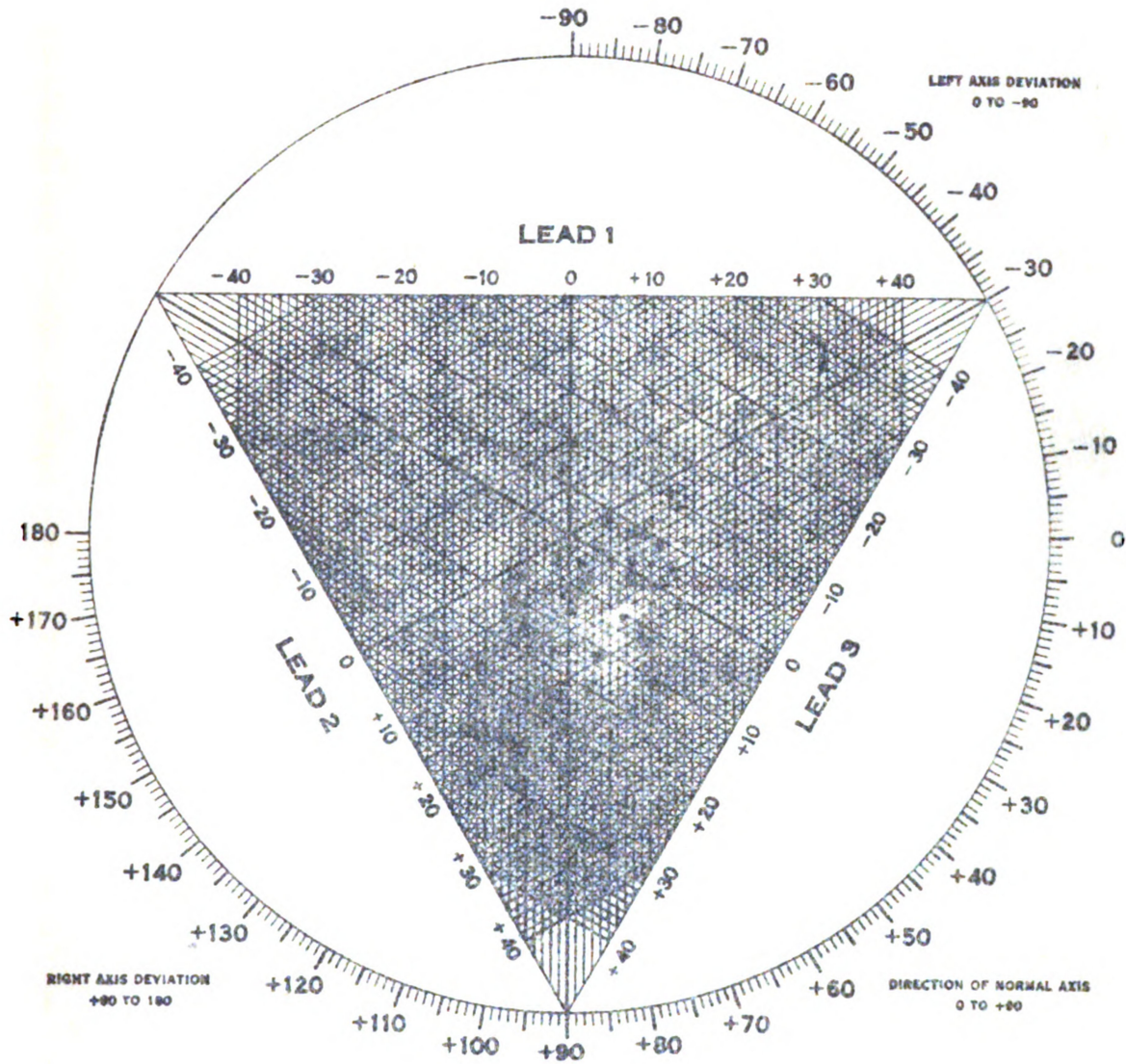
APPENDIX

FIGURE II

ECG WAVE



DIRECTION OF THE ELECTRICAL AXIS
OF THE HEART AS DETERMINED BY THE
HUMAN ELECTROCARDIOGRAM*



*Method as devised by W. Einthoven in 1908 and further designed by Carter, Richter and Greene-- Bulletin of the Johns Hopkins Hospital, January 1919.

EXPLANATION OF METHOD -- 1. From the electrocardiogram of Lead 1 note the values of R_1 and S_1 , and whether each is plus or minus. (Above the base line is Plus, and below is minus.)

Add these values algebraically, R_1 and S_1 , thus $(\pm R_1 \pm S_1)$. Then plot this value on the side of triangle marked "Lead 1." (Plus to the right of 0; minus to the left).

2. Similarly find the plus or minus value of R_3 and S_3 . Then plot this value on the side of triangle marked "Lead 3." (Minus to the right of 0; plus to the left.)

3. From the point plotted on the "Lead 1" side of the triangle follow a line that is perpendicular to this side; and similarly from the point plotted on the "Lead 3" side of the triangle, follow a line that is perpendicular to this side. Where these two lines meet is a point on the electrical axis. Through this point draw a line from the center of the circle to the circumference and here read the angle of direction of the electrical axis.

4. The NORMAL direction of the electrical axis lies within the lower right hand quadrant (between 0 and +90;)
the RIGHT axis deviation within the lower left hand quadrant (between +90 and 180) and the LEFT axis deviation within the upper right hand quadrant (between 0 and -90).

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