INFORMATION TO USERS

This was produced from a copy of a document sent to us for microfilming. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the material submitted.

The following explanation of techniques is provided to help you understand markings or notations which may appear on this reproduction.

1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting through an image and duplicating adjacent pages to assure you of complete continuity.

2. When an image on the film is obliterated with a round black mark it is an indication that the film inspector noticed either blurred copy because of movement during exposure, or duplicate copy. Unless we meant to delete copyrighted materials that should not have been filmed, you will find a good image of the page in the adjacent frame. If copyrighted materials were deleted you will find a target note listing the pages in the adjacent frame.

3. When a map, drawing or chart, etc., is part of the material being photographed the photographer has followed a definite method in "sectioning" the material. It is customary to begin filming at the upper left hand corner of a large sheet and to continue from left to right in equal sections with small overlaps. If necessary, sectioning is continued again—beginning below the first row and continuing on until complete.

4. For any illustrations that cannot be reproduced satisfactorily by xerography, photographic prints can be purchased at additional cost and tipped into your xerographic copy. Requests can be made to our Dissertations Customer Services Department.

5. Some pages in any document may have indistinct print. In all cases we have filmed the best available copy.

University Microfilms International
300 N. ZEEB RD., ANN ARBOR, MI 48106
van der Merwe, Marina Suzanne

The Relationship Between Physical Fitness and the Health Status of Selected Canadian College Women

The Ohio State University

Ph.D. 1981

University Microfilms International 300 N. Zeeb Road, Ann Arbor, MI 48106

Copyright 1981

by

van der Merwe, Marina Suzanne

All Rights Reserved
PLEASE NOTE:

In all cases this material has been filmed in the best possible way from the available copy. Problems encountered with this document have been identified here with a check mark √.

1. Glossy photographs or pages ___
2. Colored illustrations, paper or print ___
3. Photographs with dark background ___
4. Illustrations are poor copy √
5. Pages with black marks, not original copy ___
6. Print shows through as there is text on both sides of page ___
7. Indistinct, broken or small print on several pages √
8. Print exceeds margin requirements ___
9. Tightly bound copy with print lost in spine ___
10. Computer printout pages with indistinct print ___
11. Page(s) ___________ lacking when material received, and not available from school or author.
12. Page(s) ___________ seem to be missing in numbering only as text follows.
13. Two pages numbered ___________. Text follows.
14. Curling and wrinkled pages ___
15. Other ____________________________

University Microfilms International
THE RELATIONSHIP BETWEEN PHYSICAL FITNESS AND THE
HEALTH STATUS OF SELECTED CANADIAN COLLEGE WOMEN

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Marina S. van der Merwe, B.S., M.A.

* * * * * *

The Ohio State University
1981

Reading Committee:
Dr. M.K. Beyrer
Dr. R.L. Bartels
Dr. E.L. Fox

Approved By
Mary K. Beyrer
Adviser
School of Health, Physical Education and Recreation
DEDICATION

To friends who are the essence of life
ACKNOWLEDGEMENTS

I wish to extend deep gratitude to my adviser Dr. Mary K. Beyrer who originally kindled my interest in the field of Health Education. Her encouragement and support served as motivation to complete this study. My sincere thanks are offered to Dr. Edward L. Fox and Dr. Robert L. Bartels, members of the reading committee, for their time and assistance.

My very special thanks go to Dr. Bryce M. Taylor and the Administrative Staff at York University for having faith in my ability to tackle this task; to Susan Kirkland who extended well beyond the call of duty to assist in the completion of this study; and to Robert Hunt and Michael Davidson for their invaluable assistance, suggestions and encouragement.
VITA

February 7, 1937 .................. Born - Cape Town, South Africa

1957 ............................. Elementary and High School Teacher's Certificate, Cape Town Teacher's College, Cape Town, South Africa

1958-1959 ......................... Teacher, Somerset East, South Africa and Bulawayo, S. Rhodesia

1960 ............................. Specialist Diploma in Physical Education, Fredensborg, Denmark

1961-1971 ......................... Lecturer and Assistant Professor, School of Physical and Health Education, University of Toronto, Toronto, Ontario, Canada

1966 ............................. B.S., Physical Education, Syracuse University, Syracuse, New York

1970 ............................. M.A., Physical Education, University of Iowa, Iowa City, Iowa

1973-1974 ......................... Graduate Teaching Associate, School of Health, Physical Education and Recreation, Health Education Division, The Ohio State University, Columbus, Ohio

1971-1981 ......................... Lecturer and Assistant Professor, Department of Physical Education and Athletics, York University, Toronto, Ontario, Canada

FIELDS OF STUDY

Major Field: Health Education
Minor Field: Physical Education
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEDICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>VITA</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>viii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xi</td>
</tr>
<tr>
<td>CHAPTER I - INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Government Authorities and Health Status</td>
<td>1</td>
</tr>
<tr>
<td>The Medical Profession and Health Status</td>
<td>3</td>
</tr>
<tr>
<td>Health Educators and Health Status</td>
<td>5</td>
</tr>
<tr>
<td>Rationale for the Study</td>
<td>7</td>
</tr>
<tr>
<td>Significance of the Problem</td>
<td>7</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>8</td>
</tr>
<tr>
<td>Definition of Terms</td>
<td>9</td>
</tr>
<tr>
<td>Limitations</td>
<td>12</td>
</tr>
<tr>
<td>CHAPTER II - REVIEW OF LITERATURE</td>
<td>13</td>
</tr>
<tr>
<td>Physical Fitness and Health</td>
<td>13</td>
</tr>
<tr>
<td>Components of Physical Fitness</td>
<td>13</td>
</tr>
<tr>
<td>Coronary Heart Disease and Physical Fitness</td>
<td>15</td>
</tr>
<tr>
<td>Psychological Profiles and Health</td>
<td>18</td>
</tr>
<tr>
<td>Mental Health Profiles and Stress</td>
<td>19</td>
</tr>
<tr>
<td>Stress and Physical Activity</td>
<td>20</td>
</tr>
<tr>
<td>Psychological Theories to Explain the Relationship Between Exercise and Modification of Stress Emotions</td>
<td>21</td>
</tr>
<tr>
<td>Physiological Theories to Explain the Relationship Between Exercise and Modification of Stress Emotions</td>
<td>22</td>
</tr>
<tr>
<td>Summary</td>
<td>22</td>
</tr>
<tr>
<td>Health Hazard Appraisal Profiles as Indicators of High Risk Factors</td>
<td>23</td>
</tr>
<tr>
<td>Coronary Heart Disease and Risk Factors</td>
<td>23</td>
</tr>
<tr>
<td>Health Maintenance and Risk Factors</td>
<td>25</td>
</tr>
<tr>
<td>Health Hazard Appraisals</td>
<td>25</td>
</tr>
<tr>
<td>Summary of the Review of Literature</td>
<td>29</td>
</tr>
</tbody>
</table>
CHAPTER III - METHODS AND PROCEDURES

The Subjects
Selection of the Assessment Instruments and Rationale for the Choices
Measurements of Cardiorespiratory Fitness
Tests Used for Maximum Oxygen Uptake
Tests Used for Submaxium Oxygen Uptake
Canadian Home Fitness Test
Measurements of Psychological Profiles
Jackson's Personality Research Form-E (PRF-E)
Measurements of Mental Health Profiles
Lanyon's Psychological Screening Inventory (PSI)
Measurements of Identifiable Health Hazards
Canadian Health Hazard Appraisal (Evalu-life)
Organization of Measuring Procedure and Methods of Scoring
Statistical Treatment
Summary

CHAPTER IV - PRESENTATION AND ANALYSIS OF THE DATA

Personality Profiles
Achievement Scale
Affiliation Scale
Change Scale
Nurturance Scale
Desirability Scale
Endurance Scale
Order Scale
Dominance Scale
Play Scale
Understanding Scale
Factor Analysis of the Personality Traits
Factor Analysis of the Total Set of 21 PRF Scales
Factor Analysis of the Ten Scale Subset of the PRF Scale
Summary
Mental Health Profiles
Discomfort Scale
Social Nonconformity Scale
Alienation Scale
Expression Scale
Summary
Canadian Health Hazard Appraisal Profiles
Frequency Distributions of the Responses
Two-way Frequency Tables for Three-Fitness Groups
Smoking Behaviour
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The Means and Standard Deviations for, and the Intercorrelations among, the</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>22 PRF Scales and the Six Fitness Groups</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Analysis of Variance and Trend Analysis on the Achievement Scale Based on Six</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Fitness Levels</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Analysis of Variance and Trend Analysis on the Achievement Scale Based on Three</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Fitness Levels</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Analysis of Variance and Trend Analysis on the Affiliation Scale Based on Six</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Fitness Levels</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Analysis of Variance and Trend Analysis on the Affiliation Scale Based on Three</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Fitness Levels</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Analysis of Variance and Trend Analysis on the Change Scale Based on Six Fitness Groups</td>
<td>70</td>
</tr>
<tr>
<td>7.</td>
<td>Analysis of Variance and Trend Analysis on the Change Scale Based on Three Fitness Groups</td>
<td>73</td>
</tr>
<tr>
<td>8.</td>
<td>Analysis of Variance and Trend Analysis on the Nurturance Scale Based on Six Fitness Groups</td>
<td>75</td>
</tr>
<tr>
<td>9.</td>
<td>Analysis of Variance and Trend Analysis on the Nurturance Scale Based on Three Fitness Groups</td>
<td>78</td>
</tr>
<tr>
<td>10.</td>
<td>Analysis of Variance and Trend Analysis on the Desirability Scale Based on Six Fitness Groups</td>
<td>81</td>
</tr>
</tbody>
</table>
11. Analysis of Variance and Trend Analysis on the Desirability Scale Based on Three Fitness Groups .......................... 83
12. Analysis of Variance and Trend Analysis on the Endurance Scale Based on Six Fitness Groups .......................... 86
13. Analysis of Variance and Trend Analysis on the Order Scale Based on Six Fitness Groups ................................ 88
14. Analysis of Variance and Trend Analysis on the Dominance Scale Based on Three Fitness Groups .......................... 91
15. Analysis of Variance and Trend Analysis on the Play Scale Based on Three Fitness Groups .......................... 94
16. Analysis of Variance and Trend Analysis on the Understanding Scale Based on Three Fitness Groups .......................... 96
17. The Varimax Rotated Factor Pattern for the 21 PRF Scales with a Four Factor Solution .......................... 100
18. The Inter-factor Correlation Coefficients for the Four Factor Solution with a Promax Rotation .......................... 101
19. The Varimax Rotated Factor Pattern for the 10 PRF Scale Subset with a Two Factor Solution .......................... 103
20. The Means and Standard Deviations for, and the Intercorrelations among, the Five PSI Scales and the Six Fitness Groups .... 106
21. Analysis of Variance and Trend Analysis on the Discomfort Scale Based on Six Fitness Groups .......................... 108
22. Analysis of Variance and Trend Analysis on the Discomfort Scale Based on Three Fitness Groups .......................... 110
23. Analysis of Variance and Trend Analysis on the Social Nonconformity Scale Based on Three Fitness Groups .................. 113
24. Analysis of Variance and Trend Analysis on the Alienation Scale Based on Three Fitness Groups .......................... 115
25. Analysis of Variance and Trend Analysis on the Expression Scale Based on Three Fitness Groups .......................... 118
26. Two-way Contingency Table for the Three-Fitness Levels Against Smoking Behaviour .. 124
27. Two-way Contingency Table for the Three-Fitness Levels Against Drinking Behaviour ............................. 125
28. The Means and Standard Deviations for, and the Intercorrelations among, the Age Variables and the Six Fitness Groups ..... 127
29. Analysis of Variance and Trend Analysis on the subject's Age Based on Six Fitness Groups ................................. 128
30. Analysis of Variance and Trend Analysis on the subject's Age Based on Three Fitness Groups ................................. 131
31. Analysis of Variance and Trend Analysis on the subject's Appraised Age Based on Three Fitness Groups ........................ 133
32. Analysis of Variance and Trend Analysis on the Sum of the subject's Achievable Age Based on Three Fitness Groups .......... 135
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mean Achievement-Scale Scores as a Function of Six Fitness Levels</td>
<td>61</td>
</tr>
<tr>
<td>2.</td>
<td>Mean Achievement-Scale Scores as a Function of Three Fitness Levels</td>
<td>63</td>
</tr>
<tr>
<td>3.</td>
<td>Mean Affiliation-Scale Scores as a Function of Six Fitness Levels</td>
<td>66</td>
</tr>
<tr>
<td>4.</td>
<td>Mean Affiliation-Scale Scores as a Function of Three Fitness Levels</td>
<td>69</td>
</tr>
<tr>
<td>5.</td>
<td>Mean Change-Scale Scores as a Function of Six Fitness Levels</td>
<td>71</td>
</tr>
<tr>
<td>6.</td>
<td>Mean Change-Scale Scores as a Function of Three Fitness Levels</td>
<td>74</td>
</tr>
<tr>
<td>7.</td>
<td>Mean Nurturance-Scale Scores as a Function of Six Fitness Levels</td>
<td>77</td>
</tr>
<tr>
<td>8.</td>
<td>Mean Nurturance-Scale Scores as a Function of Three Fitness Levels</td>
<td>79</td>
</tr>
<tr>
<td>9.</td>
<td>Mean Desirability-Scale Scores as a Function of Six Fitness Levels</td>
<td>82</td>
</tr>
<tr>
<td>10.</td>
<td>Mean Desirability-Scale Scores as a Function of Three Fitness Levels</td>
<td>84</td>
</tr>
<tr>
<td>11.</td>
<td>Mean Endurance-Scale Scores as a Function of Six Fitness Levels</td>
<td>87</td>
</tr>
<tr>
<td>12.</td>
<td>Mean Order-Scale Scores as a Function of Six Fitness Levels</td>
<td>89</td>
</tr>
<tr>
<td>13.</td>
<td>Mean Dominance-Scale Scores as a Function of Three Fitness Levels</td>
<td>92</td>
</tr>
<tr>
<td>14.</td>
<td>Mean Play Scale-Scores as a Function of Three Fitness Levels</td>
<td>95</td>
</tr>
</tbody>
</table>
15. Mean Understanding-Scale Scores as a Function of Three Fitness Levels .......... 97
16. Mean Discomfort-Scale Scores as a Function of Six Fitness Levels ................... 109
17. Mean Discomfort-Scale Scores as a Function of Three Fitness Levels ............... 111
18. Mean Social Nonconformity-Scale Scores as a Function of Three Fitness Levels .... 114
19. Mean Alienation-Scale Scores as a Function of Three Fitness Levels ............... 116
20. Mean Expression-Scale Scores as a Function of Three Fitness Levels ............... 119
21. Mean Age Scores as a Function of Six Fitness Levels .............................. 130
22. Mean Age Scores as a Function of Three Fitness Levels .............................. 132
23. Mean Appraised Age Scores as a Function of Three Fitness Levels ................. 134
24. Mean Sum of the Achievable Age Scores as a Function of Three Fitness Levels .... 137
CHAPTER I

INTRODUCTION

In Canada, government authorities and the medical profession, and in the United States health educators, have made a strong case for the existence of a positive relationship between physical fitness and health status.

Government Authorities and Health Status

In his "New Policy of Physical Fitness" the Honourable Robert Welch, Minister of Culture and Recreation in the Ontario Provincial Government, stated that the more physically fit individuals become, the more their health status would improve and consequently society would have a lessened financial burden due to lower medical costs. (116)

Marc Lalonde, who was Canada's Minister of Health and Welfare, pointed out that inconclusive scientific evidence as to the existence of a positive relationship between physical fitness and health cannot serve as a rationale for inactivity. He further stated that personal health is often abused under the guise of the "scientific" excuse. The classic example of the "scientific" excuse is reflected in the general attitude that because scientific data are lacking to substantiate that exercise will lessen the likelihood, or abate
the severity of coronary artery disease, no positive action is taken. Furthermore, he commented that the avoidance of positive health action is no longer acceptable and until the scientific community has resolved such debates on health questions, the following hypothesis must be subscribed to:

Exercise and fitness are better than sedentary living and lack of fitness. Immediate action for the indoctrination of all Canadians with guides toward positive health lifestyles is warranted. (70)

During the early part of 1977 the Lifestyle Award was initiated as part of Operation Lifestyle instituted by the Department of Health and Welfare in Canada. The award honours those individuals who voluntarily aim at the promotions of positive health lifestyles.

In many local communities, there are individuals who volunteer their time and talents to improve the lifestyle of their fellow citizens. These are the people who have worked for many years, often unrecognized, to expand community services and raise the level of health awareness in their areas.

The Department of National Health and Welfare feels that these people should receive the recognition they deserve. To this end, the Lifestyle Award has been created to acknowledge the invaluable contributions made by these Canadians in the promotion of positive health lifestyle.

It is hoped that those people honoured by the Award will be encouraged to continue and expand their efforts towards improving the community health lifestyle. It is hoped also, that the examples set by the Award winners will provide the incentive for other capable
Canadians to become involved and volunteer their much needed services to change and better the lifestyle of their communities. (91)

The government of Canada has identified the need to moderate self-imposed risks for the future improvement in the level of health of Canadians and has clearly stated that the area of lifestyle modification is "open to federal initiatives". (70) This statement lends support to the notion that government authorities are vitally concerned with the relationship between physical fitness and health status and are willing to provide monetary aid for research in this area.

The Medical Profession and Health Status

Hansen suggested at the 1970 Coronary Heart Disease and Physical Fitness Symposium that the medical profession had a responsibility to the public with regard to its physical fitness levels. He posed the following question:

Does available evidence justify large-scale application of physical conditioning training in the prevention and therapy of coronary heart disease?

Strictly speaking in the traditional exact scientific sense, the answer is no and our conference has not changed that situation in spite of many fine scientific communications. The answer is no because the pure irrefutable laboratory type of experiment in which exercise can be shown to prevent coronary heart disease, either by itself or by influencing other risk factors, does not exist and probably never will.
In a way I am not quite satisfied with the answer nor am I satisfied with the question. I shall therefore allow myself to rephrase the question in such a way that it becomes pertinent to our present situation and the way in which it will actually be asked. It has to be answered in the same way a physician would answer a question coming from the public, politicians and press included. We must therefore answer yes or no, even though we are in doubt. I would like to word the question as follows: Should the medical profession encourage the public - patients and others - to exercise more than they do? If so, should it do so for the purpose of preventing heart attacks, should it say so, and finally should it advise as to which kind of exercise people should engage in? To all three sections of the question I think the answer is yes.

This investigator was interested in establishing whether members of the medical profession were willing to accept the responsibility of a positive reply to the above questions.

A survey was conducted on six hundred (600) Ontario physicians who specialized in either cardiology or internal medicine or were in general practice. The physicians were randomly selected from medical telephone listings.

The results of the Medical Opinion Survey suggested that members of the medical profession have accepted the responsibility of encouraging the general public to exercise more and furthermore that a significant percentage subscribe to the existence of a positive relationship between health and physical exercise.
Although 32.2% of the physicians polled commented on the lack of proof, 85.4% were, in spite of inconclusive evidence, in favour of recommending more exercise for the purpose of preventing cardiovascular disease. (see Appendix A)

Health Educators and Health Status

The Second World War focussed a great deal of attention on health problems in the United States. The physical and mental defectiveness of the nation was revealed through draft statistics and consequently the Health Education profession received renewed attention. (76)

In the 1970's Health Educators were actively involved in defining the meaning of the term "health" in relation to a fast changing environment. The multi-faceted dimension of the term gave birth to numerous definitions.

The World Health Organization (WHO) in its 1947 charter defined health as "a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity". (37) Over the last decade health text books repeatedly refer to this particular definition. (14,17,29, 37,43,51,61,62,68,72,79) Kogan questions the realism of such a definition and suggests that a more "usable" concept of health requires a more imaginative approach than the definition offered by the World Health Organization. (68)

No time in history has man's future held such uncertainty as it does today and the problems which are to be identified and solved have broadened the meaning of the term health. (61)
John La Place points out that health is something that the individual must define for himself in accordance with his own lifestyle, values, ambitions and goals. (72)

Until the twentieth century health was visualized in a negative way i.e. the freedom from disease, defect, or disability. (43) Present day health educators have incorporated the concept of "positive" health in addition to emphasizing personal and/or research biases such as emotional health is basic to all health (62); health is a process of adaptation (14); health is to live a full, vigorous life (51); health is a process of continuous change throughout life (17); good health is a product of good prevention (29); and optimal health is the highest level of well-being (37).

From the above it is safe to conclude that health educators conceptualize health as a dynamic interaction of many different components and processes and that the pursuit of physical fitness toward an improved health status is paramount in their teaching strategy.

Finally Oberteuffer defined health as "the condition of the organism which measures the degree to which its aggregate powers are able to function". (86)

To measure the functioning of an organism therefore requires the investigation of the components and processes which make up the total. In this investigation physical, psychological, mental and health hazard components served as health indicators and were examined to determine the relationship between physical fitness and health.
Rationale for the Study

A review of the literature reveals an extensive and well researched body of knowledge with regard to the relationship between physical fitness and health; the relationship between psychological profiles and health; the relationship between mental health profiles and stress; and health hazard appraisal profiles as indicators of risk factors.

A small number of studies which investigated the relationship between personality traits and the participation in various physical and leisure activities by young women were found and are discussed in Chapter II.

No information was available with regard to the investigation of the interrelationships of the above three profiles collectively and levels of physical fitness in young women.

It was therefore the paucity of research dealing with physical fitness levels of young women relative to psychological, mental health, and health hazard appraisal profiles which provides a sound rationale for pursuing with further investigations of this topic.

Significance of the Problem

It has been suggested that government authorities, the medical profession and health educators sanction and support the pursuit of physical fitness as a means of improving health status.
Government commitment to the promotion of physical fitness in Canada as a means to deploy the expense of health care (94) brings the following questions to mind: Is there a positive relationship between physical fitness and health? Do investigations of the relationship between physical fitness and health include the components of physical, psychological, mental and health hazard appraisals? It was to consider questions such as these that this study was designed.

Statement of the Problem

After identifying six levels of physical fitness among selected Canadian college women, this study seeks to determine the relationship between the degree of physical fitness and certain factors relative to the health status of each group.

The problems which were investigated are:

1. To determine the relationship between physical fitness and psychological profiles as measured by the twenty one personality scales on Jackson's Personality Research Form-E. (see Appendix C)
2. To determine the relationship between physical fitness and mental health profiles as measured by the five mental health screening scales on Lanyon's Psychological Screening Inventory. (see Appendix D)
3. To determine the relationship between physical fitness and health hazard factors supplied by the Canadian Health Hazard Appraisal (Evalu-life). (see Appendix E)

Definition of Terms

For the purpose of this study the following terms have been defined:
Achievable age - the Appraised Age with the adoption of certain health screening procedures and/or changes in life style.
Activity/Frequency checklist - records of physical activity participation rates to verify that low physical fitness levels equalled low levels of physical activity. (see Appendix F)
Appraised age - the sum of all risks and their effects on specific causes of death is translated into an age-risk group i.e. the subject's "health age" in that she is currently living the same risks as a person of that age.
Average age - the actual age and sex of the subject relative to the number of deaths per 100,000 for each of the causes of death for Canadians i.e. the "chronological risk group" to which the subject belongs as a result of her birthdate.
Canadian college women - female students between the ages of 18 and 25 years who have completed the high school requirements to enter into a university or college and who are pursuing studies toward an undergraduate degree or diploma

Canadian Health Hazard Appraisal - a specific instrument also referred to as Evalu-life which assesses the interaction of a variety of every day risks which people assume or to which they are exposed and which can effect the quality as well as the quantity of life. (see Appendix E)

Canadian Home Fitness Test - a simple, self-administered test intended to initiate and sustain personal interest in the development of cardio-respiratory fitness. It is based on a modified double step test of cardio-respiratory fitness. (see Appendix B)

Carotid palpation - a method of pulse-taking by placing the thumb on the chin putting the middle three fingers of one hand along the back edge of the pharynx and locating the carotid pulse at the side of the neck

Health - a state of physical, mental and social well-being

High risk group - presence in or absence from a group as outlined in the Canadian Health Hazard Appraisal (Evalu-life) because of recent screening for breast or cervical cancer
Infrequency scale - the measure of careless responses to Jackson's Personality Research Form-E. Scores less than four are specified as acceptable by Jackson (56).

Life style factors - those practices outlined in the Canadian Health Hazard Appraisal (Evalu-life) relative to smoking, drinking, exercising and driving.

Mental health - a human condition which reflects the degree to which an individual's behaviour is acceptable to society.

Mental health screening scales - five mental health scales described by Lanyon's Psychological Screening Inventory. (see Appendix D)

Personal/family health history - the personal or family history of certain diseases stipulated in the Canadian Health Hazard Appraisal (Evalu-life).

Personality scales - twenty one personality traits described by Jackson's Personality Research Form-E. (see Appendix C)

Physical fitness - cardiorespiratory fitness i.e. how well do the lungs and heart respond to physical activity.

Physical fitness categories - classifications of physical fitness established by determining the heart rate through carotid palpation 5 to 15 seconds after stepping at a given cadence.

Physical health status - factors outlined in the Canadian Health Hazard Appraisal (Evalu-life) relative to blood pressure and weight.
Infrequency scale - the measure of careless responses to Jackson's Personality Research Form-E. Scores less than four are specified as acceptable by Jackson (56).

Life style factors - those practices outlined in the Canadian Health Hazard Appraisal (Evalu-life) relative to smoking, drinking, exercising and driving.

Mental health - a human condition which reflects the degree to which an individual's behaviour is acceptable to society.

Mental health screening scales - five mental health scales described by Lanyon's Psychological Screening Inventory. (see Appendix D)

Personal/family health history - the personal or family history of certain diseases stipulated in the Canadian Health Hazard Appraisal (Evalu-life).

Personality scales - twenty one personality traits described by Jackson's Personality Research Form-E. (see Appendix C)

Physical fitness - cardiorespiratory fitness i.e. how well do the lungs and heart respond to physical activity.

Physical fitness categories - classifications of physical fitness established by determining the heart rate through carotid palpation 5 to 15 seconds after stepping at a given cadence.

Physical health status - factors outlined in the Canadian Health Hazard Appraisal (Evalu-life) relative to blood pressure and weight.
Limitations

The following limitations were identified in this study:

1. The sample was limited to females between the ages of 18 and 25 years who were pursuing post secondary education.
2. The data did not include comparisons of the habitual activity patterns performed during the normal course of the day.
3. Motivational factors for becoming physically fit were not incorporated into the data.
CHAPTER II

REVIEW OF LITERATURE

The literature for this study is reviewed in the following four divisions: the relationship between physical fitness and health; the relationship between psychological profiles and health; the relationship between mental health profiles and stress; and health hazard appraisal profiles as indicators of risk factors.

Physical Fitness and Health

In the literature health educators tend either to relate physical fitness and total fitness which encompasses the intellectual, emotional and social aspects of health or to associate physical fitness with general health and regard it as one aspect of good personal health care. Regardless of the bias expressed, the health texts which were reviewed and are discussed below, commended the virtues of physical fitness as a positive health characteristic.

Components of Physical Fitness

Bucher et al. (14) in explaining the complexity of the term physical fitness identifies three categories of individuals. Individuals who make no attempt to pursue a
purposeful exercise regime or recreational activity are placed in the passive fitness category. The second group of individuals misunderstand the term completely and only emphasize one element of fitness as opposed to the third category of individuals who give consideration to the multiplicity of the term physical fitness.

Steinmann (37) describes physical fitness as the development of three elements: strength, suppleness and stamina while LaPlace (72) places emphasis on the positive affects of physical fitness on three body systems namely, the cardiovascular, respiratory and muscular systems.

Physical fitness is viewed also more globally, by certain authors, as a type of preventive medicine (17); as a stimulus for normal growth processes of the body (61) and as an element of organic soundness and motor condition. (43)

The all-inclusive nature of physical fitness is clearly illustrated by the Yuhasz Model of Physical Fitness Components (120):

<table>
<thead>
<tr>
<th>Heredity</th>
<th>Physical Fitness</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physique</td>
<td>Motor Fitness</td>
<td>Endurance Fitness</td>
</tr>
<tr>
<td>- proportions</td>
<td>- flexibility</td>
<td>- cardiovascular</td>
</tr>
<tr>
<td>- weight</td>
<td>- agility</td>
<td>- respiratory</td>
</tr>
<tr>
<td>- composition</td>
<td>- speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- strength</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- power</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- endurance</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>- cardiovascular</td>
</tr>
<tr>
<td>- respiratory</td>
</tr>
</tbody>
</table>
Therefore there is a general consensus that physical fitness is a part of total fitness and consists of the following major classifications:

* physical dimensions
* motor fitness
* endurance fitness

Endurance fitness defined as the capacity to perform work is a basic health concept which is easily monitored by administering either simple or complex tests for cardio-respiratory effectiveness. The prevalence of Coronary Heart Disease has led to a great deal of research in the area of physical inactivity and physical fitness.

Coronary Heart Disease and Physical Fitness

Physical inactivity, perhaps fostered by modern mechanization, is a serious health hazard. On the other hand, since 1953 evidence has been steadily accumulating on the relationship between physical activity and the decreased incidence of ailments such as Coronary Heart Disease. The pioneers in this area, Morris et al. (80) reported that conductors in the London Transport System had experienced only 70 percent of the age-corrected incidence of CHD manifestations of the less active drivers. The same authors reported a similar reduced incidence of coronary illness manifestations in London postmen relative to the less active postal clerks. Associated with the overt manifestations of CHD were such symptoms as high serum lipids and
cholesterol and high blood pressure. Since this early report, a large number of similar studies have been conducted and a sampling which was collated by Reville (94) appears in summarized form in Appendix G. The majority of investigators have reported a statistically significant relationship between physical activity and decreased manifestations of illness such as angina pectoris, hypertension, coronary heart disease and myocardial infarctions.

Research in this area is still going on and the Kelly and Mednick study (94) recorded a significant relationship between physical fitness and CHD from an investigation of physical fitness conducted during 1976 in the YMCA, YMHA and DCIEM in Toronto, Ontario. Following is a table from their report:

**EFFECTS OF PHYSICAL FITNESS ON THE INCIDENCE OF CHD**

Incidence of CHD Within One Year

(number of cases per 10,000 population)

<table>
<thead>
<tr>
<th>Age-Sex</th>
<th>Below Average</th>
<th>Average or Above</th>
<th>Percent Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MALES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-44</td>
<td>16.1</td>
<td>12.9</td>
<td>19.9%</td>
</tr>
<tr>
<td>45-54</td>
<td>80.0</td>
<td>65.2</td>
<td>18.5%</td>
</tr>
<tr>
<td>55-64</td>
<td>189.0</td>
<td>137.0</td>
<td>27.5%</td>
</tr>
<tr>
<td><strong>FEMALES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-44</td>
<td>3.7</td>
<td>3.1</td>
<td>16.2%</td>
</tr>
<tr>
<td>45-54</td>
<td>23.7</td>
<td>21.9</td>
<td>7.6</td>
</tr>
<tr>
<td>55-64</td>
<td>59.4</td>
<td>50.6</td>
<td>14.8</td>
</tr>
</tbody>
</table>

Kelly and Mednick. Research conducted in the YMCA, YMHA and DCIEM in Toronto, 1976.
Circulation and respiration are the most important components relative to the physical working capacity of the human body. Measurements of the combined cardio-respiratory system yields data which describes an individual's fitness to perform work. The efficiency of oxygen uptake and oxygen utilization are clear indicators of the health status of the cardio-respiratory system. (101, 51)

Today exercise tests are widely used for diagnosis and functional evaluation in heart disease and for the identification of latent coronary artery disease. In a survey on safety and procedures used in exercise testing it was found that 96% of the testing was medically supervised. The usual device for imposing the workload was the treadmill (60%), the double Master's Test (45%), the upright bicycle ergometer (40%) the supine bicycle (20%) and 15% of "Other" techniques which included the Harvard Step Test. (97)

Bailey et al. (7) pointed out that logistics and finance preclude regular medically-supervised testing. The need for a simple home fitness test led to the design of the Canadian Home Fitness Test which also serves as the first screening procedure in a three tier system of periodic health assessment; the second and third tiers involve testing by paramedical and medical personnel respectively.
Psychological Profiles

A knowledge of human behaviour is a prerequisite for the study of health behaviour. (14)

Human behaviour and the classification of the elements which determine human behaviour have occupied researchers and theorists for many years. Their attempts to design measuring instruments which describe these elements serve as a constant source for controversy. (15)

Murray (82) proposed that the extrapolation of a viable psychological profile requires consideration of a large number of needs which describe human behaviour. Based upon Murray's classification of needs, Jackson (56) developed personality scales which examine a broad spectrum of human behaviour in an attempt to provide greater understanding of the motivational factors which influence behavioural patterns.

The use of personality scales in the field of medicine has been supported by the research of Friedman and Rosenman. (35) On the basis of laboratory, clinical and epidemiological studies, they have described the coronary-prone personality which is characterized by a specific type of behaviour pattern and referred to as type A. Type A behaviour consists of competitiveness, achievement drive, aggressiveness, haste, impatience, feelings of time urgency and the challenge of responsibility. The opposite behaviour pattern (type B) is characterized by a relaxed, unhurried, satisfied style.
Studies in which the behaviour pattern was analyzed as a independent risk factor revealed an incidence of clinical coronary heart disease more than twice as great in type A subjects as in type B. (99)

The suggestion that psychological make-up can lead to a deterioration of physical health is not a popular argument within the medical research establishment according to Fried. (34) He points out however, that researchers have related lupus erythematosus, cancer and rheumatoid arthritis to specific personality traits and suggests that psychological profiles may serve as legitimate diagnostic instruments for the prescription of good health and preventive medicine.

Mental Health Profiles and Stress

Mental health concerns itself with an individual's ability to adapt within a given society. Unsuccessful assimilation into that society has been shown to lead to serious deterioration of the health status of that individual. As a consequence, research in the area of mental health is extensive. (66)

Studies have shown that societies today are plagued with the phenomenon of a constantly changing environment. (26) Life change, whether it is social, cultural or interpersonal, acts as a stressor which evokes adaptive efforts by the human organism. When these efforts are faulty in kind and duration, bodily resistance is lowered, which enhances the probability of disease. (47,96,44)
Since his early studies on the "general adaptation syndrome", Selye (103) has viewed stress as part of life and a natural by-product of all human activities whereas other investigators define stress as a result of "unsuccessful coping" (109), "an observable response to a stimulus or a situation", or "an inferred inner state. (25)

In a more recent publication Selye (104) claims that "distress" is more likely to cause disease. Distress has been defined as an accumulation of too much stress and the inability to adequately dispel or relieve it. (60) A combination of methods is employed to protect the human condition from distress. Participation in physical activity is regarded as one method which may serve as a pressure value to relieve stress.

Stress and Physical Activity

Lazarus (74) suggested that most diseases could be stress-related since the organ systems of the body tend to function poorly under stress-filled conditions. Cooper (22) promoted the notion that exercise can relieve stress emotions, and Kane (64) points out that most studies have confirmed the above association.

Jette (57) concluded that regular exercisers were more tough-minded, prudent and relaxed compared with non-exercisers.

Ismail and Young (55) found that high-fitness male subjects demonstrated significantly more emotional stability
and imagination than low-fitness subjects before participating in a fitness program over a 4-month period. After completion of the program, the high-fitness group was still more imaginative and unconventional and now was also more confident and unshakable. The low-fitness group appeared significantly more self-sufficient and resourceful as compared with the high-fitness group and no longer demonstrated low emotional stability. The data do suggest that exercise and fitness enable a person to better cope with emotional stress.

Psychological Theories to Explain the Relationship Between Exercise and Modification of Stress Emotions

Ismail and Trachtman (54) suggest that changes occur when an individual confronts a challenge such as a strenuous exercise program, for example, and overcomes it. The positive outcome, i.e. mastery of the challenge, provides a sense of accomplishment or self-control. Distressing situations "condition" and improve adaptive responses.

Folkins and Amsterdam (33) speculate that the experience of exercising in a group could provide social-psychological benefits that would assist in stress management. Also, improved body-image might be seen to bolster the resources needed to deal with stress.

Greenwood (38) postulated that age-appropriate exercise with realistic expectations about performance offers a ready source of emotional well-being by providing acceptable means for resolving frustrations, relieving boredom, strengthening the ego and sublimating aggressive drives.
Physiological Theories to Explain the Relationship Between Exercise and Modification of Stress Emotions

Physiologically, the increased circulation to the brain due to exercise increases the availability of glucose which is essential to cerebral metabolism and the increased oxygen supply may enhance mental function. (54)

The trained heart responds to psychological stress with greater stroke volume, rather than increased rate. This type of response is more efficient because of the release of smaller amounts of adrenalin normally associated with a racing heart. (33)

Exercise may be critical to restful sleep patterns which in turn produce a "sense of well-being". (32,6)

Michael (78) points out that adrenocortical activity along with the autonomic nervous system are involved in adjusting to stress. The ability to adjust is helped with exercise and, therefore, the duration of the adjusting phase is lessened. The adaptation to exercise produces a degree of protection against emotional stress. Michael elaborates that the increased adrenal activity which results from repeated exercise seems to cause an increased reserve of steroids available to counter a stress.

Summary

A variety of psychological and physiological shifts most likely follow from improvements in physical fitness. Each provides input in varying degrees in different individuals which allows greater control of the stress emotions.
Health Hazard Appraisal Profiles as Indicators of High Risk Factors

The nature of the illnesses from which the North American population suffers has, in recent years, undergone a transition from a predominance of infectious diseases to the present predominance of degenerative diseases. Many studies (21,27,93,113,115) attempted to link characteristics in the North American life style with certain disease states. The increase in degenerative diseases such as cardiovascular accident, hypertension, lung problems and malignancies may be due to our diet and life style or it may be a necessary concomitant of our living longer.

Coronary Heart Disease and Risk Factors

The famous Framingham study (65) identified eight risk factors thought to increase the chance of coronary attacks. Of the factors identified (sex, age, obesity, smoking, hypertension, elevated serum cholesterol, inactivity and heredity), few contribute much additional information after subjects have been classified in terms of serum cholesterol and systemic blood pressure.

The insidious nature of coronary heart disease and the risk of sudden death has served to stimulate medical and public concern. Self-care type questionnaires dealing specifically with heart disease have become common. The
Michigan Heart Association, for example, has published a questionnaire which is designed to make the subject aware of existing heart disease risk factors present in a person's lifestyle. It is inexpensive and is sold under the name of RISKO. The subject classifies himself numerically according to the presence or absence of each of the eight risk factors. The number associated with each risk factor are totalled and the sum is then classified: (see Appendix H)

- 6-11 risk well below average
- 12-17 risk below average
- 18-24 risk generally average
- 25-31 risk moderate
- 32-40 risk at a dangerous level
- 41-62 danger urgent - see your doctor now

This is a relatively simple screening device and it can be completed in a matter of minutes. More extensive surveys are available to the public at a greater cost and at increased interaction with a physician.

Inactivity has been identified as a risk factor relative to coronary heart disease. (81,110) Physical activity has been shown to serve as a prophylactic measure against coronary artery disease mainly by its improvement in coronary circulation (28), lowering of blood pressure (11) and reducing serum triglycerides. (46) Therefore, it seems reasonable to assume that a mass screening device which would alert the public concerning their risks of developing a degenerative disease
may be effective in reducing the morbidity and mortality of the population.

Health Maintenance and Risk Factors

Risk factor intervention studies are underway in most of the western world. The United States and Finland are currently involved in a large-scale and expensive venture where the general aim is to test the feasibility of reducing the risk factors initially and, eventually, to reduce the diseases and mortality resulting from these risk factors.

Breslow (12) points out that preliminary evidence shows that certain risk factors for cardiovascular disease have been partially successful and suggests that intervention will prove to be successful particularly once the concept of intervention receives higher priority than the diseases themselves.

Health Hazard Appraisals

Ian Irons, M.D., President and Medical Director of the Bellevue, Ohio based Medical Datamation Corporation makes a strong case for the Automated Medical History health screening methodology as opposed to the Traditional Physical Examination for colleges and universities. He recommends that for college health services to identify existing health problems, pick-up potential problems, and to provide students with health education services, the adoption of a self-administered automated medical history system (SAMH) will prove effective and advantageous. (52)
The Medical Datamation Corporation is in the business of health promotion, screening and early disease detection. Various institutions have adopted Datamation products. The University of South Carolina for example successfully implemented the personalized Health Risk Index as part of an Open Door Health Education delivery service. (98)

Bowling Green State University employed the Database Acquisition for Student Health (DASH) format on each student entering the university and keeps the Health Risk Index on file in the Student Health Service. (42)

Central Michigan University adopted the Datamation DASH Questionnaire in teaching a Personal Health course. Subjective observations by Bensley (8) suggest that the use of a Health Risk Appraisal "as a major source in designing a personal health class" is sound.

Chenoweth (19) surveyed five major health risk appraisal formats "to determine the most comprehensive instrument relevant to health variables".

The five appraisals were:

- Health Hazard Appraisal, (HHA), Indianapolis, Indiana - Methodist Hospital of Indiana
- Health Evaluation and Learning Program (HELP), Bellevue, Ohio, Medical Datamation Corporation
- Health Risk Profile, San Diego, California, Inter-health, Inc.
- Life Style Assessment, Life Extension Institute, Stevens Point, Wisconsin
Based upon the results of the survey, Chenoweth (20) selected the Health Evaluation and Learning Program (HELP) as the most appropriate instrument to identify students' risks in a health education setting and to, "hopefully, motivate them to reduce their existing probability of death". He reported that the use of health risk appraisals coupled with a personalized conference appears to "motivate apparently healthy undergraduates to actively incorporate positive health behaviours into their life styles".

The Chenoweth Survey (19) attempted to establish that the Medical Datamation Health Evaluation and Learning Program (HELP) is identical to the original health risk appraisal format known as Health Hazard Appraisal (HHA) Indianapolis, Indiana–Methodist Hospital of Indiana. (20) Irons (53) explained that the differences between Medical Datamation's version of health hazard appraisal, the Health Risk Index (HRI), and the traditional Health Hazard Appraisal (HHA), Indiana–Methodist Hospital, are as follows:

- HHA was traditionally intended to be used on relatively healthy people. Risk factors or contributing factors for coronary heart disease were excluded.
- HHA uses a fixed 10-year interval for estimating risks regardless of age. HRI produces two appraisals as a function of people's ages to more adequately reflect lifetime risks for all ages.
- HHA does not provide life expectancy predictions. HRI accounts for a person's chances of reaching the beginning of a time interval as well as surviving through the interval by using repetitive appraisals through five year increments.
- HHA portrays health or the analysis - age as a function of 10-year risk-of-dying. HRI portrays a person's health age as a function of life remaining or life expectancy.

Irons (53) concludes that while the Health Risk Index is an improved version of the traditional Health Hazard Appraisal, all techniques share the goal of promoting "prospective medicine".

The Canadian Health Hazard Appraisal (Evalu-life) was developed by Lewis C. Robbins, M.D., Jack Hall, M.D. and colleagues of the Methodist Hospital of Indiana in Indianapolis as a tool for physicians interested in the practice of preventive medicine. It was introduced in 1972 as an on-line computerized version which permitted a client to "interact" with the computer. Due to the cost and complexity of the above system it has been replaced by an inexpensive centralized batch processing system based on mailed questionnaires (see Appendix E) and returns. The Health Promotion Directorate, Department of National Health and Welfare provides the health hazard appraisal service to health professionals throughout Canada. (45)
Summary of the Review of Literature

Physical fitness is viewed as an integral part of total fitness. A number of authors refer to total fitness as the physical, mental, social, intellectual and spiritual dimensions of health.

The effectiveness of the cardio-respiratory system has been identified as a reliable indicator of human work capacity and serves as the most commonly used measure of physical fitness.

Medical researchers have been tardy in the exploration of the psychosomatic causes of disease. Persuasive evidence with regard to the relationships between personality traits and coronary heart disease and cancer has steadily accumulated to warrant serious consideration in this domain by the medical profession.

The body responds to internal and external stressors. Sound mental health depends upon the ability to maintain a balanced fight/flight response. Participation in physical activities, preferably ones with a training effect, has been identified as an effective strategy for stress management.

The traditional physical examination by a general practitioner has become expensive, time consuming and sometimes unreliable because of its cursory nature. Life style has been identified as the single most contributing factor to health status. Risk factor intervention strategies have
been mounted in an attempt to practise preventive rather than prescriptive medicine. Numerous self-administered questionnaires are available to assist the general public with positive actions toward reduction of unhealthy behaviours. Research studies give support to the effectiveness of health risk reduction programs and leave one to speculate that refinement of these questionnaires will lead to less expensive and more inclusive health services.
CHAPTER III

METHODS AND PROCEDURES

The purpose of this study is to investigate the relationship between the physical fitness levels of six groups of selected Canadian college women and the psychological, mental health, and health hazard appraisal profiles of each group.

The Subjects

Between January, 7 and 18, 1980 female students, between the ages of 18 and 25, who were enrolled at York University in Toronto, Ontario, Canada responded to advertisements which offered to measure personal physical fitness levels through the use of a simple step-test. The advertisements were placed in the student newspaper, Excalibur, on the major bulletin boards of the campus, and in 600 residence mailboxes.

Preliminary pilot studies by this investigator with students enrolled in recreation and activity classes had demonstrated that regardless of their physical fitness abilities, undergraduate college women were interested in knowing how "fit" or "unfit" they were. Based upon these findings it was assumed that a large population of college
women would be willing to subject themselves to a simple, easily administered physical fitness test.

This assumption proved to be correct as the positive responses to the advertisements totalled 306. Individual appointment times were arranged by telephone.

Between January 21, 1980, and June 11, 1980, the subjects reported to the Tait McKenzie Building where they were tested and placed into one of six physical fitness categories (Very Fit, Good, Moderately Fit, Moderately Unfit, Poor, Very Poor) as determined by the Canadian Home Fitness Test. From each category twenty subjects were randomly drawn (N=120) and their services to participate in the study were requested.

The subjects who refused to participate in the study were replaced by drawing names from the resource pool in each category. Ninety eight percent of the sample were caucasian.

Selection of the Assessment Instruments and Rationale for the Choices

The measurements which were pertinent to this study are:

Levels of physical fitness which were established by completion of the Canadian Home Fitness Test (see Appendix B)

Physical activity participation rates which were recorded on Activity/Frequency Checklists (see Appendix F)
General personality traits which are outlined in Jackson's Personality Research Form Manual (see Appendix C) Mental health profiles which are described in Lanyon's Psychological Screening Inventory Manual (see Appendix D) Life Style Factors, High Risk Factors, Physical Status Variables, Personal and/or Family History Diseases and Age Variables were determined through the use of the Canadian Health Hazard Appraisal (Evalu-life) (see Appendix E)

The above assessment instruments were used to provide measurements of cardiorespiratory fitness and to yield psychological, mental health and identifiable health hazard profiles of each group.

The rationale for selecting them for use in this study is discussed below.

Measurements of Cardiorespiratory Fitness

The true measure of cardiorespiratory fitness is maximum oxygen uptake. The most accurate method for measuring maximum oxygen uptake requires maximal exertion and few people are motivated to such a degree. Maximum testing is time consuming and requires the use of expensive instrumentation (oxygen and carbon dioxide analyzers and spirometer).

In the use of tests for maximum oxygen uptake, the danger exists of precipitating cardiac arrhythmias, which could prove to be fatal in persons with coronary disorders. The presence of certain cardiac arrhythmias (fibrillation,
atrial and ventricular) may result in decreased pumping efficiency and as a result circulatory demands may not be met.

For these reasons a number of acceptable submaximum tests which range from simple to complex have been validated and are in use today.

Tests Used for Maximum Oxygen Uptake

Traditionally the test for maximum oxygen uptake involves treadmill running. However, research studies have shown that maximum testing may be performed on an ergometer.

Comparisons of maximum treadmill and ergometer tests have shown that treadmill tests elicit higher maximum oxygen uptake values because of the larger working muscle mass involved (7) while ergometry requires little habituation and learning problems are slight compared to the treadmill. (105) A problem associated with the mechanically braked bike is that the subject can reduce the workload by decreasing the pedalling frequency, unlike the treadmill where the subject is forced to maintain a constant workload.

Ekblom and Goldberg (30) found that leg work on the ergometer is perceived as being more strainful than comparable work on the treadmill at the same oxygen uptake level. This may cause the exercise bout to be limited by local muscle fatigue rather than the attainment of maximal exertion of the cardiorespiratory system.
Tests Used for Submaximum Oxygen Uptake

Because maximal exertion would be a contraindication to people with cardiac problems, submaximum stress tests are often used to assess cardiorespiratory fitness. Commonly used submaximum evaluation tools are ergometer tests, step tests and recently, the Canadian Home Fitness Test.

Submaximum tests have many inherent advantages from a practical point of view. The cost of a treadmill limits many laboratories in their choice of performance equipment. Instrumentation (ECG, breathing valve positioning, blood sampling etc.) is more difficult on running subjects because of their movements. The units of work on a treadmill must be stated in arbitrary terms (i.e. running at 7 m.p.h. on a 10% slope) because much of the work is done in a horizontal direction and this eliminates any kind of evaluation in the standard units of watts or joules.

For Astrand's submaximum ergometer test (6 minutes of pedalling and the attainment of a steady state heart rate), the prediction of maximum oxygen uptake is based on the principle that under normal conditions, a linear relationship does not hold true. Astrand et al. (5) found that at low workloads, the increase in cardiac output is due mainly to an increase in stroke volume rather than heart rate. This was found to be true up to workloads representing 40% of the maximum oxygen uptake. At the high workloads, increased oxygen extraction can increase the oxygen uptake without affecting heart rate. This problem has been noted by
Wyndham et al. (119) and Teraslinna (112). Therefore heart rates between approximately 120-170 are required for accurate predictions of maximum oxygen uptake which requires continuous monitoring of the subject throughout the test with the use of an ECG or a stethoscope. Careful calibration of the ergometer is an essential requisite prior to testing sessions.

Step tests have also been widely used in submaximum testing. (59) In 1953 Rhyming (95) developed a single step test for which Astrand (3) was able to devise a nomogram. Astrand's nomogram enables the aerobic capacity to be calculated from the pulse rate during submaximal work. Astrand and Rhyming (3) both show that oxygen uptake during work can be calculated from the work level within a range of approximately 6% in 66% of the subjects.

**Canadian Home Fitness Test**

Since its introduction in 1975, the Canadian Home Fitness Test has been established as a simple yet effective test for assessing cardiorespiratory fitness in a laboratory setting and in the home or office. This test enables the mass assessment of predicted maximum oxygen uptake with a minimal amount of equipment and exertion. It is a simple variant of a laboratory and office double-step test. The rhythm of stepping was adjusted to allow for the lesser height of domestic stairs. A three-minute "warm-up" is performed at 65-70% of aerobic power anticipated for a person one decade
older than the individual being tested, followed by three minutes of definitive exercise at 65-70% of aerobic power for an average sedentary person of the same age. Predetermined pulse ceilings are used as criteria for continuing with a third set of exercise which is performed at 65-70% of the aerobic power for a person who is a decade younger. (7)

Jette established that the Canadian Home Fitness Test could be employed as a valid predictor of maximum oxygen consumption and on the strength of this he developed simple exercise prescription charts for use by the general public in conjunction with the Home Fitness Test. (59)

The test was validated on a cross-section of the population (N=1544) living in Saskatoon, Saskatchewan. Results were compared with a more traditional analysis of step-test data and with standard bicycle ergometer test data for the same population. (7)

The Canadian Home Fitness Test was selected to measure the physical fitness levels of the college females who participated in this study. The test was well suited in terms of the time spent and the instrumentation required. The procedures are easy to follow and were further simplified by having one pulsetaker per subject.

Measurements of Psychological Profiles

In the literature reviewed for this study Cattell's Sixteen Personality Factor questionnaire (16PF) was most commonly employed to measure personality traits. The
questionnaire is the product of twenty five years of developmental research and consequently is widely used and widely criticized. According to Bolton (10) it compares favourably with other inventories that attempt to measure variations in normal personality functioning. Whether the 16PF can measure the source traits of normal personality functioning, as is claimed, remains a controversial issue. Furthermore, Bolton agrees with other reviewers that the 16PF Manual is inadequate and requires serious revision. (15)

The scale which measures the "tendency to fake good" is confusing for it is unclear whether the opposite end of the continuum i.e. "to fake bad" can be assumed. (9)

Jackson's Personality Research Form-E (PRF-E)

Douglas N. Jackson (56) developed sets of personality scales based upon Henry Murray's framework (82) for the description of personality. The scales examine a broad spectrum of behaviour within the normal range and the major thrust behind their development was to draw practice and current research knowledge closer together.

Extensive item pools were developed and edited. The reliability and validity of the PRF scales were tested and found to be satisfactory.

The standard forms (Form A and Form B) are each comprised of 300 items and include the following fifteen scales:

Achievement, Affiliation, Aggression, Autonomy, Dominance, Endurance, Exhibition, Harmavoidance, Impulsivity, Nurturance, Order, Play, Social, Recognition, Understanding, Infrequency
Long forms (Form AA and Form BB) contain 440 items and twenty two scales. In addition to the above fifteen the following seven scales are included:

Abasement, Change, Cognitive Structure, Defendence, Sentience, Succorance, Desirability

For the purposes of this study, the wide range standard Form PRF-E was selected. (see Appendix C) This particular form contains items which are appropriate for junior and senior high school students, a number of non-college populations and for more educated groups. The PRF-E is comprised of 352 items and contains the same twenty two scales as Form AA and Forms BB. The items found in the PRF-E form were selected on the basis of simplicity of wording, content saturation and interscale independence using an algorithm for minimum redundancy item analysis. (56)

Compared with the often used 16PF, the selection of Jackson's PRF seemed more appropriate for this study. The Personality Research Forms measure "broadly relevant personality traits" and the scales are in keeping with the purposes of the study namely to investigate group differences. The manual provides up-dated material, clear instructions and is more familiar to the investigator.

The major attribute of the PRF lies in that "low scores like high scores signify the presence of important characteristics". (56) Being able to define both ends of a dimension gave the advantage of more exactly specifying what was being measured.
Measurements of Mental Health Profiles

Lanyon's Psychological Screening Inventory (PSI) was compared with the California Psychological Inventory (CPI), the Minnesota Multiphasic Personality Inventory (MMPI), the Eysenck Personality Inventory (EPI) and was found to be satisfactory. (71)

The California Psychological Inventory was developed to make possible the comprehensive multi-dimensional assessment of normal persons in a variety of settings. The inventory is composed of four hundred and eighty statements which yield eighteen raw scores. A basic theoretical claim of the CPI is that its variables have universal relevance and meaning and therefore cross-cultural studies are of central importance. (15)

The Minnesota Multiphasic Personality Inventory (MMPI) is one of the most extensively employed tools. It remains matchless as an objective instrument for the assessment of psychopathology according to King. (67)

The complexity of the MMPI warranted the publication of a two-volume revision of the MMPI Handbook (Dahlstrom, Welsh and Dahlstrom) in addition to many guides already in existence. Alker recommends that application of the MMPI in connection with mental health requires serious study and understanding of the abovementioned MMPI Handbook. (1)

The Eysenck Personality Profile measures two major personality dimensions namely neuroticism and aversion. Twenty-one of the twenty-four neuroticism items seem to
describe negative or unpleasant experiences. Tellegen notes that the emotional overreactivity associated with neuroticism may influence the respondent and/or the response. As a self-report inventory CPI, MMPI and PRF are regarded as superior to EPI. (111)

The PSI deals with two kinds of behaviour which society has traditionally found unacceptable namely psychiatric difficulty and antisocial problems. The primary intended use of the PSI is the screening of self-referred populations. Ethical legal issues become a serious problem if the inventory is utilized to identify potential psychiatric or antisocial misfits. (36)

**Lanyon's Psychological Screening Inventory (PSI)**

Richard I. Lanyon developed the Psychological Screening Inventory as a non-threatening, brief, easily administered, easily interpreted mental health screening device. The inventory is appropriate for use with college adults as well as high school adolescents. (71)

The PSI is comprised of 130 items and includes the following scales:

- Alienation, Social Nonconformity, Discomfort, Expression and Defensiveness

Male and female grids on the profile sheet are separate as the norms for all the scales are slightly different between the sexes. (see Appendix D)

The inventory can be hand-scored by using templates and the scores can be compared with established norms.
For the purposes of this study, the PSI was selected because it attempts to identify common mental health problems. The Discomfort and Expression scales were designed "to contribute to descriptive personality information". (71) The Alienation and Social Nonconformity scales answer specific questions while the Defensiveness scale was designed to assess the test-taking attitude.

The ethical-legal issues in this study were circumvented by confidential coding, avoidance of individual counselling or discussion and statistical compilation of the data which was used to describe differences between separate groups in broad general mental health terms.

Administration of the PSI takes minimum effort (10-20 minutes) and the item wording is at a grade school level.

Measurements of Identifiable Health Hazard

After a review of the available health hazard appraisals, Health 80's Four Page Questionnaire was identified as being very similar to the Canadian Health Hazard Appraisal (Evalife). This questionnaire would take approximately 30 minutes to complete and provides basic health history and health risk analysis. The survey is divided into several sections: illnesses and medical problems, feelings, family medical history, eating, exercise, smoking, alcohol, drugs, trauma, stress, health needs, self care and tests. Under the illnesses section, the subject is expected to understand whether or not he/she has had ulcerative colitis, fibrocystic breasts and specific heart problems (valve problems, murmur, rhythm
problems). Not all physicians elaborate to the patient on
the specifics of his/her ailment and this may cause an improper
response on the survey. (77)

A visit to the doctor is required to obtain blood levels
of sugar, cholesterol and triglycerides. The results outline
the potential causes of death for the individual over the next
20 years. These are determined from the presence of any
risk factors or behavioural characteristics identified on
the survey. The average percent risk of dying from each
cause for people of the subject's own age group is given as is
the subject's own percent risk. The percent by which the
subject can decrease his risk is printed as well as the
contributing factors which cause his/her risk percent. The
subject's actual age, health age and achievable health age
are listed and these are used in determining "life remaining"
and total lifespan. A list of behaviour modifications are
listed at the bottom of the computer printout along with the
increase in life expectancy (years) if the subject eliminates
each particular risk factor from his/her life style. (52)

Canadian Health Hazard Appraisal (Evalu-life)

The appraisal was developed by Lewis Robbins, M.D., and
Jack Hall, M.D., and colleagues at the Methodist Hospital
of Indiana in Indianapolis. The Canadian Department of
Health and Welfare, (Health Promotion Directorate) oversees
the program which is provided free of charge to health
professionals.
Specifically the Canadian Health Hazard Appraisal assesses the interaction of a variety of everyday risks to which people are exposed and which can affect the quality and quantity of life. It puts numerical values upon the everyday risks which give individuals a more clear understanding of their physical health status. (see Appendix E)

Four classes of information are collected:

Life style factors such as smoking, drinking, exercising and driving practices.

Physical status items such as blood pressure, weight and blood cholesterol.

Presence in or absence from a high risk group through recent screening for breast or cervical cancer.

Personal or family history of cardiac disorders, diabetes, rectal disorders, chronic bronchitis and emphysema.

The results of the Canadian Health Hazard Appraisal serve to help those individuals who have unknowingly slipped into hazardous life styles. The appraisal may reinforce the healthful life style of an individual at low risk and "it provides the basis for a prescription for health which is personal and quantitative unlike our traditional scatter-gun admonitions". (41)

The CHHA was selected for this study because it is a simple, inexpensive, effective tool which outlines existing risk factors for the respondent. It takes minutes to
administer and requires no medical examination. Measurement of fasting blood cholesterol levels are not required but they do add accuracy to the results. (41)

The 12 leading causes of death for each subject's age are listed with the average chance of dying per 100,000 population. The subject's chance of dying from each major cause per 100,000 population is listed as well as the achievable chance of dying relative to certain listed behaviour modifications.

The section in the questionnaire which deals with physical activity allows the respondent to record the score achieved on the Canadian Home Fitness Test. No other survey which was investigated required either the direct or indirect measurement of maximum oxygen uptake.

Organization of Measuring Procedure and Methods of Scoring

Individual Data Files were established for each of the subjects in the six physical fitness categories. Testing days were set for Mondays, Wednesdays and Fridays between 10:00 a.m. and 1:00 p.m. and commenced on January 21st and concluded on June 11th, 1980. A total of 306 subjects were tested over sixty testing days. On the average, to complete the Fitness Test and the paper and pencil questionnaires, one hour was required. Appointments, scheduled at 30 minute intervals, were confirmed by telephone at which time each subject was given directions to the Tait McKenzie Building, the room location and told to wear "running" shoes.
Upon arrival and after introductions, the subject was placed in a comfortable sitting position. The testing procedure was explained and the queries were answered.

The subject was first given the questionnaires to complete. During this period of time blood pressure was measured three times at various intervals and the average recorded on the Evalu-life Form. (see Appendix E)

After measuring the subject for height and weight, three sets of carotid pulse counts over 15 seconds were taken while the subject was standing to familiarize her with the procedure. The average "standing" pulse rate was recorded.

The procedure for conducting the Canadian Home Fitness Test was as follows:

The long playing (33-1/3 rpm) record which dictated the stepping cadence was played on Band Three for women. The step-test (see Appendix B) was demonstrated and the subject joined the instructor when she felt comfortable and ready.

After each of two trial runs the carotid pulse was taken and the rate recorded. If a subject requested a third trial run or if the first two trail run rates had more than one beat separating them, a third trial run was performed (Bailey (7) suggested that the test be "repeated a number of times" to avoid erratic pulse-counts. Of 306 subjects, four subjects recorded three trial runs).

The pulse taker averaged the two trial runs which demonstrated consistency and recorded one base-line trial rate value. The subject was now ready for the "starting" exercise.
The starting-exercise tempo for a period of three minutes was played on Band 3 for women (a cadence of 102 beat per minute). The tempo is equivalent to 65-70% of the aerobic power anticipated for a person 10 years older than the subjects in the study.

After three minutes of exercise the carotid pulse was taken and the rate recorded. A pulse rate of 29 or more denotes the Very Poor fitness category. If the pulse rate did not equal or exceed the ceiling of 29 or more beats, the subject was asked to perform a second three minute stepping exercise.

The second set of stepping exercises were performed at 65-70% of the aerobic power for the average sedentary female of the same age as the subjects in the study (a cadence of 114 beats per minute played on Band 4 for women).

After three minutes of exercise the carotid pulse was taken and the rate recorded. A pulse rate of 29 or more denotes the Poor fitness category while a rate of 28, 27 and 26 categorizes the Moderately Unfit. If the pulse rate did not equal or exceed the ceiling of 26 or more beats, the subject was asked to perform a third three minute stepping exercise.

The third set of stepping exercises were performed at 65-70% of the aerobic power for a person who is ten years younger than the subjects in the study (a cadence of 120 beats per minute played on Band 5 for women).

After three minutes of exercise, the carotid pulse was taken and the rate recorded. A pulse rate of 26 denotes Moderately Fit individuals; 25 and 24 denotes Good fitness while 23 and less categorizes the Very Good fitness group.
Four paper and pencil questionnaires were completed: Jackson's PRF-E, Lanyon's PSI, the Canadian Health Hazard Appraisal (Evalu-life) and the Activity/Frequency Checklist. The latter was used to establish the physical activity pattern of the subjects. Both the type of exercise and the frequency were recorded to verify that low fitness levels equalled low physical activity levels.

The subjects were placed into one of six physical fitness categories (Very Fit, Good, Moderately Fit, Moderately Unfit, Poor, Very Poor). Placement was based on each individual's performance pulse rate achieved on the Canadian Home Fitness Test. From each category twenty subjects were randomly drawn and their permission to be included in the study was requested. Refusals were replaced from the resource pool in each category.

Statistical Treatment

The data were key punched and analyzed by York University Computer Services. For the purposes of this study, two separate one-way multivariate analysis of variance (MANOVAs) were performed on the scale scores from Jackson's Personality Research Form (PRF-E) and Lanyon's Psychological Screening Inventory (PSI) with level of physical fitness as the independent variable. Selected age variables derived from the information on the Canadian Health Hazard Appraisal (Evalu-life) scale were also included in two separate one-way MANOVAs. These variables included the subject's age, the
subject's appraised age, sum of the appraised scores and the sum of the achievable scores in the first MANOVA and the difference scores between the sum of the appraised scores and the sum of the achievable scores and the difference scores between the appraised and achievable ages in the second MANOVA.

The categorical variables included on the Canadian Health Hazard Appraisal (Evalu-life) and the activities included on the Activity/Frequency Checklist were tested in two-way frequency tables against the six groups derived from the Canadian Home Fitness Test. To avoid empty cells, categories were collapsed where appropriate. Consequently, the six fitness groups were collapsed into three groups of Above Average, Average and Below Average fitness for the chi squares analysis. This collapsed grouping was also used to provide secondary information for the MANOVAs described above. That is, the MANOVAs were rerun using three fitness groups rather than the original six.

The multivariate test statistic in the MANOVA reflects variation in the data as a whole. The overall multivariate test is that the entire matrix of parameter coefficients is zero (i.e. a test of whether there is a significant association between any linear combinations of dependent and independent variables). (31) However, it does not locate the association on the subtests of predictors or criterion measures. Without the protection of the multivariate test,
separate univariate decisions are likely to inflate statistical error rates dramatically. With the protection of a significant overall multivariate F-test, the univariate F-statistics will usually give some guide to locating the measures responsible for the significant effect. Consequently, the univariate F-tests were only examined if the multivariate or omnibus F-test was statistically significant.

Orthogonal polynomials were used to test for linear and quadratic trend components. This procedure assumes that the treatment groups (fitness groups) represent equally spaced quantitative steps along an underlying continuum and that the sample size (n) be constant for all treatments. These trend components were interpreted only if the univariate F-tests for the overall model were statistically significant.

Higher-degree polynomials were not tested. The interpretation of significant higher-degree polynomials for example cubic, quartic and quintic, would probably be both difficult and scientifically meaningless. The model's residual component of variation (i.e. the model sum of squares minus the sum of the linear and quadratic sum of squares) was tested also for significance by dividing the residual mean square for the model by the total error mean square. If the residual proves to be nonsignificant, the researcher could be confident that the use of higher-degree polynomials would contribute little towards improving the fit of the curve.
In addition to providing analysis of variance tables and plotting the dependent variables against group membership when the univariate F-test indicates a significant relationship, a number of summary statistics is also provided. This will include the percentage of the variation in scale scores for the fitness groups that could be predicted from a linear regression equation. This is derived by dividing the sum of squares for the linear component by the sums of squares for the entire model. (117)

The linear and linear and quadratic correlations between group membership and the scale score also were included. These indicators are obtained by dividing the square root of the sum of squares for the linear component (or the square root of the sum of the linear and quadratic sum of squares) by the square root of the total sum of squares. (117)

An estimate of the intraclass correlation was calculated and reported for descriptive purposes. (117) Also, because the estimate of the intraclass correlation is biased, the square root of the intraclass correlation was provided. The square root of the intraclass correlation provides an upper bound for the correlation associated with any polynomial regression. These measures of association are reported on the analysis of variance tables for the various dependent variables.
Summary

Undergraduate female students between the ages of 18 and 25 were invited to participate in this study. A total of 306 respondents performed the Canadian Home Fitness step test and were placed in one of six physical fitness categories, twenty persons in each group (N=120). The six physical fitness levels were categorized as Very Good, Good, Moderately Fit, Moderately Unfit, Poor and Very Poor. Each respondent completed four paper and pencil questionnaires: the Activity/Frequency Checklist, Jackson's Personality Research Form-E, Lanyon's Psychological Screening Inventory and the Canadian Health Hazard Appraisal (Evalu-life).

The data were key punched and analyzed by York University Computer Services. Two separate one-way multivariate analysis of variance (MANOVAs) were performed on the scale scores from Jackson's Personality Research Form (PRF-E) and Lanyon's Psychological Screening Inventory (PSI) with level of physical fitness as the independent variable. Selected age variables derived from information on the Canadian Health Hazard Appraisal (Evalu-life) scale were included also in a separate one-way MANOVA. The categorical variables included on the Canadian Health Hazard Appraisal (Evalu-life) and the activities included on the Activity/Frequency Checklist were tested in two-way frequency tables against the six groups derived from the Canadian Home Fitness Test. To avoid empty cells, categories were collapsed where appro-
appropriate. Consequently, the six fitness groups were collapsed into three groups of Above Average, Average and Below Average fitness for the chi squares analysis. This collapsed grouping also was used to provide secondary information for the MANOVAs described above. That is, the MANOVAs were rerun using three fitness groups rather than the original six.
CHAPTER IV
PRESENTATION AND ANALYSIS OF THE DATA

For the purpose of organization and ease of understanding, the presentation and analysis of the data are divided into three main sections. The first section includes a discussion of the physical fitness categories and personality profiles which were derived from data collected by administering Jackson's Psychological Research Form-E.

The second section includes a presentation of physical fitness categories and mental health profiles which were derived from data collected by administering Lanyon's Psychological Screening Inventory.

The third section includes data concerning physical fitness categories and life style items, high risk factors, personal and family history of diseases and age variables which were collected by administering the Canadian Health Hazard Appraisal (Evalu-life).

Personality Profiles

The relationship between physical fitness and personality profile is examined by performing a one-way MANOVA on the 21 scales of Jackson's PRF. The Infrequency scale was dropped from the analysis as it had served its purpose of reflecting the accuracy of the responses. Ninety four percent of the sample had a score of less than 4 which was specified as acceptable by
One-way MANOVAs were performed on both the original six-category fitness grouping (1 = Very Poor, 2 = Poor, 3 = Moderately Unfit, 4 = Moderately Fit, 5 = Good, 6 = Very Good) and a recoded three-category fitness group (1 = Below Average, 2 = Average, 3 = Above Average). Using Wilks Lambda, the multivariate F-tests for the six-fitness categories ($F = 1.72; \text{df} = 105, 464; p < .0001$) and the three-fitness categories ($F = 2.30; \text{df} = 42, 194; p < .0001$) were both statistically significant but there were some differences between the two analysis when the univariate results were compared.

In the MANOVA with the six-fitness categories, the Achievement, Affiliation, Change, Nurturance, and Desirability scales had significant univariate F-tests and significant linear components. The Endurance scale had a significant F-test and a significant quadratic component. The Order scale had a significant F-test but neither the linear or the quadratic component reached statistical significance. However, the residual effect was significant. Each of these scales will be described more fully below.

The means and standard deviations for, and intercorrelations among, the 21 PRF scale scores and the six-category fitness test are provided in Table 1. In the MANOVA with the three-fitness categories the Achievement, Change, Dominance, Play and Desirability scales had significant univariate F-tests and both the linear and residual components reached statistical significance. These scales will be discussed more fully below.
<table>
<thead>
<tr>
<th>Ab</th>
<th>Ac</th>
<th>Af</th>
<th>Ag</th>
<th>Au</th>
<th>Ch</th>
<th>Cs</th>
<th>De</th>
<th>Do</th>
<th>En</th>
<th>Ex</th>
<th>Ha</th>
<th>Im</th>
<th>Nu</th>
<th>Or</th>
<th>Pl</th>
<th>Se</th>
<th>Sr</th>
<th>Su</th>
<th>Un</th>
<th>In</th>
<th>Dy</th>
<th>Grp</th>
</tr>
</thead>
<tbody>
<tr>
<td>.22</td>
<td>.06</td>
<td>-.30</td>
<td>-.28</td>
<td>-.01</td>
<td>-.08</td>
<td>-.41</td>
<td>.11</td>
<td>.24</td>
<td>-.02</td>
<td>-.35</td>
<td>-.13</td>
<td>.22</td>
<td>-.05</td>
<td>.02</td>
<td>.10</td>
<td>.04</td>
<td>.22</td>
<td>.18</td>
<td>.17</td>
<td>-.10</td>
<td>-.16</td>
<td></td>
</tr>
<tr>
<td>Ac</td>
<td>.10</td>
<td>-.14</td>
<td>-.01</td>
<td>.19</td>
<td>.29</td>
<td>-.12</td>
<td>.60</td>
<td>.56</td>
<td>.17</td>
<td>-.35</td>
<td>-.36</td>
<td>.30</td>
<td>.15</td>
<td>-.16</td>
<td>.32</td>
<td>-.01</td>
<td>.17</td>
<td>.39</td>
<td>-.06</td>
<td>.47</td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>Af</td>
<td>-.13</td>
<td>-.19</td>
<td>.36</td>
<td>-.07</td>
<td>-.20</td>
<td>.13</td>
<td>.10</td>
<td>.33</td>
<td>-.10</td>
<td>.14</td>
<td>.44</td>
<td>.04</td>
<td>.56</td>
<td>.13</td>
<td>.18</td>
<td>.09</td>
<td>.14</td>
<td>.01</td>
<td>.02</td>
<td>-.23</td>
<td>-.08</td>
<td></td>
</tr>
<tr>
<td>Ag</td>
<td>.23</td>
<td>-.07</td>
<td>.05</td>
<td>.51</td>
<td>.04</td>
<td>-.16</td>
<td>.07</td>
<td>.25</td>
<td>.10</td>
<td>-.26</td>
<td>.06</td>
<td>.08</td>
<td>-.11</td>
<td>.14</td>
<td>.01</td>
<td>-.02</td>
<td>-.02</td>
<td>-.23</td>
<td>-.08</td>
<td>.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Au</td>
<td>.19</td>
<td>-.08</td>
<td>.07</td>
<td>.08</td>
<td>.07</td>
<td>.16</td>
<td>-.03</td>
<td>.18</td>
<td>-.31</td>
<td>.10</td>
<td>.14</td>
<td>.00</td>
<td>-.30</td>
<td>-.50</td>
<td>.10</td>
<td>-.15</td>
<td>-.02</td>
<td>-.03</td>
<td>.34</td>
<td>.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch</td>
<td>-.14</td>
<td>-.12</td>
<td>.25</td>
<td>.18</td>
<td>.30</td>
<td>-.26</td>
<td>.19</td>
<td>.24</td>
<td>-.10</td>
<td>.35</td>
<td>.14</td>
<td>-.02</td>
<td>-.12</td>
<td>-.06</td>
<td>-.22</td>
<td>.09</td>
<td>.34</td>
<td>.34</td>
<td>.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cs</td>
<td>-.01</td>
<td>.16</td>
<td>.33</td>
<td>-.08</td>
<td>.10</td>
<td>-.51</td>
<td>.01</td>
<td>.51</td>
<td>-.32</td>
<td>.01</td>
<td>.07</td>
<td>.10</td>
<td>.35</td>
<td>.04</td>
<td>.29</td>
<td>.07</td>
<td>.34</td>
<td>.34</td>
<td>.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>De</td>
<td>-.12</td>
<td>-.34</td>
<td>.00</td>
<td>.39</td>
<td>-.07</td>
<td>.30</td>
<td>.04</td>
<td>-.07</td>
<td>.11</td>
<td>.20</td>
<td>-.05</td>
<td>.15</td>
<td>-.08</td>
<td>-.18</td>
<td>-.03</td>
<td>.34</td>
<td>.34</td>
<td>.34</td>
<td>.34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do</td>
<td>.61</td>
<td>.32</td>
<td>-.28</td>
<td>-.27</td>
<td>.21</td>
<td>-.02</td>
<td>.05</td>
<td>.29</td>
<td>-.03</td>
<td>-.17</td>
<td>.43</td>
<td>-.10</td>
<td>.40</td>
<td>.24</td>
<td>.29</td>
<td>.24</td>
<td>.24</td>
<td>.24</td>
<td>.24</td>
<td>.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>En</td>
<td>.16</td>
<td>-.30</td>
<td>-.41</td>
<td>.31</td>
<td>.30</td>
<td>-.06</td>
<td>.35</td>
<td>-.09</td>
<td>-.15</td>
<td>.51</td>
<td>-.09</td>
<td>.44</td>
<td>.11</td>
<td>.11</td>
<td>.11</td>
<td>.11</td>
<td>.11</td>
<td>.11</td>
<td>.11</td>
<td>.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex</td>
<td>-.14</td>
<td>.18</td>
<td>.18</td>
<td>-.07</td>
<td>.35</td>
<td>.29</td>
<td>.13</td>
<td>-.21</td>
<td>.09</td>
<td>.03</td>
<td>.17</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td>.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ha</td>
<td>-.09</td>
<td>-.28</td>
<td>-.07</td>
<td>-.05</td>
<td>-.30</td>
<td>.02</td>
<td>.06</td>
<td>-.23</td>
<td>-.11</td>
<td>-.14</td>
<td>-.17</td>
<td>.17</td>
<td>.17</td>
<td>.17</td>
<td>.17</td>
<td>.17</td>
<td>.17</td>
<td>.17</td>
<td>.17</td>
<td>.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Im</td>
<td>-.15</td>
<td>-.47</td>
<td>.39</td>
<td>-.08</td>
<td>.04</td>
<td>-.22</td>
<td>.04</td>
<td>-.35</td>
<td>-.10</td>
<td>.10</td>
<td>.40</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nu</td>
<td>.11</td>
<td>.15</td>
<td>.38</td>
<td>.11</td>
<td>.19</td>
<td>.08</td>
<td>.00</td>
<td>.40</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td>.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Or</td>
<td>-.23</td>
<td>.03</td>
<td>.06</td>
<td>.25</td>
<td>.11</td>
<td>.04</td>
<td>.21</td>
<td>.05</td>
<td>.05</td>
<td>.06</td>
<td>-.31</td>
<td>-.21</td>
<td>-.03</td>
<td>-.17</td>
<td>-.17</td>
<td>-.17</td>
<td>-.17</td>
<td>-.17</td>
<td>-.17</td>
<td>-.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pl</td>
<td>.05</td>
<td>.06</td>
<td>-.31</td>
<td>-.21</td>
<td>-.03</td>
<td>-.17</td>
<td>-.05</td>
<td>.39</td>
<td>.06</td>
<td>.32</td>
<td>.23</td>
<td>.32</td>
<td>.23</td>
<td>.32</td>
<td>.23</td>
<td>.32</td>
<td>.23</td>
<td>.32</td>
<td>.23</td>
<td>.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Se</td>
<td>.07</td>
<td>.05</td>
<td>.39</td>
<td>-.06</td>
<td>.32</td>
<td>.23</td>
<td>.33</td>
<td>.05</td>
<td>.07</td>
<td>.00</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td>.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sr</td>
<td>.06</td>
<td>-.05</td>
<td>-.12</td>
<td>-.13</td>
<td>.01</td>
<td>.28</td>
<td>-.15</td>
<td>-.05</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su</td>
<td>.06</td>
<td>-.05</td>
<td>-.12</td>
<td>-.13</td>
<td>.01</td>
<td>.28</td>
<td>-.15</td>
<td>-.05</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Un</td>
<td>.06</td>
<td>-.05</td>
<td>-.12</td>
<td>-.13</td>
<td>.01</td>
<td>.28</td>
<td>-.15</td>
<td>-.05</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In</td>
<td>.06</td>
<td>-.05</td>
<td>-.12</td>
<td>-.13</td>
<td>.01</td>
<td>.28</td>
<td>-.15</td>
<td>-.05</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dy</td>
<td>.06</td>
<td>-.05</td>
<td>-.12</td>
<td>-.13</td>
<td>.01</td>
<td>.28</td>
<td>-.15</td>
<td>-.05</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td>-.40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 1**
The Means and Standard Deviations for, and the Intercorrelations among, the 22 PRF Scales and the Six-Fitness Groups

<table>
<thead>
<tr>
<th>Grp</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ab</td>
<td>7.27</td>
<td>3.09</td>
</tr>
<tr>
<td>Ac</td>
<td>9.66</td>
<td>3.47</td>
</tr>
<tr>
<td>Af</td>
<td>10.01</td>
<td>3.44</td>
</tr>
<tr>
<td>Ag</td>
<td>7.88</td>
<td>3.24</td>
</tr>
<tr>
<td>Au</td>
<td>7.01</td>
<td>3.00</td>
</tr>
<tr>
<td>Ch</td>
<td>9.24</td>
<td>2.72</td>
</tr>
<tr>
<td>Cs</td>
<td>9.23</td>
<td>2.80</td>
</tr>
<tr>
<td>De</td>
<td>6.73</td>
<td>2.89</td>
</tr>
<tr>
<td>Do</td>
<td>6.54</td>
<td>3.16</td>
</tr>
<tr>
<td>En</td>
<td>10.07</td>
<td>3.62</td>
</tr>
<tr>
<td>Ex</td>
<td>8.78</td>
<td>4.07</td>
</tr>
<tr>
<td>Ha</td>
<td>9.39</td>
<td>3.51</td>
</tr>
<tr>
<td>Im</td>
<td>6.38</td>
<td>2.97</td>
</tr>
<tr>
<td>Nu</td>
<td>10.59</td>
<td>4.02</td>
</tr>
<tr>
<td>Or</td>
<td>8.72</td>
<td>3.02</td>
</tr>
<tr>
<td>Pl</td>
<td>9.09</td>
<td>2.98</td>
</tr>
<tr>
<td>Se</td>
<td>9.43</td>
<td>3.15</td>
</tr>
<tr>
<td>Sr</td>
<td>8.32</td>
<td>3.31</td>
</tr>
<tr>
<td>Su</td>
<td>8.01</td>
<td>3.84</td>
</tr>
<tr>
<td>Un</td>
<td>7.35</td>
<td>1.98</td>
</tr>
<tr>
<td>In</td>
<td>2.38</td>
<td>2.81</td>
</tr>
<tr>
<td>Dy</td>
<td>1.05</td>
<td>1.71</td>
</tr>
</tbody>
</table>

* $p < .05$

** $p < .01$
Achievement Scale

The analysis of variance on the Achievement scale with six-fitness categories is shown in Table 2. The model component represents the overall effect for the group. Since there are six groups, the degrees of freedom for the groups are $6-1 = 5$. The sum of squares within a single group has degrees of freedom equal to 19; the pooled within-group variation has $6 \times 19 = 114$ degrees of freedom. The pooled within-group variation defines the experimental error. This format will remain the same while discussing the univariate results from the MANOVAs which used the six-fitness categories as the independent variable. The reader is reminded to refer to the above format when reading the ensuing description of scales.

The univariate F-test ($F = 2.92$, $df = 5, 114$; $p < .02$) for the model was statistically significant which indicates that Achievement scores for the groups differ. A statistically significant linear component ($F = 11.02$; $df = 1, 114$; $p < .001$) suggests a strong linear component between group membership and achievement. Descriptive statistics are provided at the bottom of the analysis of variance table. Tests for nonlinearity and a test on the significance of the model's residual component of variation further indicate that none of the higher-order components would be significantly different from zero. Seventy-six percent of the variation in the achievement score for the groups may be predicted from linear regression.
### TABLE 2

Analysis of Variance and Trend Analysis on the Achievement Scale Based on Six Fitness Levels

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>162.94</td>
<td>5</td>
<td>32.59</td>
<td>2.92</td>
<td>.02</td>
</tr>
<tr>
<td>(Linear)</td>
<td>123.02</td>
<td>1</td>
<td>123.02</td>
<td>11.02</td>
<td>.001</td>
</tr>
<tr>
<td>(Quadratic)</td>
<td>1.87</td>
<td>1</td>
<td>1.87</td>
<td>.17</td>
<td>.68</td>
</tr>
<tr>
<td>(Residual)</td>
<td>38.05</td>
<td>3</td>
<td>12.68</td>
<td>1.14</td>
<td>.34</td>
</tr>
<tr>
<td>Error</td>
<td>1272.05</td>
<td>114</td>
<td>11.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

76 percent of the variation in the scale score for the groups may be predicted from linear regression

\[ r_{\text{linear}} = .29 \]

\[ r_{\text{linear + quad.}} = .30 \]

\[ p_{\text{intraclass}} = .09 \]

\[ \sqrt{p_{\text{intraclass}}} = .3 \]
The mean achievement scores for the six-fitness groups are plotted against group membership in Figure 1. The graph indicates that fitness and achievement are strongly correlated with the most fit having the highest achievement scores and the least fit having the lowest achievement scores.

When the data from the MANOVA which used three-fitness categories as the independent variable is considered, the pattern is further confirmed. The analysis of variance on the Achievement scale for three-fitness groups is shown in Table 3. It should be noted that since there are now three groups, the degrees of freedom for the groups are 3-1 = 2. The sum of squares within a single group now has degrees of freedom equal to 39; the pooled within-group variation has 3 x 39 = 117. With only three points in the recoded group dimension, only two components can be obtained: linear and residual. A significant second-order trend could be quadratic or of a higher order, but with three groups there are not enough data points to establish this.

The model ($F = 3.72; \text{df} = 2, 117; p < .03$) and the linear component ($F = 7.29; \text{df} = 1, 117; p < .008$) were both statistically significant. Ninety-eight percent of variation in the achievement scores for the groups may be predicted from linear regression. The graph of average achievement scores for the three groups against group membership in Figure 2 also indicates an almost perfect linear relationship.
$X = .59K + 7.59$

**FIGURE 1**

Mean Achievement-Scale Scores as a Function of Six Fitness Levels
### TABLE 3

Analysis of Variance and Trend Analysis on the Achievement Scale
Based on Three Fitness Levels

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (Linear)</td>
<td>85.72</td>
<td>2</td>
<td>42.86</td>
<td>3.72</td>
<td>.03</td>
</tr>
<tr>
<td>(Residual)</td>
<td>84.05</td>
<td>1</td>
<td>84.05</td>
<td>7.29</td>
<td>.008</td>
</tr>
<tr>
<td>(Residual)</td>
<td>1.67</td>
<td>1</td>
<td>1.67</td>
<td>.14</td>
<td>.70</td>
</tr>
<tr>
<td>Error</td>
<td>1349.28</td>
<td>117</td>
<td>11.53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

98 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .24$

$r_{linear + quad.} = .24$

$p_{intraclass} = .24$

$\sqrt{p_{intraclass}} = .50$
FIGURE 2
Mean Achievement-Scale Scores as a Function of Three Fitness Levels
In summary, the linear trend appears to be the only trend that is significantly greater than zero. Hence, a first degree equation is the form of the best-fitting curve with high achievement motivation and good fitness being positively correlated.

Affiliation Scale

The analysis of variance on the affiliation scale with six-fitness categories as the independent variable is shown in Table 4. The model ($F = 2.62; df = 5, 114; p < .03$) and the linear component ($F = 5.23; df = 1, 114; p < .02$) were both significant. However, only 40 percent of the variation in the affiliation scores for the groups could be predicted from linear regression. Inspection of the group means in Figure 3 suggests that the two middle groups, Moderately Fit (Group 4) and Moderately Unfit (Group 3), deviate from the linear trend in the direction of scoring higher on the affiliation scale than a linear equation would predict. However, both the quadratic and the model's residual components of variation were not significantly different from zero. The best-fit of the curve changed when the results from the MANOVA with the three-fitness categories as an independent variable were considered.

The analysis of variance on the affiliation scale with three-fitness categories as the independent variable is shown in Table 5. The model ($F = 5.31; df = 2, 117;$
TABLE 4

Analysis of Variance and Trend Analysis on the Achievement Scale Based on Six Fitness Levels

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>145.44</td>
<td>5</td>
<td>29.09</td>
<td>2.62</td>
<td>.03</td>
</tr>
<tr>
<td>(Linear)</td>
<td>58.02</td>
<td>1</td>
<td>58.02</td>
<td>5.23</td>
<td>.02</td>
</tr>
<tr>
<td>(Quadratic)</td>
<td>24.29</td>
<td>1</td>
<td>24.29</td>
<td>2.19</td>
<td>.14</td>
</tr>
<tr>
<td>(Residual)</td>
<td>63.13</td>
<td>3</td>
<td>21.04</td>
<td>1.89</td>
<td>.13</td>
</tr>
<tr>
<td>Error</td>
<td>1265.55</td>
<td>114</td>
<td>11.10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

40 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .20$

$r_{linear + quad.} = .24$

$p_{intraclass} = .17$

$v_{p_{intraclass}} = .41$
$X = 0.41K + 8.57$

**FIGURE 3**

Mean Affiliation-Scale Scores as a Function of Six Fitness Levels
TABLE 5

Analysis of Variance and Trend Analysis on the Affiliation Scale Based on Three Fitness Levels

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (Linear)</td>
<td>117.32</td>
<td>2</td>
<td>58.66</td>
<td>5.31</td>
<td>.006</td>
</tr>
<tr>
<td>(Residual)</td>
<td>56.07</td>
<td>1</td>
<td>56.07</td>
<td>5.07</td>
<td>.03</td>
</tr>
<tr>
<td>Error</td>
<td>1293.68</td>
<td>117</td>
<td>11.06</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

52 percent of the variation in the scale score for the groups may be predicted from linear regression

\[ r_{\text{linear}} = .21 \]

\[ r_{\text{linear + quad.}} = .29 \]

\[ \rho \text{ intraclass} = .19 \]

\[ \sqrt{\rho \text{ intraclass}} = .44 \]
£ < .006), linear ($F = 5.54; df = 1, 117; p < .02$) and residual ($F = 5.07; df = 1, 117; p < .03$) components were all statistically significant. Collapsing the fitness groups from six to three increased the percentage of the variation in the affiliation scores accounted for by the groups from 40 percent for six groups to 52 percent for three groups. The increase in predictability that would accrue for the sample data by using a higher-degree instead of a first-degree equation is also indicated by comparing the linear correlation between group membership and the scale score ($r = .21$) and the combined linear and quadratic (non-linear) correlation between group membership and the scale score ($r = .29$).

The non-linear component of variation is displayed graphically in Figure 4. The Average fitness group had the highest average affiliation score, followed closely by the Above Average group, with the Below Average group having the lowest average affiliation score.

Change Scale

The analysis of variance on the Change Scale with six-fitness categories as the independent variable is shown in Table 6. The model ($F = 5.62; df = 5, 114; p < .0001$), the linear ($F = 16.53; df = 1, 114; p < .0001$) and the residual components ($F = 3.71; df = 3, 114; p < .01$) were all significant. Fifty-nine percent of the variation in the Change scores for the groups could be predicted from linear regression. Inspection of Figure 5 supports
FIGURE 4
Mean Affiliation-Scale Scores as a Function of Three Fitness Levels
TABLE 6

Analysis of Variance and Trend Analysis on the Change Scale Based on Six Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (Linear)</td>
<td>102.60</td>
<td>1</td>
<td>102.60</td>
<td>16.53</td>
<td>.0001</td>
</tr>
<tr>
<td>Model (Quadratic)</td>
<td>2.75</td>
<td>1</td>
<td>2.75</td>
<td>.44</td>
<td>.51</td>
</tr>
<tr>
<td>Model (Residual)</td>
<td>69.09</td>
<td>3</td>
<td>23.03</td>
<td>3.71</td>
<td>.01</td>
</tr>
<tr>
<td>Error</td>
<td>707.55</td>
<td>114</td>
<td>6.21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

59 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .34$

$r_{linear + quad.} = .35$

$\rho_{intraclass} = .44$

$\sqrt{\rho_{intraclass}} = .66$
$X = .54K + 7.35$

**FIGURE 5**

Mean Change-Scale Scores as a Function of Six Fitness Levels
the choice of a first-degree equation except for the Moderately Unfit group which deviated in the direction of scoring higher than would be expected with a linear equation. A significant residual component indicates that a curve of higher-order than quadratic may provide the best fit to the data.

The analysis of variance on the Change scale with three-fitness categories as the independent variable is shown in Table 7. The model ($F = 9.77; df = 2, 117; p < .0001$) and the linear component ($F = 16.38; df = 1, 117; p < .0001$) are both significant. Eighty-four percent of the variation in the Change scores for the groups could be predicted from linear regression. Figure 6 shows the average Change scores for the three-fitness groups plotted against group membership. The Above Average and Average groups had Change scores of similar value while the Below Average group scored considerably lower.

In summary, when three-fitness categories are considered the linear trend appears to be the only trend that is significant. However, good and average fitness was associated with high Change scores and poor fitness was associated with low Change scores.

Nurturance Scale

The analysis of variance on the Nurturance scale with six-fitness categories as the independent variable is shown in Table 8. The model ($F = 3.15; df = 5, 114; p < .01$) and the linear component ($F = 11.15; df = 1, 114; p < .001$)
TABLE 7

Analysis of Variance and Trend Analysis on the Change Scale Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>126.22</td>
<td>2</td>
<td>63.11</td>
<td>9.77</td>
<td>.0001</td>
</tr>
<tr>
<td>(Linear)</td>
<td>105.80</td>
<td>1</td>
<td>105.80</td>
<td>16.38</td>
<td>.0001</td>
</tr>
<tr>
<td>(Residual)</td>
<td>20.42</td>
<td>1</td>
<td>20.42</td>
<td>3.16</td>
<td>.08</td>
</tr>
<tr>
<td>Error</td>
<td>755.78</td>
<td>117</td>
<td>6.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

84 percent of the variation in the scale score for the groups may be predicted from linear regression

\[ r_{\text{linear}} = .35 \]
\[ r_{\text{linear} + \text{quad.}} = .38 \]
\[ p_{\text{intraclass}} = .43 \]
\[ \sqrt{p_{\text{intraclass}}} = .65 \]
Mean Change-Scale Scores as a Function of Three Fitness Levels

\[ X = 1.63K + 5.98 \]
Analysis of Variance and Trend Analysis on the Nurturance Scale Scale Based on Six Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (Linear)</td>
<td>127.04</td>
<td>5</td>
<td>25.41</td>
<td>3.15</td>
<td>.01</td>
</tr>
<tr>
<td>(Quadratic)</td>
<td>90.01</td>
<td>1</td>
<td>90.01</td>
<td>11.15</td>
<td>.001</td>
</tr>
<tr>
<td>(Residual)</td>
<td>12.69</td>
<td>1</td>
<td>12.69</td>
<td>1.57</td>
<td>.21</td>
</tr>
<tr>
<td>Error</td>
<td>24.34</td>
<td>3</td>
<td>8.11</td>
<td>1.00</td>
<td>.39</td>
</tr>
<tr>
<td></td>
<td>919.95</td>
<td>114</td>
<td>8.07</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

71 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .29$

$r_{linear + quad.} = .31$

$p_{intraclass} = .34$

$\sqrt{p_{intraclass}} = .58$
were both significant. Seventy-one percent of the variation in the Nurturance scores for the groups could be predicted from linear regression.

The average nurturance scores for the six-fitness groups are plotted against group membership in Figure 7. The Moderate Fit and Moderate Unfit groups scored higher on the Nurturance Scale than would be expected from a linear equation. The trend towards a second-degree equation is supported by the univariate results on the Nurturance scale from the one-way MANOVA with the three-fitness categories as the independent variable.

The analysis of variance on the Nurturance scale with the three-fitness categories as the independent variable is shown in Table 9. The model ($F = 7.91; df = 2, 117; p < .0006$), the linear component ($F = 11.73; df = 1, 117; p < .0008$) and the residual component ($F = 4.09; df = 1, 117; p < .04$) were all significant. Seventy-four percent of the variation in the Nurturance scores for the groups could be predicted from linear regression. The increase in predictability with a second-degree equation is indicated by comparing the linear correlation between group membership and the scale scores ($r = .30$) and the combined linear and quadratic (non-linear) correlation between group membership and the scale score ($r = .34$).

The non-linear component is displayed graphically in Figure 8. The graph resembles the patterns shown in Figure 4 for the Affiliation scale and in Figure 6 for the
FIGURE 7

Mean Nurturance-Scale Scores as a Function of Six Fitness Levels
### TABLE 9

Analysis of Variance and Trend Analysis on the Nurturance Scale Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>124.72</td>
<td>2</td>
<td>62.36</td>
<td>7.91</td>
<td>0.0006</td>
</tr>
<tr>
<td>(Linear)</td>
<td>92.45</td>
<td>1</td>
<td>92.45</td>
<td>11.73</td>
<td>0.0008</td>
</tr>
<tr>
<td>(Residual)</td>
<td>32.27</td>
<td>1</td>
<td>32.27</td>
<td>4.09</td>
<td>0.04</td>
</tr>
<tr>
<td>Error</td>
<td>922.28</td>
<td>117</td>
<td>7.88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

74 percent of the variation in the scale score for the groups may be predicted from linear regression

\[ r_{linear} = 0.30 \]

\[ r_{linear + quad.} = 0.34 \]

\[ r_{intra} = 0.35 \]

\[ r_{intra}^{0.5} = 0.59 \]
Nurturance Scores (Means)

$X = 1.52K + 7.55$

Mean Nurturance-Scale Scores as a Function of Three Fitness Levels

FIGURE 8
Change scale in that the Above Average and Average groups have high average Affiliation and Change scores compared to the Below Average group.

Desirability Scale

The analysis of variance on the Desirability scale with six-fitness categories as the independent variable is shown in Table 10. The model \( F = 2.68; \text{df} = 5, 114; p < .02 \) and the linear component \( F = 10.10; \text{df} = 1, 114; p < .002 \) are both significant. Seventy-five percent of the variation in the Desirability scores for the groups could be predicted from linear regression. This trend is displayed graphically in Figure 9.

The linear trend is even more apparent in the analysis of variance with the three-fitness categories as the independent variable. The analysis of variance on the Desirability scale with three-fitness categories as the independent variable is shown in Table 11. The model \( F = 4.62; \text{df} = 2, 117; p < .01 \) and the linear component \( F = 9.21; \text{df} = 1, 117; p < .003 \) were both significant. One hundred percent of the Desirability scores for the groups could be predicted from linear regression. Figure 10 indicates a perfect correlation between the average Desirability scores for the three groups and group membership. The more fit, the higher the Desirability score.
TABLE 10

Analysis of Variance and Trend Analysis on the Desirability Scale Based on Six Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>98.79</td>
<td>5</td>
<td>19.76</td>
<td>2.68</td>
<td>.02</td>
</tr>
<tr>
<td>(Linear)</td>
<td>74.30</td>
<td>1</td>
<td>74.30</td>
<td>10.10</td>
<td>.002</td>
</tr>
<tr>
<td>(Quadratic)</td>
<td>8.45</td>
<td>1</td>
<td>8.45</td>
<td>1.15</td>
<td>.29</td>
</tr>
<tr>
<td>(Residual)</td>
<td>16.04</td>
<td>3</td>
<td>5.35</td>
<td>.73</td>
<td>.54</td>
</tr>
<tr>
<td>Error</td>
<td>839.05</td>
<td>114</td>
<td>7.36</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

75 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{\text{linear}} = .28$

$r_{\text{linear + quad.}} = .30$

$\rho_{\text{intraclass}} = .31$

$\sqrt{\rho_{\text{intraclass}}} = .56$
FIGURE 9

Mean Desirability-Scale Scores as a Function of Six Fitness Levels

\[ X = 0.46K + 9.44 \]
TABLE 11

Analysis of Variance and Trend Analysis on the Desirability Scale Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>68.62</td>
<td>2</td>
<td>34.31</td>
<td>4.62</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>(Linear)</td>
<td>68.45</td>
<td>1</td>
<td>68.45</td>
<td>9.21</td>
<td>.003</td>
<td></td>
</tr>
<tr>
<td>(Residual)</td>
<td>0.17</td>
<td>1</td>
<td>.17</td>
<td>.02</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>869.22</td>
<td>117</td>
<td>7.43</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

100 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{\text{linear}} = .27$

$r_{\text{linear} + \text{quad.}} = .27$

$p_{\text{intracllass}} = .29$

$s_{\text{intracllass}} = .54$
Figure 10

Mean desirability-scale scores as a function of three fitness levels.

Equation: \[ X = 1.31K + 8.43 \]
Endurance Scale

The analysis of variance on the Endurance scale with six-fitness categories as the independent variable is shown in Table 12. The model ($F = 2.55; df = 5, 114; p < .03$) is significant but the linear and quadratic components both failed to reach statistical significance. The model's residual component of variation ($F = 2.61; df = 3, 114; p < .05$) was significant which suggests that a higher-degree polynomial would improve the fit of the curve. The group means for the Endurance scale plotted against group membership is shown in Figure 11. The graph shows a complex pattern. The Very Good, Moderately Fit and Very Poor groups all score very high on the average while the Good, Moderately Unfit and Poor Groups all had comparatively lower scores on the average.

Order Scale

The analysis of variance on the Order scale with six-fitness categories as the independent variable is shown in Table 13. The model ($F = 4.21; df = 5, 114; p < .002$) reached significance but the linear and quadratic components did not. The model's residual component of variation ($F = 6.75; df = 3, 114; p < .0001$) was significant which suggests that a higher-degree polynomial would improve the fit of the curve. Examination of the groups' scale means plotted against group membership in Figure 12
### TABLE 12

Analysis of Variance and Trend Analysis on the Endurance Scale Based on Six Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (Linear)</td>
<td>152.67</td>
<td>5</td>
<td>30.53</td>
<td>2.55</td>
<td>.03</td>
</tr>
<tr>
<td>(Linear)</td>
<td>20.16</td>
<td>1</td>
<td>20.16</td>
<td>1.69</td>
<td>.20</td>
</tr>
<tr>
<td>(Quadratic)</td>
<td>39.00</td>
<td>1</td>
<td>39.00</td>
<td>3.26</td>
<td>.07</td>
</tr>
<tr>
<td>(Residual)</td>
<td>93.51</td>
<td>3</td>
<td>31.17</td>
<td>2.61</td>
<td>.05</td>
</tr>
<tr>
<td>Error</td>
<td>1362.80</td>
<td>114</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .11$

$r_{linear + quad.} = .20$

$\rho_{intra class} = .41$

$\sqrt{\rho_{intra class}} = .64$
Endurance Scores (Means)

\[ X = 0.24K + 9.23 \]

Group Membership

FIGURE 11

Mean Endurance-Scale Scores as a Function of Six Fitness Levels
TABLE 13

Analysis of Variance and Trend Analysis on the Order Scale Based on Six Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>299.67</td>
<td>5</td>
<td>59.93</td>
<td>4.21</td>
<td>.002</td>
</tr>
<tr>
<td>(Linear)</td>
<td>4.13</td>
<td>1</td>
<td>4.13</td>
<td>.29</td>
<td>.59</td>
</tr>
<tr>
<td>(Quadratic)</td>
<td>7.07</td>
<td>1</td>
<td>7.07</td>
<td>.50</td>
<td>.48</td>
</tr>
<tr>
<td>(Residual)</td>
<td>288.47</td>
<td>3</td>
<td>96.16</td>
<td>6.75</td>
<td>.0001</td>
</tr>
<tr>
<td>Error</td>
<td>1624.70</td>
<td>114</td>
<td>14.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 percent of the variation in the scale score for the groups may be predicted from linear regression

$\tau_{linear} = .05$

$\tau_{linear + quad.} = .08$

$\rho_{intracl} = - .04$

$\sqrt{\rho_{intracl}} = .20$
Order Scores (Means)

\[ X = 0.11K + 8.33 \]

**FIGURE 12**

Mean Order Scale-Scores as a Function of Six Fitness Levels
suggests that the difficulty with fitting the proper curve to the data is due to the Good fitness group (Group 5) which had an average scale score much lower than the remaining five groups.

Three of the models for the scales included in Jackson's PRF failed to reach significance for the MANOVA with the six-fitness categories as the independent variable but did attain statistical significance for the MANOVAs with the three-fitness categories as the independent variable. These scales were the Dominance, Play and Understanding scales. This difference can be explained by the fact that the independent variable with three-fitness categories is a cruder measure of physical fitness and smaller differences between the fitness groups will be more likely to be recorded as a significant effect compared to the independent variable with six fitness levels.

Dominance Scale

The analysis of variance for the Dominance scale with three-fitness categories as the independent variable is presented in Table 14. The model \( F = 3.59; \text{df} = 2, 117; \ p < .03 \) and the linear component \( F = 6.76; \text{df} = 1, 117; \ p < .01 \) were both significant. Ninety-four percent of the variation in the Dominance scores may be predicted from linear regression. Figure 13 shows the strong linear trend graphically with the Above Average group having the highest average score on the Dominance scale and the Average and Below Average groups following with distinctly lower average scores.
### TABLE 14

Analysis of Variance and Trend Analysis on the Dominance Scale Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model (Linear)</td>
<td>119.32</td>
<td>2</td>
<td>59.66</td>
<td>3.59</td>
<td>.03</td>
</tr>
<tr>
<td>(Residual)</td>
<td>112.31</td>
<td>1</td>
<td>112.31</td>
<td>6.76</td>
<td>.01</td>
</tr>
<tr>
<td>Error</td>
<td>7.00</td>
<td>1</td>
<td>7.00</td>
<td>.42</td>
<td>.52</td>
</tr>
<tr>
<td>Error</td>
<td>1944.29</td>
<td>117</td>
<td>16.62</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

94 percent of the variation in the scale score for the groups may be predicted from linear regression

\[ r_{\text{linear}} = .23 \]

\[ r_{\text{linear} + \text{quad.}} = .24 \]

\[ \rho \text{ intraclass} = .22 \]

\[ \sqrt{\rho \text{ intraclass}} = .47 \]
\[ x = 1.67k + 6.20 \]

FIGURE 13

Mean Dominance-Scale Scores as a Function of Three Fitness Levels
Play Scale

Table 15 shows the analysis of variance table for the Play scale with three-fitness categories as the independent variable. The model \( F = 3.02; \ df = 2, 117; \ p < .05 \) and the linear component \( F = 4.76; \ df = 1, 117; \ p < .03 \) were both significant. Seventy-nine percent of the variation in the Play scale for the groups may be predicted from linear regression. Figure 14 shows the average Play scores for the three groups plotted against group membership. The curve suggests that the Above Average and Average groups on the Play scale scored approximately the same on the average. The Below Average group appears to be distinctly different from the other two groups and had the lowest average score.

Understanding Scale

The analysis of variance on the Understanding scale with three-fitness categories as the independent variable is shown in Table 16. The model \( F = 4.77; \ df = 2, 117; \ p < .01 \) and the linear \( F = 4.05; \ df = 1, 117; \ p < .05 \) and residual components \( F = 5.49; \ df = 1, 117; \ p < .02 \) were all significant. Figure 15 shows the three groups' average Understanding scores plotted against group membership. The Below Average group had the highest average understanding score followed with distinctly lower average scores by the Above Average and Average groups.
### TABLE 15

Analysis of Variance and Trend Analysis on the Play Scale Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>53.32</td>
<td>2</td>
<td>26.66</td>
<td>3.02</td>
<td>.05</td>
</tr>
<tr>
<td>(Linear)</td>
<td>42.05</td>
<td>1</td>
<td>42.05</td>
<td>4.76</td>
<td>.03</td>
</tr>
<tr>
<td>(Residual)</td>
<td>11.27</td>
<td>1</td>
<td>11.27</td>
<td>1.28</td>
<td>.26</td>
</tr>
<tr>
<td>Error</td>
<td>1032.68</td>
<td>117</td>
<td>8.83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

79 percent of the variation in the scale score for the groups may be predicted from linear regression

\[ r_{\text{linear}} = 0.20 \]

\[ r_{\text{linear + quad.}} = 0.22 \]

\[ \rho_{\text{intraclass}} = 0.16 \]

\[ \sqrt{\rho_{\text{intraclass}}} = 0.40 \]
$X = 1.02K + 7.05$

FIGURE 14

Mean Play Scale-Scores as a Function of Three Fitness Levels
### TABLE 16

**Analysis of Variance and Trend Analysis on the Understanding Scale Based on Three Fitness Groups**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>132.05</td>
<td>2</td>
<td>66.03</td>
<td>4.77</td>
<td>.01</td>
</tr>
<tr>
<td>(Linear)</td>
<td>56.11</td>
<td>1</td>
<td>56.11</td>
<td>4.05</td>
<td>.05</td>
</tr>
<tr>
<td>(Residual)</td>
<td>75.94</td>
<td>1</td>
<td>75.94</td>
<td>5.49</td>
<td>.02</td>
</tr>
<tr>
<td>Error</td>
<td>1619.25</td>
<td>117</td>
<td>13.84</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

42 percent of the variation in the scale score for the groups may be predicted from linear regression

- $r_{linear} = .18$
- $r_{linear + quad.} = .27$
- $\rho_{intraclass} = .13$
- $\sqrt{\rho_{intraclass}} = .36$
\[ X = 1.18K + 4.99 \]

FIGURE 15
Mean Understanding-Scale Scores as a Function of Three Fitness Levels
Factor Analysis of the Personality Traits

A conceivable pattern in the results of the MANOVAs the indicators of psychological health suggested that a factor analysis could possibly provide some overall order and meaning to the information provided by the univariate results.

The primary purpose of this factor analysis was to determine whether the results of the MANOVAs could be interpreted in terms of some underlying dimensions relevant to the relationship being studied. That is, the relationship between physical fitness and the psychological profiles. The factor analysis of the total set of 21 PRF scales (the Infrequency scale was dropped for reasons previously discussed) was performed to illustrate the possible relationship between factors found in the smaller subset of PRF scales that had significant univariate results in the MANOVAs with factors found in the total set of PRF scales.

Principal axis factor analysis with iterations and Varimax (orthogonal) and Promax (nonorthogonal) rotations were performed on the PRF scales using the Statistical Analysis System computer package. (108) Two sets of the PRF scales were factor analyzed, namely, the total set of 21 scales and a subset of the 10 scales which reached significance in the univariate results included within the MANOVAs used to analyze the PRF scales. The ten scales included in this subset were the Desirability, Achievement, Dominance, Understanding, Change, Play, Affiliation, Nurturance, Order and Endurance scales.
Factor Analysis of the Total Set of 21 PRF Scales

A Scree test (18) performed on the pre-rotation eigenvalues suggested that a three factor solution would be appropriate for the total set of 21. However, to test the conceptual clarity of the various alternative solutions, two, three and four factor solutions were performed and examined. The Varimax and Promax rotated solutions were also compared for each of these three factor solutions. Only factor loadings equal to or greater than .40 were considered high enough to be included in the interpretation of the different factors.

After considering all the possibilities it was concluded that the four factor solution with a Varimax rotation provided the best solution in terms of interpretability. The factor loadings for this solution are shown in Table 17. The four factors respectively account for 16.2, 11.1, 8.1, and 9.8 percent of the total variance.

The Varimax solution has the advantage of statistical and conceptual simplicity due to its enforced statistical independence among the factors. The Promax solution has the advantage of being a more accurate reflection of "real-life" where factors are in fact correlated with each other. The interfactor correlation coefficients from the four factor solution with a Promax rotation are shown in Table 18. The correlation coefficients are fairly low with the highest reaching -.36 for the correlation between Factor 2 and Factor 4. The reasonably low interfactor correlation
TABLE 17

The Varimax Rotated Factor Pattern for the 21 PRF Scales with a Four Factor Solution

<table>
<thead>
<tr>
<th>FACTOR ONE: Goal-oriented Achiever</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>.75 Endurance</td>
<td>.68 Achievement</td>
</tr>
<tr>
<td>.61 Desirability</td>
<td>.61 Dominance</td>
</tr>
<tr>
<td>.57 Cognitive Structure</td>
<td>.54 Understanding</td>
</tr>
<tr>
<td>.42 Order</td>
<td>-.65 Impulsivity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FACTOR TWO: Sociable Extravert</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>.70 Affiliation</td>
<td>.70 Play</td>
</tr>
<tr>
<td>.58 Exhibition</td>
<td>.53 Change</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FACTOR THREE: Independent Loner</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>.73 Autonomy</td>
<td>-.42 Succorance</td>
</tr>
<tr>
<td>-.62 Social Recognition</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FACTOR FOUR: Self-belittler</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>.66 Abasement</td>
<td>-.51 Aggression</td>
</tr>
<tr>
<td>-.56 Harm Avoidance</td>
<td>-.69 Defendence</td>
</tr>
</tbody>
</table>

The following scales failed to load on any of the above factors:

Nurturance
Sentience
TABLE 18

The Inter-factor Correlation Coefficients for the Four Factor Solution with a Promax Rotation

<table>
<thead>
<tr>
<th></th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>-.05</td>
<td>-.05</td>
<td>.23</td>
</tr>
<tr>
<td>Factor 2</td>
<td>-.12</td>
<td>-.36</td>
<td></td>
</tr>
<tr>
<td>Factor 3</td>
<td>.04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
coefficients indicate that the data would suffer little damage if the orthogonal Varimax solution was selected over the nonorthogonal Promax solution.

The four factors which resulted from the Varimax rotation have been labelled to represent the following:
1. The Goal-Oriented Achiever
2. The Sociable Extravert
3. The Independent Loner
4. The Self-Belittler

Factor Analysis of the Ten Scale Subset of the PRF Scales

A Scree test on the pre-rotation eigenvalues suggested that a two factor solution would be appropriate for the ten scale subset. However, two and three factor solutions with Varimax and Promax rotations were also performed and examined. After considering the different possibilities, the two factor solution with a Varimax rotation was selected. The factor loadings for this solution are shown in Table 19. These two factors respectively accounted for 26.2 and 17.7 percent of the total variance. The inter-factor correlation coefficient was -.13 which suggests that the two factors are in fact relatively independent.

The two factors which resulted from the Varimax rotation are quite similar to Factor One (the Goal-Oriented Achiever) and to Factor Two (the Sociable Extravert) from the four factor solution from the factor analysis of the total set of 21 PRF scales.
TABLE 19
The Varimax Rotated Factor Pattern for the 10 PRF Scale Subset with a Two Factor Solution

<table>
<thead>
<tr>
<th>FACTOR ONE: Goal-oriented Achiever</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>.80  Endurance</td>
<td></td>
</tr>
<tr>
<td>.74  Achievement</td>
<td></td>
</tr>
<tr>
<td>.68  Dominance</td>
<td></td>
</tr>
<tr>
<td>.62  Understanding</td>
<td></td>
</tr>
<tr>
<td>.57  Desirability</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FACTOR TWO: Sociable Extravert</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>.81  Affiliation</td>
<td></td>
</tr>
<tr>
<td>.70  Play</td>
<td></td>
</tr>
<tr>
<td>.49  Change</td>
<td></td>
</tr>
<tr>
<td>.44  Nurturance</td>
<td></td>
</tr>
</tbody>
</table>

The Order Scale failed to load on either scale.
Summary

The analysis of variance and trend analysis on the 21 scales of Jackson's PRF using both six and three-fitness groups as the independent variable are presented on the following Summary Chart.

Summary Chart on Jacksons' PRF Scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Percent of the variation in the scale score for the groups which may be predicted from linear regression</th>
<th>Comments on the average scores of the groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement</td>
<td>76%</td>
<td>The more fit group obtained the higher average score.</td>
</tr>
<tr>
<td>Desirability</td>
<td>75%</td>
<td>The more fit group obtained the higher average score.</td>
</tr>
<tr>
<td>Nurturance</td>
<td>71%</td>
<td>Demonstrates a trend toward a higher order polynomial - the Average and Above Average groups have similar high scores.</td>
</tr>
<tr>
<td>Change</td>
<td>59%</td>
<td>Moderately Unfit scores are higher than would be expected with linear equation. A curve of a higher order than quadratic may provide the best fit to the data.</td>
</tr>
<tr>
<td>Dominance</td>
<td>-</td>
<td>All 3 groups' average scores follow approximately a straight line.</td>
</tr>
<tr>
<td>Play</td>
<td>-</td>
<td>The Average and Above Average groups scored similarly high.</td>
</tr>
<tr>
<td>Affiliation</td>
<td>40%</td>
<td>Moderately Fit and Unfit scored higher than would be expected from a linear equation.</td>
</tr>
<tr>
<td>Affiliation</td>
<td>52%</td>
<td>The Below Average group scored the highest with the Average and Above Average groups considerably lower.</td>
</tr>
<tr>
<td>Understanding</td>
<td>-</td>
<td>Very Good, Moderately Fit and Very Poor groups scored high. The other 3 groups scored lower.</td>
</tr>
<tr>
<td>Endurance</td>
<td>-</td>
<td>The Good group's average scale score is considerably lower than all 5 groups.</td>
</tr>
<tr>
<td>Order</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- Linear regression
- Residual analysis
- Six-Fitness Categories
- Three-Fitness Categories
Mental Health Profiles

The mental health profile is provided by performing a one-way MANOVA on the five scales of Lanyon's PSI. Two separate analysis were performed on both the original six-category fitness grouping and the recoded three-category fitness grouping. Using Wilk's Lambda, the omnibus F-tests for the six-fitness categories ($F = 1.79; df = 25, 410; p < .01$) and the three-fitness categories ($F = 3.44; df = 10, 226; p < .0003$) were both significant but there were differences between the two analysis when the univariate results were compared.

The means and standard deviations for, and inter-correlations among the five PSI scales and the six-fitness group membership variable are provided in Table 20. In the one-way MANOVA with six-fitness categories the Discomfort scale had a significant univariate F-test and a significant linear component. In the one-way MANOVA with three-fitness categories the Discomfort and Social Nonconformity scales had significant univariate F-tests for the model and a significant linear component. The Alienation and Expression scales had significant univariate F-tests for the model and a significant residual component. These scales will be discussed more fully below.
TABLE 20

The Means and Standard Deviation for, and the Intercorrelations among, the Five PSI Scales and the Six Fitness Groups

<table>
<thead>
<tr>
<th></th>
<th>Al</th>
<th>Sn</th>
<th>Di</th>
<th>Ex</th>
<th>De</th>
<th>Grp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al</td>
<td></td>
<td>.48**</td>
<td>.51**</td>
<td>.07</td>
<td>-.09</td>
<td>-.11</td>
</tr>
<tr>
<td>Sn</td>
<td>.40**</td>
<td></td>
<td>.28**</td>
<td>-.32**</td>
<td>-.22**</td>
<td></td>
</tr>
<tr>
<td>Di</td>
<td></td>
<td></td>
<td></td>
<td>-.07</td>
<td>-.28**</td>
<td>-.28**</td>
</tr>
<tr>
<td>Ex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.12</td>
<td>.06</td>
</tr>
<tr>
<td>De</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.00</td>
</tr>
</tbody>
</table>

Mean 6.98   6.76   9.71   13.38   11.11   3.5
S.D. 3.13   3.60   5.20   4.88   2.57   1.71

* P < .05
** P < .01

Al = Alienation
Sn = Social Nonconformity
Di = Discomfort
Ex = Expression
De = Defensiveness
Grp = Six Fitness Group
Discomfort Scale

The analysis of variance on the Discomfort scale with six-fitness categories as the independent variable is shown in Table 21. The model \( F = 3.02; \ df = 5, 114; \ p < .01 \) and the linear component \( F = 9.88; \ df = 1, 114; \ p < .002 \) were both significant. Sixty-five percent of the variation in the Discomfort scores for the groups could be predicted from linear regression. Inspection of the average scale scores for the groups plotted against group membership Figure 16 suggest that Group Six (Very Good) and Group Two (Poor) deviate the strongest from a linear trend. Group Six and Group Two seem to accentuate the linear relation of good fitness with low average Discomfort scores.

Table 22 shows the analysis of variance on the Discomfort scale with three-fitness categories as the independent variable. The model \( F = 4.86; \ df = 2, 117; \ p < .009 \) and the linear component \( F = 9.65; \ df = 1, 117; \ p < .002 \) were both significant. Ninety-nine percent of the variation in the Discomfort scores could be predicted from linear regression. Figure 17 confirms the almost perfect linear relationship between the average scale scores for the groups and group membership. The more fit the group, the lower the average score on the Discomfort scale.
### TABLE 21

Analysis of Variance and Trend Analysis on the Discomfort Scale Based on Six Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>376.54</td>
<td>5</td>
<td>75.31</td>
<td>3.02</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>(Linear)</td>
<td>246.12</td>
<td>1</td>
<td>246.12</td>
<td>9.88</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>(Quadratic)</td>
<td>66.40</td>
<td>1</td>
<td>66.40</td>
<td>2.67</td>
<td>.10</td>
<td></td>
</tr>
<tr>
<td>(Residual)</td>
<td>64.02</td>
<td>3</td>
<td>21.34</td>
<td>.66</td>
<td>.46</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>2840.25</td>
<td>114</td>
<td>24.91</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

65 percent of the variation in the scale score for the groups may be predicted from linear regression

\[ r_{\text{linear}} = .28 \]

\[ r_{\text{linear + quad.}} = .31 \]

\[ \rho_{\text{intraclass}} = .31 \]

\[ \sqrt{\rho_{\text{intraclass}}} = .57 \]
Discomfort Scores (Means)

\[ X = 0.84K + 6.77 \]

![Graph showing mean discomfort-scale scores as a function of six fitness levels.](image)

**FIGURE 16**

Mean Discomfort-Scale Scores as a Function of Six Fitness Levels
TABLE 22

Analysis of Variance and Trend Analysis on the Discomfort Scale Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>246.67</td>
<td>2</td>
<td>123.33</td>
<td>4.86</td>
<td>.009</td>
</tr>
<tr>
<td>(Linear)</td>
<td>245.00</td>
<td>1</td>
<td>245.00</td>
<td>9.65</td>
<td>.002</td>
</tr>
<tr>
<td>(Residual)</td>
<td>1.67</td>
<td>1</td>
<td>1.67</td>
<td>.07</td>
<td>.80</td>
</tr>
<tr>
<td>Error</td>
<td>2970.13</td>
<td>117</td>
<td>25.39</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

99 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .27$
$r_{linear + quad.} = .28$
$p_{intracl} = .30$
$\sqrt{p_{intracl}} = .55$
FIGURE 17

Mean Discomfort-Scale Scores as a Function of Three Fitness Levels

\[ X = 2.47K + 4.77 \]
Social Nonconformity Scale

The analysis of variance on the Social Nonconformity Scale with three-fitness categories as the independent variable is shown on Table 23. The model \( (F = 5.01; df = 2, 117; p < .008) \) and the linear component \( (F = 7.43; df = 1, 117; p < .007) \) were both significant. Seventy-four percent of the variation in the Social Nonconformity scores for the groups could be predicted from linear regression. Comparison of the linear \( (r = .24) \) and the linear and quadratic \( (r = .28) \) correlations between group membership and the scale scores and inspection of Figure 18 suggest that a higher-order component, though not significant, is involved to some extent. The average scale scores for the Above Average and Average groups were at approximately the same level but the average scale score for the Below Average group was considerably higher.

Alienation Scale

The analysis of variance on the Alienation scale with three-fitness categories as the independent variable is shown in Table 24. The model \( (F = 3.87; df = 2, 117; p < .02) \) and the residual component \( (F = 5.81; df = 1, 117; p < .02) \) were both significant. Comparing the linear \( (r = .12) \) and the linear and quadratic \( (r = .30) \) correlations between group membership and the scale score, and inspection of Figure 19, suggest the influence of a
TABLE 23

Analysis of Variance and Trend Analysis on the Social Nonconformity Scale Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>P-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>121.85</td>
<td>2</td>
<td>60.93</td>
<td>5.01</td>
<td>.008</td>
</tr>
<tr>
<td>(Linear)</td>
<td>90.31</td>
<td>1</td>
<td>90.31</td>
<td>7.43</td>
<td>.007</td>
</tr>
<tr>
<td>(Residual)</td>
<td>31.54</td>
<td>1</td>
<td>31.54</td>
<td>2.59</td>
<td>.11</td>
</tr>
<tr>
<td>Error</td>
<td>1422.65</td>
<td>117</td>
<td>12.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

74 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .24$

$r_{linear + quad.} = .28$

$\rho_{intraclass} = .24$

$\sqrt{\rho_{intraclass}} = .50$
X = 1.50K + 3.76

FIGURE 18

Mean Social Nonconformity-Scale Scores as a Function of Three Fitness Levels
TABLE 24

Analysis of Variance and Trend Analysis on the Alienation Scale Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>72.20</td>
<td>2</td>
<td>36.10</td>
<td>3.87</td>
<td>.02</td>
</tr>
<tr>
<td>(Linear)</td>
<td>18.05</td>
<td>1</td>
<td>18.05</td>
<td>1.94</td>
<td>.17</td>
</tr>
<tr>
<td>(Residual)</td>
<td>54.15</td>
<td>1</td>
<td>54.15</td>
<td>5.81</td>
<td>.02</td>
</tr>
<tr>
<td>Error</td>
<td>1090.73</td>
<td>117</td>
<td>9.32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

25 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .12$

$r_{linear + quad.} = .30$

$p_{intraclass} = .05$

$\sqrt{p_{intraclass}} = .22$
Alienation Scores (Means)

\[ X = 0.67K + 5.64 \]

FIGURE 19

Mean Alienation-Scale Scores as a Function of Three Fitness Levels
higher-order component. The Below Average group had the highest average score on the Alienation scale, followed by the Above Average group, with the Average group having the lowest average scale score.

Expression Scale

The analysis of variance on the Expression scale with three-fitness categories as the independent variable is shown in Table 25. The model ($F = 4.63; \, df = 2, 117; \, p < .01$) and the residual component ($F = 9.00; \, df = 1, 117; \, p < .003$) were both significant. Comparing the linear ($r = .05$) and the linear and quadratic ($r = .27$) correlations between group membership and the scale scores and inspection of Figure 20 suggests a non-linear relationship similar to that displayed by the Alienation scale in Figure 19. The Above Average group had the highest average score on the Expression scale, followed closely by the Below Average group, with the Average group having a distinctly lower average scale score.

Summary

The analysis of variance and trend analysis on the 5 scales of Lanyon's PSI using both six and three-fitness groups as the independent variable are presented on the following Summary Chart.
higher-order component. The Below Average group had the highest average score on the Alienation scale, followed by the Above Average group, with the Average group having the lowest average scale score.

Expression Scale

The analysis of variance on the Expression scale with three-fitness categories as the independent variable is shown in Table 25. The model ($F = 4.63;\ df = 2,\ 117;\ p < .01$) and the residual component ($F = 9.00;\ df = 1,\ 117;\ p < .003$) were both significant. Comparing the linear ($r = .05$) and the linear and quadratic ($r = .27$) correlations between group membership and the scale scores and inspection of Figure 20 suggests a non-linear relationship similar to that displayed by the Alienation scale in Figure 19. The Above Average group had the highest average score on the Expression scale, followed closely by the Below Average group, with the Average group having a distinctly lower average scale score.

Summary

The analysis of variance and trend analysis on the 5 scales of Lanyon's PSI using both six and three-fitness groups as the independent variable are presented on the following Summary Chart.
TABLE 25

Analysis of Variance and Trend Analysis on the Expression Scale Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>207.72</td>
<td>2</td>
<td>103.86</td>
<td>4.63</td>
<td>.01</td>
</tr>
<tr>
<td>(Linear)</td>
<td>6.05</td>
<td>1</td>
<td>6.05</td>
<td>.27</td>
<td>.60</td>
</tr>
<tr>
<td>(Residual)</td>
<td>201.67</td>
<td>1</td>
<td>201.67</td>
<td>9.00</td>
<td>.003</td>
</tr>
<tr>
<td>Error</td>
<td>2622.65</td>
<td>117</td>
<td>22.42</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

0.03 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .05$

$r_{linear + quad.} = .27$

$\rho_{intraclass} = -.04$

$\sqrt{\rho_{intraclass}} = .2$
$X = 0.39K + 12.60$

Mean Expression-Scale Scores as a Function of Three Fitness Levels
A relationship was found to exist between group membership and the following scales. Significance was reached on the univariate F-test and the following components:

<table>
<thead>
<tr>
<th>Scale</th>
<th>Percent of variation in the scale score for the groups which may be predicted from linear regression</th>
<th>Comments on the average scores of the groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discomfort</td>
<td>-linear 65% 99%</td>
<td>The Very Good and Poor groups deviate strongest from the linear trend which accentuates the linear relationship of good fitness with low Discomfort scores.</td>
</tr>
<tr>
<td>Social Non-Conformity</td>
<td>-linear</td>
<td>The Average and Above Average groups were similarly low and the Below Average group was considerably higher which suggests that a higher order component, though not significant, may be involved.</td>
</tr>
<tr>
<td>Alienation</td>
<td>-residual (using 3-fitness groups)</td>
<td>The Below Average group had the highest average score followed by the Above Average and Average groups which suggests the influence of a high-order component.</td>
</tr>
<tr>
<td>Expression</td>
<td>-residual (using 3-fitness groups)</td>
<td>The Above Average group had the highest score followed closely by the Below Average group with the Average group being distinctly below which suggests the influence of a high-order component.</td>
</tr>
</tbody>
</table>
Limiting the sample to female university students in their early twenties appears to have produced a homogeneous sample in terms of life style factors, physical status variables, high risk factors and personal and/or family history disease. Many of these variables were restricted from further analysis because there was little or no variation among the responses.

Frequency Distributions of the Responses

The women in this sample ranged in age from 18 to 25 years old with a mean of 21 and a standard deviation of 1.87. One hundred and four of the women were single, 14 were married and 2 were divorced.

Twenty percent of the sample smoked, 11 percent were ex-smokers and 69 percent had never smoked. Seventy-three percent of the sample drank alcoholic beverages, 6 percent were ex-drinkers and 21 percent were non-drinkers. Less than 35 percent of the sample used their seat belt less than 75 percent of the time.

Twenty-three percent of the sample began regular sexual intercourse in their teen years, 33 percent began regular intercourse between the ages of 20 and 25 years old and 44 have never had regular intercourse. Fifty percent of the sample have never had a pap smear, 18 percent have had one pap smear more than a year ago but less than five years ago, 21 percent have had a pap smear within the last year
and 11 percent have had three or more pap smears within the past five years. Three percent of the sample reported having a mother or sister that had breast cancer and 38 percent of the sample reported having monthly breast self-examinations.

Eight percent of the sample reported that one of their parents died of a heart attack before the age of 60. Fourteen percent of the sample reported a history of diabetes in the immediate family and eight percent reported having diabetes themselves. Less than three percent of the respondents reported having had chronic bronchitis and/or emphysema.

Ninety-three percent of the sample reported that they seldom or never suffered from disabling depression, while seven percent reported that they often did. Only one respondent reported that a member of her immediate family had died by suicide.

Two-way Frequency Tables for the Three-Fitness Groups

Two-way frequency tables were established by "collapsing" the possible response categories. For instance, the six-fitness groups were collapsed into three groups of Above Average, Average and Below Average. Collapsing of the response categories was necessary because of the homogenous response patterns displayed on many of the items. That is, the original coding resulted in too many small or missing cells in the contingency tables. The tables will be discussed below.
Smoking Behaviour

A two-way contingency table for the three-fitness levels against smoking behaviour is shown in Table 26. This relationship produced a significant chi-square test statistic \( \chi^2 = 8.23; \text{ df} = 2; p < .02 \) for the likelihood ratio test. The frequency distribution indicates that the more fit the individuals, the less likely they are to report that they smoke.

Drinking Behaviour

A two-way contingency table for the three-fitness levels against drinking behaviour is shown in Table 27. This relationship also produced a significant chi-square test statistic \( \chi^2 = 11.05; \text{ df} = 2; p < .004 \) for the likelihood ratio test. Similar to smoking behaviour, the more fit the individuals, the less likely they are to report that they drink alcoholic beverages.

The relationship between the three-fitness levels and the other variables included on the Canadian Health Hazard Appraisal were also tested. It was found that they either failed to reach statistical significance or that they had too many empty cells (even after collapsing the response categories) to be of any significant interpretive value.

Selected Age Variables

Selected age variables derived from information on the Canadian Health Hazard Appraisal scale were included in two
TABLE 26

Two-Way Contingency Table for the Three-Fitness Levels Against Smoking Behaviour

<table>
<thead>
<tr>
<th></th>
<th>Below Average</th>
<th>Average</th>
<th>Above Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smokers</td>
<td>14</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Non- and ex-smokers</td>
<td>26</td>
<td>35</td>
<td>34</td>
</tr>
</tbody>
</table>

$x^2 = 8.234$
TABLE 27

Two-Way Contingency Table for the Three-Fitness Levels Against Drinking Behaviour

<table>
<thead>
<tr>
<th></th>
<th>Below Average</th>
<th>Average</th>
<th>Above Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinkers</td>
<td>36</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>Non- and ex-drinkers</td>
<td>3</td>
<td>15</td>
<td>13</td>
</tr>
</tbody>
</table>

$x^2 = 11.045$
separate one-way MANOVAs with the three and six-category fitness groups. These age variables included the subject's age, the subject's appraised age, the sum of the subject's appraised age scores and the sum of the achievable age scores. The means and standard deviations for, and the intercorrelations among, the selected age variables and the six-fitness groups is shown in Table 28.

Using Wilks Lambda, the omnibus F-tests for the six-fitness categories ($F = 2.23; df = 20, 369; p < .002$) and the three-fitness categories ($F = 4.76; df = 8, 228; p < .0001$) were both statistically significant. When the six-fitness categories were considered, only the subject's age had a significant univariate F-test and a significant linear component. When the three-fitness categories were considered the subjects' age, the subjects' appraised age and the sum of the subjects' achievable age scores had significant univariate F-tests and significant linear components. These results will be discussed more fully below.

Subjects' Age

The analysis of variance on the subjects' age with six-fitness categories as the independent variable is shown in Table 29. The model ($F = 5.77; df = 5, 114; p < .0001$) and the linear component ($F = 22.30; df = 1, 114; p < .0001$) were both significant. Seventy-seven percent of the variation in the subjects' age for the groups may be predicted
TABLE 28

The Means and Standard Deviations for, and the Intercorrelations among, the Age Variables and the Six Fitness Groups

<table>
<thead>
<tr>
<th></th>
<th>HHA4</th>
<th>AGEAP</th>
<th>THAP</th>
<th>THAC</th>
<th>GRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>HHA4</td>
<td></td>
<td>.54**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGEAP</td>
<td></td>
<td>.62**</td>
<td>.29**</td>
<td></td>
<td>-.23**</td>
</tr>
<tr>
<td>THAP</td>
<td></td>
<td></td>
<td>.56**</td>
<td></td>
<td>-.17</td>
</tr>
<tr>
<td>THAC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.25**</td>
</tr>
</tbody>
</table>

Mean  21.06  15.37  11.40  10.68  3.5
S.D.  1.87   5.09  1.90   1.13   1.71

* $p < .05$
** $p < .01$

HHA4  = Subject's Age
AGEAP = Subject's Appraised Age
THAP  = Sum of the subject's Appraised Age Scores
THAC  = Sum of the Subject's Achievable Age Scores
GRP   = Six Fitness Groups
Analysis of Variance and Trend Analysis on the Subject's Age Based on Six Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>83.74</td>
<td>5</td>
<td>16.75</td>
<td>5.77</td>
<td>.0001</td>
</tr>
<tr>
<td>(Linear)</td>
<td>64.72</td>
<td>1</td>
<td>64.72</td>
<td>22.30</td>
<td>.0001</td>
</tr>
<tr>
<td>(Quadratic)</td>
<td>1.15</td>
<td>1</td>
<td>1.15</td>
<td>.40</td>
<td>.53</td>
</tr>
<tr>
<td>(Residual)</td>
<td>17.87</td>
<td>3</td>
<td>5.96</td>
<td>2.05</td>
<td>.11</td>
</tr>
<tr>
<td>Error</td>
<td>330.85</td>
<td>114</td>
<td>2.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

77 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .40$
$r_{linear + quad.} = .40$
$p_{intraclass} = .52$
$\sqrt{p_{intraclass}} = .72$
from linear regression. Figure 21 shows the average age for each of the six groups plotted against group membership. Generally, the less fit the group the higher the average age of that group.

The analysis of variance on the subjects' age with three-fitness categories as the independent variable is shown in Table 30. The model \( F = 12.35; \text{df} = 2, 117; p < .0001 \) and the linear component \( F = 24.68; \text{df} = 1, 117; p < .0001 \) were both significant. Inspection of Figure 22 shows a perfect linear relationship. The older the subject, the less fit on the average.

**Subjects' Appraised Age**

The analysis of variance on the subjects' appraised age with three-fitness groups as the independent variable is shown in Table 31. The model \( F = 3.39; \text{df} = 2, 117; p < .04 \) and the linear component \( F = 6.64; \text{df} = 1, 117; p < .01 \) were both significant. Ninety-eight percent of the variation in the appraised ages may be predicted from linear regression. Figure 23 shows the strong linear relationship. The more fit the group, the lower the average appraised age for the group.

**Subjects' Achievable Age**

The analysis of variance on the sum of the subjects' achievable age scores with three-fitness groups as the independent variable is shown in Table 32. The model \( F = 4.05; \text{df} = 2, 117; p < .02 \) and the linear component
$X = 0.43K + 19.55$

**FIGURE 21**

Mean Age Scores as a Function of Six Fitness Levels
### TABLE 30

Analysis of Variance and Trend Analysis on the Subject's Age Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>72.27</td>
<td>2</td>
<td>36.13</td>
<td>12.35</td>
<td>.0001</td>
</tr>
<tr>
<td>(Linear)</td>
<td>72.20</td>
<td>1</td>
<td>72.20</td>
<td>24.68</td>
<td>.0001</td>
</tr>
<tr>
<td>(Residual)</td>
<td>.07</td>
<td>1</td>
<td>.07</td>
<td>.02</td>
<td>.89</td>
</tr>
<tr>
<td>Error</td>
<td>342.33</td>
<td>117</td>
<td>2.93</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

100 percent of the variation in the scale score for the groups may be predicted from linear regression

\[ r_{\text{linear}} = .42 \]

\[ r_{\text{linear} + \text{quad.}} = .42 \]

\[ \rho_{\text{intra class}} = .54 \]

\[ \sqrt{\rho_{\text{intra class}}} = .73 \]
X = 1.34K + 18.38

Mean Age Scores as a Function of Three Fitness Levels
TABLE 31

Analysis of Variance and Trend Analysis on the Subject's Appraised Age Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>168.82</td>
<td>2</td>
<td>84.41</td>
<td>3.39</td>
<td>.04</td>
</tr>
<tr>
<td>(Linear)</td>
<td>165.31</td>
<td>1</td>
<td>165.31</td>
<td>6.64</td>
<td>.01</td>
</tr>
<tr>
<td>(Residual)</td>
<td>3.50</td>
<td>1</td>
<td>3.50</td>
<td>.14</td>
<td>.71</td>
</tr>
<tr>
<td>Error</td>
<td>2911.05</td>
<td>117</td>
<td>24.88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

98 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{linear} = .23$

$r_{linear + quad.} = .23$

$\rho_{intraclass} = .22$

$\sqrt{\rho_{intraclass}} = .47$
FIGURE 23

Mean Appraised Age Scores as a Function of Three Fitness Levels

\[ X = 2.03K + 11.31 \]
TABLE 32

Analysis of Variance and Trend Analysis on the Sum of the Subject's Achievable Age Based on Three Fitness Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>9.89</td>
<td>2</td>
<td>4.94</td>
<td>4.05</td>
<td>.02</td>
</tr>
<tr>
<td>(Linear)</td>
<td>9.66</td>
<td>1</td>
<td>9.66</td>
<td>7.92</td>
<td>.006</td>
</tr>
<tr>
<td>(Residual)</td>
<td>.23</td>
<td>1</td>
<td>.23</td>
<td>.19</td>
<td>.67</td>
</tr>
<tr>
<td>Error</td>
<td>142.79</td>
<td>117</td>
<td>1.22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

98 percent of the variation in the scale score for the groups may be predicted from linear regression

$r_{\text{linear}} = .25$

$r_{\text{linear} + \text{quad.}} = .25$

$\rho_{\text{intraclass}} = .42$

$\sqrt{\rho_{\text{intraclass}}} = .65$
\( F = 7.92; \text{df} = 1, 117; p < .006 \) were both significant. Ninety-eight percent of the variation in the sum of the achievable age scores may be predicted from linear regression. Figure 24 indicates that the more fit the group, the higher the average total achievable age score for the group.

Summary

The analysis of variance and trend analysis on the selected age variables of the Canadian Health Hazard Appraisal using both six and three-fitness groups as the independent variable are presented on the following Summary Chart.

### Summary Chart on Age Variables of the Canadian Health Hazard Appraisal

<table>
<thead>
<tr>
<th>A relationship was found to exist between group membership and the following scales</th>
<th>Percent of the variation in the scale scores for the groups which may be predicted from linear regression</th>
<th>Comments on the average scores of the groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significance was reached on the univariate F-test and the following components:</td>
<td>The independent variable was the use of:</td>
<td></td>
</tr>
<tr>
<td>Six-Fitness Categories</td>
<td>Three-Fitness Categories</td>
<td></td>
</tr>
<tr>
<td>Age - linear</td>
<td>77%</td>
<td>100%</td>
</tr>
<tr>
<td>Appraised Age - linear</td>
<td>-</td>
<td>98%</td>
</tr>
<tr>
<td>Achievable Age - linear</td>
<td>-</td>
<td>98%</td>
</tr>
</tbody>
</table>
FIGURE 24
Mean Sum of the Achievable Age Scores as a Function of Three Fitness Levels

$$X = .49K + 9.70$$
Summary of the Presentation and Analysis of the Data

The analysis concerned itself with a description of the relationship between physical fitness and three sets of variables, namely, personality, mental health and health hazard appraisal profiles. One-way MANOVAs and Trend analysis were performed on the three sets of variables.

The analysis was performed on both the original six-category fitness grouping (Very Poor, Poor, Moderately Unfit, Moderately Fit, Good and Very Good) and a recoded three-category fitness group (Below Average, Average and Above Average). The three-fitness categories as the independent variable was a cruder measure of physical fitness and smaller differences between the fitness groups were more likely to produce a significant effect compared to the independent variable with six-fitness levels.

The relationship between physical fitness and personality was examined by performing a one-way MANOVA on the 21 scales of Jackson's PRF. In the MANOVA with the six-fitness categories the Achievement, Affiliation, Change, Nurturance, and Desirability scales had significant univariate F-tests for the models and significant linear components. The Endurance scale had a significant F-test for the model and a significant quadratic component. The Order scale had a significant F-test for the model but neither the linear or the quadratic component reached statistical significance. The residual effect however was significant.
In the MANOVA with the three-fitness categories the Achievement, Change, Dominance, Play and Desirability scales had significant univariate F-tests for the models and significant linear components. The Affiliation, Nurturance and Understanding scores had significant univariate F-tests for the models and significant linear and univariate components.

The results of the MANOVAs on the indicators of psychological health suggested that a factor analysis could provide some overall order and meaning to the information provided by the univariate results. Two sets of the PRF scales were factor analyzed namely, the total set of 21 scales and a subset of only the 10 scales which reached significance in the MANOVAs used to analyze the PRF scales.

The four independent factors which resulted from the factor analysis on the 21 PRF scales have been labelled the Goal-Oriented Achiever, the Sociable Extravert, the Independent Loner and the Self-Belittler. The two factors which resulted from the factor analysis on the 10 PRF scales were quite similar to the Goal-Oriented Achiever and the Sociable Extravert.

The relationship between physical fitness and mental health was examined by performing one-way MANOVAs on the five scales of Lanyon's PSI. In the one-way MANOVA with six-fitness categories the Discomfort scale had a significant univariate F-test for the model and a significant linear component. In the one-way MANOVA with three-fitness categories the Discomfort and Social Noncomformity
scales had significant univariate F-tests for the models and a significant linear component. The Alienation and Expression scales had significant univariate F-tests and a significant residual component.

The relationship between physical fitness and the items included on the health hazard questionnaire was examined by performing one-way MANOVAs on the life style factors, physical status variables, high risk factors and personal and/or family history of disease items on the Canadian Health Hazard Appraisal. Limiting the sample to female university students in their early twenties produced a homogeneous sample in terms of the above factors and therefore many of these variables were restricted from further analysis because there was little or no variation among the responses.

Two-way frequency tables were established by collapsing the possible response categories from six-fitness groups to three-fitness groups. The frequency distribution indicates that the more fit individuals are less likely to report that they either smoke or drink alcoholic beverages.

The relationship between the three-fitness levels and the other variables included on the Canadian Health Hazard Appraisal were also tested. It was found that they either failed to reach statistical significance or that they had too many small or empty cells to be of any significant interpretive value.
Selected age variables derived from information on the Canadian Health Hazard Appraisal scale were included in two separate one-way MANOVA's with the three and six-category fitness groups. These age variables included the subject's actual age, the subject's appraised age, the sum of the subject's appraised age scores and the sum of the achievable age scores. When the six-fitness categories were considered, only the subject's age had a significant univariate F-test for the model and a significant linear component. When the three-fitness categories were considered, the subjects' age, the subjects' appraised age and the sum of the subjects' achievable age scores had significant univariate F-tests for the models and significant linear components.

The presentation of the data lends itself to further discussion with regard to the relationship between physical fitness and the health status of the college women in this sample.
CHAPTER V

DISCUSSION OF THE DATA

The purpose of this study is to investigate the relationship between the physical fitness levels of six groups of selected Canadian college women and the psychological, mental health and health hazard appraisal profiles of each group.

Sample

The sample was restricted to female college students, between the ages of 18 and 25, who were enrolled at York University in Toronto, Ontario, Canada during the time from January 21, 1980 to June 11, 1980. The sample consisted of 120 women. The age range and sex of the sample are limitations of the study both in terms of generalizability of the findings and because the homogeneity of the sample should have lessened the chances of obtaining significant results. However, because the analysis of the data did yield significant results despite this homogeneity the relationships examined in this study are probably quite strong and general to the public.

Physical Fitness Categories

Preliminary pilot studies by the investigator with students enrolled in recreation and activity classes
demonstrated that undergraduate college women were interested in being evaluated relative to their physical fitness status.

During the fitness evaluation phase of this study, it became evident that the Good, Moderately Fit and Moderately Unfit categories were the most common classifications. The Very Good category was the next largest pool while the Poor and Very Poor categories did not reach the original goal of a minimum of 50 persons per group. The final breakdown was as follows: Very Good = 42; Good = 69; Moderately Fit = 78; Moderately Unfit = 50; Poor = 37; Very Poor = 30 for a total of 306. Twenty subjects were drawn from each pool (N=120) to participate in this study.

If physical fitness is viewed as a crucial part of total health, the number breakdown in itself would suggest that more undergraduate college women between the ages of 18 and 25 enrolled at York University are inclined to participate in positive health behaviour based on physical fitness alone.

It must be remembered that cause-and-effect cannot be inferred from these findings as the levels of fitness were not experimentally manipulated and the subjects were assigned to their respective groups on the basis of a naturally occurring attribution rather than on the basis of a random assignment. In other words, it is possible that level of physical fitness determines the psychological profile or that having this profile determines levels of physical fitness or that any relationship that exists between the two
is actually caused indirectly (a spurious relationship) by a third variable for example socio-economic status.

To examine the relationship between physical fitness and health status the nature of different health components such as physical, mental and social well-being as well as a number of life style and high risk factors was investigated.

Physical Fitness and Psychological Profiles

North American society has placed certain premiums on a variety of personality traits and behaviours. By condoning or approving specific traits or behaviours, the labels of "good", "acceptable" or "permissible" become conspicuous in given environments. Positive assimilation leads to a homeostatic state of psychological comfort.

The literature has shown that behaviour and personality traits which are commonly sanctioned and condoned for the male in our society are: aggression, dominance drive, tough-mindedness, confidence, lack of anxiety, emotional stability, conscientiousness, controlled self-discipline, self-assurance, trusting, low tension levels, ambition, organization, deference, endurance, determination, persistence, durability, artistic creativity, social confidence, self-confidence, less compulsiveness, energy, enthusiasm, leadership tendencies, optimism, relaxedness.
Males engaged in different competitive and leisure activities, have demonstrated the above personality traits and behaviours. (23,49,63,83,85,89,100,114)

When these traits are sanctioned by modern society, the persons exhibiting them will be more successfully assimilated into that society. Such individuals will receive positive reinforcement and, therefore, exist in an environment which perpetuates positive psychological health.

The literature does not yield a clearcut personality profile of the females who participate in physical activity. (88) However, there is sufficient data to suggest that a profile, similar to that of the male, does exist for women. (64,90) If such traits as aggression, dominance, stamina, risk taking (69) and intelligence, self-sufficiency and control (88) are desired, sanctioned and condoned for women in today's society then women who possess these traits should consequently experience successful assimilation and display emotional stability and positive psychological health within their environment.

However, Butt suggests that when judged within a traditional framework of social values "women who pursue strenuous physical activities could find themselves in a state of role conflict". (16) Aggressiveness, strength, competitiveness and independence are viewed as characteristics of the male role and women resolve the conflict by denying
themselves constructive engagement in physical activity which also denies them of "a source for the development of competence and positive ego development". (16)

The relationship between personality traits and the pursuit of varied leisure time activities has come under investigatory scrutiny. Leisure pursuits very often include physical activity which may vary considerably relative to the degree of exertion. Researchers in the area of leisure activities (48,50,75,87,118) have found that selected personality variables were significantly related to leisure activity preferences and addressed themselves to the question of cause and effect. "If participants in active leisure time activities are different on some personality traits - were they born different or did they learn to be different?"

The relationship between physical fitness and personality characteristics is strengthened by the results of this study. For instance the tendency to present a favourable picture of self, either consciously or unconsciously whether accurately or inaccurately, are positively correlated.

Although the Desirability scale is conceived of as a validity scale, it is possible, and reasonable, that the more fit the individual, the more positive her self-image. It is also possible that the unfit in particular may suffer from a negative self-image.
This tendency may be more relevant for women because society has generally placed a heavier emphasis on the female's appearance in the sense of equating it with success or failure. The need to be either assimilated into society or to enhance self-image may serve as the motivation to become fit before the pursuit of physical health in itself is considered. Either way, physical and psychological health is being accrued toward a positive total health status.

The Achievement and Dominance scales also were positively correlated with fitness. Thus, it appears that the more fit the woman the more she "aspires to accomplish difficult tasks" and "attempts to control her environment, and to influence or direct other people". If these behaviours are condoned for women, psychological health is reinforced. If they are not condoned, the ensuing emotional discomfort couples positive physical health with negative psychological health.

The Understanding scale or the desire to understand many areas of knowledge and pursue logical thought was also related to levels of fitness. The least fit group had the highest scores while the Average and Above Average groups had comparatively lower scores. This finding leads to interesting speculation. Are the pursuit of knowledge and the pursuit of physical fitness to some extent incompatible?
The three scales, Desirability, Achievement and Dominance, may be related to the individual's self-image indirectly through her confidence of success. The above scales seem to be characteristics generally associated with "achievers".

The Understanding, Order and Endurance scales also describe traits characteristic of the goal or success-oriented individual. Unfortunately, these scales did not have a clear or simple relationship with fitness. This complexity may accurately reflect reality or it may be due to sampling fluctuations. The reader is left to draw his/her own conclusions both as to the nature and the validity of the relationship.

The Poor Fitness groups differed from the Average and Above Average fitness groups on the Change and Play scale. The unfit appear to "dislike new and different experiences" and "doing things just for fun".

The Poor Fitness groups also differed from the Average and Above Average fitness groups on the Nurturance and Affiliation scales. This suggests that in addition to being non-altruistic the unfit individual also dislikes "being with friends and people in general". These two traits, and possibly the trait measured by the Play scale, may represent a second dimension running through these relationships with fitness. The second dimension appears to be more socially oriented.
To gain further insight into the possible existence of underlying dimensions, the 21 PRF scales and the 10 significant scales were subjected to factor analysis.

Scrutiny of the factor loadings in Table 17 suggests that the first factor describes someone who is ambitious, hardworking, persevering, competitive and who has set high goals for herself. She is precise, intellectually curious, logical and she dislikes ambiguity and making uninformed decisions. As well as being controlled and deliberate, organized and methodical, she can also be forceful, directive and authoritative. This individual is also concerned with presenting a favourable impression of herself.

Factor Two describes a sociable, playful woman who may be flashy and extraverted. In addition to being flexible and adaptable, she also enjoys doing things "just for fun". Factor Three represents an independent, loner who in addition to being self-sufficient and untrusting is unconcerned also with what others think of her.

Factor Four represents a self-critical, non-argumentative individual who accepts criticism easily and fails to defend herself. She is unconcerned also with the risk of bodily harm or personal safety.

The information in Table 18 suggests that the two factors that resulted from the factor analysis on the 10 PRF scales were quite similar to Factor One and Factor Two from the four factor solution that resulted from the factor analysis on the total set of 21 PRF scales. These two factors where
labelled Goal-Oriented Achiever and the Sociable Extravert.

In conclusion, physical fitness was positively related to health status in that it has the capacity to promote psychological health. Sound psychological health is characterized by a positive self image and traits of sociability.

Physical Fitness and Mental Health Profiles

It should be noted that scores of the magnitude reported in this study (see Table 20) may or may not represent "real" problems in terms of "real" life. In other words, a high score for one group in comparison to the other two groups may not mean anything other than that the groups in this study differed.

The Expression scale where high scores represent extraversion, unreliability and impulsivity was positively correlated with fitness. The most fit groups had the highest scores, followed closely by the least fit group. Extraversion is a trait which the research has suggested as being a positive characteristic relative to the male profile. (23,49,63,83,85,89,100,114)

Discomfort or the construct described as a ready susceptibility to anxiety and complaints of many psychological discomforts, difficulties and somatic symptoms was negatively correlated with fitness. The least fit generally received the highest scores which suggests that a tendency toward psychological discomfort and anxiety may exist.
Alienation or the construct which suggests the presence of problems that may warrant formal psychological intervention was negatively correlated with fitness. The least fit generally received the highest scores which suggests that a tendency toward alienation may exist.

Social Nonconformity or the construct which indicates anti-social behaviour similar to that of people who have been institutionalized was negatively correlated with fitness. The least fit generally received the highest scores which suggests that anti-social types of behaviour may be more prevalent in this group.

However, it must be noted that for the Social Nonconformity scale the Average and Above Average fit groups had similar low scores and for the Alienation scale the Average group had a lower score than the Above Average fitness group. This deviation is greater than what one would expect from a linear relationship and suggests that a higher order component may be involved to some extent.

It should be noted that although the Defensiveness scale was designed to assess the test taking attitude and "to assess the degree of defensiveness characterizing the test-takers' responses" in the sense of a "social desirability response set" or an abnormal readiness to admit undesirable characteristics, the fitness groups in this study did not differ to a statistically significant extent. This may mean that all the responses are free from this bias or conversely suffering from the bias. However, it
also suggests that differences between the groups on the other scales should not be attributed to a group difference on this dimension.

In conclusion, mental health, or ill-health in this study, does not have a simple, negative, linear relationship with physical fitness. However, on the basis of the scales used in this investigation, it appears that the least fit group is comparatively unhealthy, the average group is healthy, and the most fit group is healthy but variable.

Physical Fitness and Health Hazard Appraisal Profiles

Due to the homogeneity of the sample many variables were restricted from further analysis. Two health hazard items, smoking and drinking behaviour, had sufficient variation to be included in a two-way contingency table appropriate for chi square analysis.

The frequency distribution (see Table 26) indicates that the more fit individuals are, the less likely they are to report that they smoke. Similar to smoking behaviour, (see Table 27) the more fit individuals are, the less likely they are to report that they drink.

The results from both tables were consistent with what would be expected, i.e., that the more fit individuals are more likely to be health conscious and consequently they were more likely to be actively concerned with behaviours that would promote good health.
The age variables were the only health hazard variables which were appropriate for a multivariate analysis of variance. The results of the MANOVAs suggest that age was negatively related to fitness with the older subjects being less fit.

The Appraised Age, which was defined as the subjects' "health age" in that she is currently living the same risks as a person of that age, is negatively also related to fitness. The less fit the group, the higher the average appraised age was for that group.

The Achievable Age, which was defined as the age that a subject may achieve if certain health screening procedures and/or changes in life style are adopted, was positively related to fitness. The more fit the group, the higher the average total achievable age score was for that group.

In conclusion, physical fitness is positively related to achievable age and negatively related to age and appraised age. These findings suggest that the more fit group is younger, may live longer if certain life style changes are adopted and that their health age is lower, on the average, than the unfit groups.
CHAPTER VI

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The rationale for this investigation was based upon the lack of research on young females in relation to physical fitness and health status. It must be re-emphasized that health status, for the purposes of this study, refers to the state of physical, mental and social well-being, and therefore to examine the health status of young women, all three aspects needed to be evaluated.

Findings

The analysis of data concerned itself primarily with a description of the relationships between physical fitness and psychological, mental health and health hazard appraisal profiles. The outcome, relative to the subjects who participated in this study, are as follows.

The Relationship Between Physical Fitness and Psychological Profiles

The findings of this study are:

Physical fitness and the tendency to present a favourable picture of self (the Desirability Scale) are positively correlated.

Physical fitness and aspirations to accomplish difficult tasks (the Achievement Scale) are positively correlated.
Physical fitness and attempts to control the individual's environment and attempts to influence or direct other people (the Dominance Scale) are positively correlated.

The Desirability, Achievement and Dominance scales, which have a positive relationship with fitness, are characteristics generally associated with "achievers".

The Understanding, Order and Endurance scales which also describe traits characteristic of "achievers" did not have a clear relationship with fitness.

The unfit appear to dislike new and different experiences (the Change Scale) and doing things just for fun (the Play Scale).

The unfit appear to display non-altruistic characteristics (the Nurturance Scale) and have an apparent dislike for being with friends and people in general (the Affiliation Scale).

The Nurturance, Affiliation and Play scales may represent a second dimension which suggests that the unfit may be less sociable by nature.

The Relationship Between Physical Fitness and Mental Health Profiles

The findings of this study are:

Physical fitness and extraversion, unreliability and impulsivity (the Expression Scale) are positively correlated.
Physical fitness and psychological discomfort and anxiety (the Discomfort Scale) are negatively correlated.

Physical fitness and alienation (the Alienation Scale) are negatively correlated.

Physical fitness and anti-social types of behaviour (the Social Nonconformity Scale) are negatively correlated.

Physical fitness and an abnormal readiness to admit undesirable characteristics (on the PSI test) were not related.

The Relationship Between Physical Fitness and Health Hazard Appraisal Profiles

The findings of this study are:

Physically fit individuals are less likely to report that they smoke.

Physically fit individuals are less likely to report that they drink.

Physical fitness and age are negatively correlated.

Physical fitness and the subjects' health age (the Appraised Age) are negatively correlated.

Physical fitness and Achievable Age are positively correlated.

Conclusions

As a result of the data analysis reported in this study, the following conclusions are derived:
First, physical fitness is positively related to health status in that physical fitness promotes psychological health. Sound psychological health is characterized by a positive self-image and traits of sociability.

A second conclusion is that, based on the scales used in this investigation, the least fit group is comparatively unhealthy from a mental health point of view, while the average group is mentally healthy and the most fit group is mentally healthy but variable.

A third conclusion is that the physically fit group is more likely to subscribe to positive life style behaviours with regard to smoking and drinking practices.

A fourth conclusion is that the physically fit group is younger, is living at a lower health age and may live longer if certain life style changes are adopted.

Recommendations for Future Studies

In view of the limitations and findings of this study it is recommended that the following research be conducted:
1. Repetition of this study over five year time periods to determine longitudinal affects.
2. A similar study introducing an experimental dimension such as the involvement in selected physical fitness programmes from which cause and effect relationships may be derived.
3. Examination of an older group of women to establish whether the relationship between age and physical fitness maintains a negative relationship.

4. Examination of U.S.A. college women in order to compare whether similar relationships exist.

5. Examination of college men to determine whether similar relationships exist.

6. Further study introducing various cultural differences and the relationship between physical fitness and health status.

7. Examination of the motivational factors which influence women to participate in physical fitness programmes at the upper fitness levels, as well as investigating the rationale for not participating in physical fitness programmes at the lower fitness levels.

8. Examination of non-college populations.
BIBLIOGRAPHY


APPENDIX A: Medical Survey
January 14, 1977

Dear Doctor:

May I please solicit a few scratch marks from you? On the enclosed postage paid card would you kindly check three questions. Your reply will be kept anonymous, and is being collected simply to determine whether a sample of medical practitioners support or negate the purported relationship between physical health and physical fitness regimes.

Thank you for your time.

Sincerely

[Signature]

Marina van der Merwe
Assistant Professor

MVDM/ddr

Enclosure
1. Should the medical profession encourage the public to exercise more? Public refers to:

Patients and others? Yes No
Patients only? Yes No
Others only Yes No

2. If "Yes" to any of the above, should the medical profession recommend more exercise for the purpose of preventing cardiovascular disease? Yes No

If "No", for what purpose.................................

3. Should the medical profession advise as to which kind of exercise people should engage in? Yes No

Thank you for your co-operation!

(Optional) Name of Physician

BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in Canada

POSTAGE WILL BE PAID BY

M. van der Merwe
Tait McKenzie Building
York University
4700 Keele Street
Downsview, Ontario
M3J 1P3
APPENDIX B: Canadian Home Fitness Test
Stepping Sequence Performed on Double Eight-inch Steps to a Six Count Musical Rhythm.
PLEASE NOTE:

Copyrighted materials in this document have not been filmed at the request of the author. They are available for consultation, however, in the author's university library.

These consist of pages:

Appendices C, D, E, F, G and H.
APPENDIX C: Jackson's Personality Research Form-E
Infrequency Scale:

Ninety four percent (94%) of the sample had a score of less than 4 which was specified as acceptable by Jackson. (56:12)
APPENDIX D: Lanyon's Psychological Screening Inventory
Dear Marina:

I was delighted to hear of your research and also that your materials arrived on schedule.

Please feel free to use any of our materials for your dissertation with proper reference to the "Department of National Health and Welfare". Also, if it is not too much trouble we would very much appreciate a copy of the final report when it is available.

Best of luck in your doctoral endeavours and thank you for your continued interest in our program.

Yours very truly,

Lynn Hawkins,
Health Hazard Appraisal Officer,
Alcohol, Tobacco and
Risk Assessment Unit,
Health Promotion Directorate.

March 26, 1981.
APPENDIX F: Activity/Frequency Checklist
APPENDIX G: Summary of Major Studies on Physical Activity and Heart Disease
APPENDIX H: Risko