THE RELATIONSHIP OF BODY TYPE TO PERFORMANCE ON AN ACTIVITY TEST BATTERY AND THE PF PLAN BY FRESHMEN MEN AT MICHIGAN STATE UNIVERSITY

Thesis for the Degree of M. A.
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Michael Gail Crain

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THE RELATIONSHIP OF BODY TYPE TO PERFORMANCE ON AN ACTIVITY TEST BATTERY AND THE PF PLAN BY FRESHMEN MEN AT MICHIGAN STATE UNIVERSITY

By

Michael Gail Crain

AN ABSTRACT OF A THESIS

Submitted to
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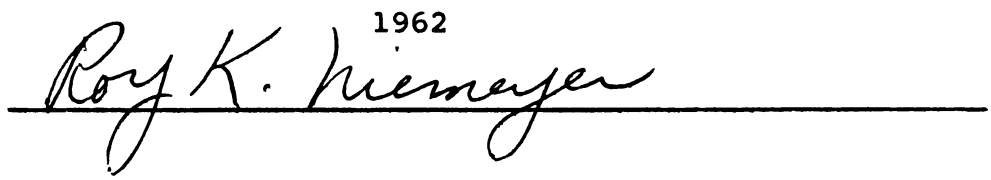
Approved 

ABSTRACT

THE RELATIONSHIP OF BODY TYPE TO PERFORMANCE ON AN ACTIVITY TEST BATTERY AND THE PF PLAN BY FRESHMEN MEN AT MICHIGAN STATE UNIVERSITY

By Michael Gail Crain

Statement of the Problem

To determine the relationship between body type and performance on the activity test battery and the PF Physical Fitness Plan by freshmen men at Michigan State University.

Methodology

At the beginning of fall term, an activity test battery, designed to measure strength, power, agility, and endurance, was given to all of the Foundations of Physical Education male students at Michigan State University. In addition, each student was body typed, using the Sheldon technique, and then placed on one of the starting charts of the PF Plan by means of percentile rankings derived from the activity tests. The PF Plan consisted of five general exercises which had to be completed during an eleven minute time period. There were twelve levels of achievement on each of the five charts which made up the plan.

Near the end of the term a questionnaire was administered to each student, asking for his activity test scores,

his body type, and his PF Plan level achievement during the first four weeks. Nineteen body type groupings were then identified to facilitate the handling of comparisons due to the large number of individual body types. The data were then punched into IBM cards for statistical tabulations and analysis. Percentile tables and profile charts for each of the body type groupings on all of the activity tests and the first four weeks of the PF Plan were derived from the data.

Conclusions

There was a definite relationship between body type and performance on the activity test battery and the PF Plan by freshmen men at Michigan State University.

Consideration should be given to body types in placing students on one of the starting charts of the PF Plan.

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ACKNOWLEDGMENT

The author wishes to express his sincere gratitude to Dr. Roy K. Niemeyer and Dr. Wayne D. Van Huss for their unfailing guidance and encouragement so often given him in this research project.

Appreciation is also extended to all the Foundation's students and instructors who were most cooperative, and to Paul Klaver of the Data Processing Department.

CHAPTER I

THE PROBLEM

Introduction to the Study

Physical fitness is a term used rather loosely by Americans to describe the physical well-being of the body. The average American sometimes falsely prides himself as having a high level of physical fitness or admits that he is too lazy to take up a vigorous exercise program designed to build up his fitness.

There is a definite need for a physical fitness plan which will bring the body up to an acceptable level of fitness and then maintain that level. At the same time the plan must not be too complicated, require long periods of exercise, or use any equipment which might be necessary for the execution of the exercises. In addition, there must be proof that the plan has worked for others. The average American will not take up a set of exercises unless he is assured that they will improve his fitness and, once he has started, he likes to be able to observe and chart his progress.

With this type of physical fitness plan many Americans could be encouraged to start building up their fitness

immediately. Others would follow as soon as they saw the results these people exhibited. However, they must understand that not everyone can achieve the same level of fitness. Differences in body size and proportion will affect performance and fitness greatly. In the world of today the American people must be strong of body as well as mind.

In the fall of 1961 the Department of Health, Physical Education, and Recreation at Michigan State University instituted the PF Plan in the required Foundations of Physical Education course. The plan was incorporated from the 5BX Plan used by the Royal Canadian Air Force. Basically, the plan consisted of five general exercises, which were done daily during an eleven minute time period. When the student completed a given number of these exercises in the allotted time period, he moved up to the next level of achievement. Not only did the number of exercises to be done in the allotted time period increase with each level, but the exercises themselves became more difficult from one chart to the next.[1]

Preceding the PF Plan was an activity test battery, which contained tests of strength, power, endurance, and

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[1] See Appendix A for a copy of the PF Plan and an explanation of the level numbering.

flexibility. The purpose of this battery was two-fold; the first being a profile chart of performance on these tests, which was used as a means of placing students on the PF Plan, and the second being a starting point of performance to be compared with later tests on the same battery to determine improvement as a result of the PF Plan.[2]

Another part of the Foundations course was the body typing of each student by the individual instructors. The method of body typing used was the one developed by Sheldon, Stevens, and Tucker[3] with some modifications made by Cureton.[4] As a result of many previous studies on the subject of body type versus performance, the Foundations instructors made a fair guess as to how well the students should have done on the activity tests, where they should have started on the PF Plan, and what level they should have eventually attained. For example, the mesomorphic body types exhibit the best all-around performance in muscular

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[2] See Olson's study on page 22 for the results of the retest on the activity test battery.

[3] W. H. Sheldon, S. S. Stevens, and W. B. Tucker, The Varieties of Human Physique. New York and London: Harper Brothers, 1940.

[4] T. K. Cureton, Physical Fitness Workbook. St. Louis: C. V. Mosby Company, 1947, pp. 103-113.

endurance activities.[5] Ectomorphs are superior to endomorphs in speed, agility, and endurance[6] and apparently endomorphy is a limiting factor in fitness.[7] Therefore, the mesomorph would be expected to perform at a higher level on the test battery and the PF Plan than either the ectomorph or the endomorph. Also, it would follow that the ectomorph should perform better than the endomorph.

If these studies are correct, then there should be a positive correlation between body type and performance on the activity tests and the PF Plan. If this is the case, then tables and charts for the test battery and for placement, improvement, and attainment on the PF Plan by body types can be set up. It was the feeling of many of the Foundations instructors that the present method of locating the starting and finishing points of students on the basis of certain test

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[5]F. L. Joranko, "The Relationship of Improvement in Mucsular Endurance To Body Types," University of Illinois Abstracts of Graduate Theses in Physical Education. Urbana, Illinois: University of Illinois, 1953, no. 12.

[6]F. D. Sills and P. W. Everett, "The Relationship of Extreme Somatotypes to Performance in Motor and Strength Tests," Research Quarterly. XXIV (May, 1953), pp. 223-228.

[7]C. E. Willgoose and M. L. Rogers, "The Relationship of Somatotype to Physical Fitness," Journal of Educational Research. XXLII (May, 1949), pp. 704-712.

results was questionable and that another method ought to be attempted.

Purpose of the Study

The purpose of this study was to determine the relationship between body type and performance on the activity test battery and the PF Plan by freshmen men at Michigan State University. The specific objectives of this study were as follows:

1. To investigate the relationship of body type to performance on the activity test battery and the PF Plan.
2. To present percentile tables for the activity test battery and the first four weeks of the PF Plan for the entire population.
3. To present percentile tables for the activity test battery and the first four weeks of the PF Plan for each of the nineteen body type groupings.
4. To present profile charts for the activity test battery and the first four weeks of the PF Plan through the use of a mean and a one standard deviation range for each of the nineteen body type groupings.

This study encompassed the entire Foundations of Physical Education Program for men and utilized a questionnaire, which was administered in each section of the course. The results of the study and the conclusions derived from it can probably be applied to other freshmen in later years, both at Michigan State University and at other institutions making use of this fitness plan.

Need for the Study

Everyone who had come in contact with the PF Plan seemed to agree that it was of great value for several reasons:

1. Only eleven minutes per day were required to perform the exercises.
2. There was no need for any equipment or devices to aid in the performance of the exercises.
3. The exercises were chosen in such a manner that even if the students performed them incorrectly they would still benefit from their use.
4. There was a level somewhere on the plan which offered a challenge to even a highly skilled student.

However, if the student was not motivated to perform the exercises daily, he would derive little or no benefit from them. It was very difficult to motivate a student who

found an activity either too difficult or too easy for him. If he progressed either faster or slower than he was expected to, problems occasionally arose. For this reason, the student must be placed accurately on one of the starting charts on the PF Plan. He must have a reasonable and attainable goal and should have some idea of whether or not he is improving at a normal rate for his body type. Through this study it is hoped to be able to provide for some of these needs.

Consideration should be given to body types in formulating standards for achievement on strength, motor, and fitness tests.[8] By setting up tables and charts of performance, the student might be placed on the PF Plan solely by body type or by a combination of body type and activity test percentile rankings. This might prove to be a more valid method than the one being used now. With profile charts for each of the nineteen body type groupings available, the instructors would have a better idea of how the student should be progressing and what level of performance he should attain.

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[8]F. D. Sills and P. W. Everett, "The Relationship of Extreme Somatotypes to Performance in Motor and Strength Tests," Research Quarterly. XXIV (May, 1953), pp. 223-228.

The results of this study should provide for motivation on the part of the students as well as making the entire PF Plan more valid. Percentile tables of performance as well as profile charts by body type will be set up and these can be refined and adjusted as more data are gathered in subsequent years until extremely accurate tables and charts will be available for general use to everyone using the activity test battery or the PF Plan.

Limitations of the Study

Instructors body typing. It must be noted that each of the students was not body typed by the same instructor. The eighteen Foundations instructors body typed all of the students in their sections. While it must be brought out that this caused some variance in body typing with certain individuals, this variance seldom caused a student to be placed in the wrong body type grouping.[9]

Student absences. This problem was two-fold: (1) Some students were occasionally absent from class and also failed to perform the exercises at home on that day. Thus they would have missed one day of work on the plan and as a result,

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[9]See page 27 for the reliability of body typing by more than one individual.

their data would not be quite accurate. (2) Several students were absent on the day that the questionnaire was administered to their section. Consequently, the study will not contain the complete population. In addition, a few of the students in each section failed to bring their Foundations work books to class, resulting in much of their data being incomplete. In spite of the above situations, approximately 85 percent of the twenty two hundred cases were included in the study.

The questionnaire. This study was, of course, subject to the degree of validity and reliability which accompanies the use of the questionnaire technique. However, to raise the reliability, the questionnaire was personally administered to each of the Foundations sections by the investigators.[10]

Lack of student participation on exercises. The main factor limiting the validity of this study was the fact that some of the students were failing to perform the exercises outside of class. Consequently, the data from these students was incomplete and partially invalid due to this lack of participation. However, since these tables and charts were set up for use in the Foundations Program, which is not an

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[10]The investigator was assisted in the administration of the questionnaires by another graduate student, Jerome Weber, who also received data from them.

ideal situation, they should not have been derived from an ideal situation.

Accuracy of stated achievement. There was little evidence to support the view that some students falsified their performance. However, this possibility must be considered and as a result, each student was required to perform the activity tests and the PF Plan on the level which he had achieved at the end of the term.

Lack of adequate sample for certain body type groupings. In some of the body type groupings there were very few cases on which to set up tables and charts due to the uncommon body types included in the groupings. As a result, those tables and charts might not have been as accurate as possible. However, as was pointed out earlier, further data in these groupings will increase their accuracy. In addition, before viewing the data, the investigator decided not to include any body type grouping which contained less than fifty cases.[11]

Reliability of activity test battery and PF Plan. A final factor influencing this study was the reliability of

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[11]This accounts for the fact that only eight body type groupings were studied out of the original nineteen.

the activity test battery and the PF Plan itself. If the methods of administering these tests and exercises varied greatly, the data were likely to be distorted.

Definition of Terms

Foundations course. The basic Physical Education course required of all freshmen men at Michigan State University.[12]

PF Physical Fitness Plan. The same basic plan as the 5BX Plan, with certain adaptations made to enable it to be incorporated into the Foundations Program.

5BX Plan. This stands for "five basic exercises." The plan was conceived by William Orban with the intention of administering it to the cadets while he was Director of Physical Education for the Royal Canadian Air Force.[13]

Exercises. The five exercises included in the PF Plan, which are specifically detailed in a copy of the PF Plan in Appendix A. Briefly, they are toe-touching, situps, head and leg raises, pushups, and running in place.

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[12]N. L. Labaw, "A Study of Acceptance and Rejection of the Foundations of Physical Education Course by Freshmen Men at Michigan State University," (A Doctoral Thesis, 1960) p. 5.

[13]See Appendix B for a copy of a letter from William Orban concerning the formulation of the 5BX Plan.

Level. Any particular level of achievement on the PF Plan for all five exercises during the eleven minute time period.

Starting point. The level on one of the starting charts of the PF Plan at which the student began working. At the time of the study this was determined by percentile rankings on the battery of activity tests.

Finishing point. The level on one of the goal charts of the PF Plan which the student should reach. This percentile level should correspond to the one he began at on one of the starting charts.

Activity test battery. A series of tests measuring strength, agility, power, and endurance, which was administered at the beginning of the term.[14]

Body type. The individual body build of each student. There are three distinct types of body builds: (1) endomorphic, (2) mesomorphic, and (3) ectomorphic. Body type is then registered as the degree to which an individual exhibits the characteristics of each type of body build on a scale of one through seven.

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[14] See page 26 for a list of and references for the description of the tests.

Endomorph. A body build tending toward obesity.

Mesomorph. A body build tending toward huskiness.

Ectomorph. A body build tending toward leanness.

Body type groupings. A series of nineteen groupings which contained all the body types identified in the study. This was done to facilitate the easier handling of comparisons due to the large number of indiviual body types.[15]

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[15]See Appendix D for a list of the nineteen body type groupings and the body types within each grouping.

CHAPTER II

RELATED LITERATURE

Ever since body typing had become accepted by physical educators, people began to wonder about its uses and implications. Attempts have been made to correlate body type with nearly every facet of mans' makeup. In many cases, results proved inconclusive or left room for doubt. However, in one area there seems to be general agreement and acceptance: physical performance. Since there are obvious differences in physical makeup, as well as physical performance, it becomes easy for one to accept studies which show a definite correlation between the two areas. Due to the fact that body typing is a relatively new practice, there were very few studies before 1940, on the subject.

Cureton,[1] in 1941, made one of the first attempts to study performance in athletic events and fitness tests in light of body type. American swimmers at the 1932 and 1936 Olympics were studied after being body typed by Cureton using the Sheldon method. Most of the American Olympic

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[1] T. K. Cureton, "Body Build as a Framework of Reference for Interpreting Physical Fitness and Athletic Performance," Research Quarterly, XII (May, 1941), pp. 301-330.

swimmers had body types which ranged from 343 to 454 and very few extremes were found. All of these fell in the mesomorphic group while there were no extreme endomorphic or ectomorphic types found. All of the swimmers were found to be above average in strength, with the sprinters tending toward ecto-mesomorphy and the middle distance men tending twoard endo-mesomorphy.

Cureton then studied physical education students at the University of Illinois and body typed them in the same manner. When performances involving strength and power were studied, it was found that the highest mean scores fell in the meso-morphic groups with the lower scores falling toward the other two extremes. On the Brace test, which involved flexibility and agility, ectomorphic types scored highest, followed by the mesomorphs and then the endomorphs. Ectomorphs also exhibited the lowest scores on the McCurdy-Larson test for circulation and respiration.

The author concluded that the mesomorphic body types excell in activities involving strength and power while the ectomorphic body types excell in activities involving flexi-bility, agility, and endurance.

Willgoose[2] and Rogers further investigated this relationship in 1949 as they examined 153 students from Syracuse University to determine what affect body type ratings had on physical fitness. Each student was photographed from the front, side, and back and the photographs were sent to Sheldon and Dupertius at Columbia University for body typing. Following this, each student was given the Rogers Physical Fitness Index, which involved tests of strength and endurance.

The endomorphs had a low PFI score and there was an inverse relationship between physical fitness and the endomorphic component. In contrast, the mesomorphs had a high PFI score and a direct relationship between physical fitness and the mesomorphic component was indicated. The authors concluded that endomorphy was a limiting factor in physical fitness. There seemed to be a very low correlation between the PFI scores and the ectomorphic component which led Willgoose and Rogers to believe that ectomorphy may not influence physical fitness to any great extent.

In 1954, Perbix[3] studied the relationship between body

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[2]C. E. Willgoose and M. L. Rogers, "Relationship of Somatotype to Physical Fitness," Journal of Educational Research, XXLII (May, 1949), pp. 704-712.

[3]J. A. Perbix, "Relationship Between Somatotype and Physical Fitness," Research Quarterly, XXV (March, 1954), pp. 84-90.

type and motor fitness in women at the University of Kentucky. The study consisted of eighty-three physical education majors and one hundred non-majors. Sheldon and his assistants came to body type the subjects as a part of their survey to establish norms for womens' physiques. The tests used in the study were trunk extension, knee pushups, the Illinois Agility Run, and the medicine ball put.

The findings indicated no relationship between body type ratings and trunk extension. However, significant relationships between mesomorphy and the medicine ball put and knee pushups were found. An inverse relationship was noted between endomorphy and knee pushups and the Illinois Agility Run when the mesomorphic component was low. Perbix concluded that mesomorphy was the determining factor in activities which involved agility, strength, and power.

The results of a study by Sills[4] and Mitchem in 1957 seemed to bear out the findings of earlier studies. In addition to further proving the relationship between body type ratings and physical fitness, the authors set up tables for the prediction of performance by body types. The 433 male

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[4]F. D. Sills and John Mitchem, "Prediction of Performance on Physical Fitness Tests by Means of Somatotype Ratings," Research Quarterly, XXVIII (March, 1957), pp. 64-71.

freshmen students at the University of Iowa were photographed, body typed by the Sheldon technique, and then given a battery of tests which included situps, pullups, the 100 yard pick-a-back-run, and the 300 yard shuttle run. Each student was placed in one of thirteen groupings according to his body type. Then these thirteen were narrowed down to four general body type groupings. Prediction equations were set up and the mean scores of these four groups were predicted. After testing, the comparison between the predicted scores and the actual scores revealed a high correlation and the tables were set up on the basis of T scores.

The authors found that the group of mesomorphs and mesomorphs with high ectomorphic components scored highest on all tests. The group of moderate mesomorphs with high endomorphic components scored next highest on all of the tests while the group of ectomorphs and ectomorphs with high endomorphic components followed. The last group, which consisted of endomorphs and endomorphs with high ectomorphic components, scored lowest on all of the tests.

Joranko,[5] in his study on muscular endurance in 1953,

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[5] F. L. Joranko, "The Relationship of Improvement in Muscular Endurance to Body Types," University of Illinois Abstracts of Graduate Theses in Physical Education, (Urbana, Illinois: University of Illinois, 1953), no. 12.

found similar results. The purpose of his study was to demonstrate the effects of training on the muscular endurance of nine body type groups. Taking 123 students at the University of Illinois, who were taking courses in developmental activities, Joranko had them body typed by T. K. Cureton, using the Sheldon method, and then submitted them to a conditioning program. The program consisted of chins, dips, and sitting tucks, three times per week for a twelve week period. The subjects were then given motor fitness tests on the first, sixth, and last week of the program.

The author found that while all body types improved in muscular endurance when subjected to a training program, the mesomorphic body types exhibited the best all-around performance in muscular endurance activities. However, mesomorphs were found to have a high level of muscular endurance to begin with; thus their improvement was slight when subjected to a training program. The mesomorph-medials and the ectomorph-mesomorphs demonstrated the most improvement while body types which had endomorphic tendencies exhibited very poor performances. It was noted, however, that both ectomorphs and endomorphs had similar initial performances.

Sills,[6] in 1950, attempted to analyze the relationship of body type to the performance of motor skills involving strength and speed. Taking 158 freshmen in the Basic Skills course in Physical Education at the University of Iowa, he body typed them using the Sheldon technique and then administered a battery of sixteen tests.

After interpreting his findings, Sills concluded that there was no significant relationship between body type and strength and speed.

Three years later, Sills[7] and Everett followed up this study with one which was designed to clarify the relationship of endomorphy, mesomorphy, and ectomorphy to the performance of motor skills. In an effort to gain significant results, the authors chose thirteen extreme endomorphs, fourteen extreme mesomorphs, and sixteen extreme ectomorphs. It was hoped that by using these extreme body types, two body components would be held constant while a third was being investigated.

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[6]F. D. Sills, "A Factor Analysis of Somatotypes and Their Relationship to Achievement in Motor Skills," Research Quarterly, XXI (December, 1950), pp. 424-437.

[7]F. D. Sills and P. W. Everett, "The Relationship of Extreme Somatotypes to Performance on Motor and Strength Tests," Research Quarterly. XXIV (May, 1953), pp. 223, 228.

Each subject was then given a battery of tests which dealt with strength, speed, agility, and endurance.

After viewing the data, the authors concluded that the mesomorphs were stronger than endomorphs and the endomorphs, in turn, were stronger than ectomorphs. The mesomorphs were also found to be superior in speed, agility, and endurance. However, the ectomorphs were found to be superior to the endomorphs in activities involving these measurements. Sills and Everett reasoned that excess weight was a handicap to endomorphs and insufficient strength was a handicap to ectomorphs.

In 1961, Fraber[8] and Sproule conducted a study to assess the value of the 5BX Plan by measuring the heart rate of subjects submitted to treadmill walking. The University of Alberta students were divided into three groups:

1. First year students enrolled in a required program of Physical Education to which the 5BX Plan was added.
2. First year medical students who took part in the 5BX Plan.

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[8] Robert Fraber and Brian Sproule, "Assessment of the 5BX Plan by Measuring Heart Rate Responses to Various Intensities of Treadmill Walking," (An unpublished Abstract: University of Alberta, 1961).

3. First year medical students who continued their regular activity but did not take part in the 5BX Plan.

Each student was then exercised on the treadmill at 3.3 miles per hour, once a week for five minutes. The grade of the treadmill was raised one percent each minute. The heart rate was measured at the end of each minute during the exercise and also during a five minute recovery period.

Groups one and two showed definite increases in treadmill performance, while group two experienced the greatest difference between the first and last treadmill test. The major improvements for groups one and two occurred during the first three weeks of work on the 5BX Plan and then their performance leveled off to some degree. Group three, acting as a control group, displayed little improvement during the testing period and led the authors to conclude that the 5BX Plan was of definite value to those wishing to increase their endurance.

Late in 1961, Olson[9] conducted a study on freshmen men, enrolled in the Foundations of Physical Education course at

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[9] H. W. Olson, "The Value of the PF Plan in Regard to Physical Fitness," (Unpublished Data on the PF Plan: Michigan State University, 1961).

Michigan State University, for the purpose of determining the value of the PF Plan. The tests, consisting of the Harvard Step Test, pushups, situps, dominant hand grip strength, and vertical jump, were administered to approximately two hundred subjects before the PF Plan was started. The PF Plan was administered to the subjects for a period of eight weeks and then each student was retested with the original battery of tests.

The results of the study showed significant increases in performance on all of the tests in the battery and the author concluded that the PF Plan was worthwhile as it contributed to these improvements in strength and endurance.

CHAPTER III

METHODOLOGY

Introduction

The PF Plan was introduced this year in the Foundations of Physical Education course at Michigan State University. The plan was designed to help students achieve an acceptable level of physical fitness through a series of five basic exercises. The students were placed on the plan by means of percentile rankings from a battery of activity tests, given at the beginning of the term. In addition, the students were body typed by their instructors and then all of the data were gathered through the use of a questionnaire, administered at the end of the term.

The purpose of this study was to examine the relationship of body type to performance on the activity test battery and the PF Plan as well as to set up percentile tables and profile charts for the test battery and the first four weeks of the PF Plan, based on the nineteen body type groupings.

Research Methods Used

Background on the 5BX Plan, of which the PF Plan was an outgrowth, was obtained through the exchange of letters

with the people involved in its origin. First, a letter was sent to the Queens Printer in Canada to obtain a copy of the 5BX Plan. Then a series of letters to Dr. William Orban, who developed the plan while at the Royal Canadian Air Force, brought to light the method used in formulating the plan. Following this, a letter was sent to Dr. Jack Alexander, who also did some work in this area, and an abstract of some research done on the 5BX Plan was received. Finally, a letter sent to the Royal Canadian Air Force with the hope of uncovering some of the figures and statistics on the plan netted no results.

The investigator then visited several of the Foundations classes and became familiar with their organization. In addition, the procedure followed in administering the activity test battery, the PF Plan, and the body typing was carefully observed.

Having done this, it was decided that due to the large number of subjects, a questionnaire administered to each of the Foundations classes was the best method of gathering the data needed. The questionnaire was developed in such a manner that the data could be transferred directly to IBM cards. This eliminated the step of transferring the information to data sheets before putting the information on the IBM cards.

With all of the information punched into eighty column IBM cards, the computers then tabulated all of the data and the investigator treated it statistically to gather the desired information.

Subjects

It must be pointed out that the entire population was used in this study rather than just a sample. Since data on all of the students in the Foundations Program was readily available to the investigator, it was decided to examine every student enrolled in the course, which would raise the validity of the study. The number of subjects studied was 1876. However, due to incorrect data, some of the cases had to be pulled out of the study, bringing the final total to 1769.

The population was classified as male freshmen students, roughly between the ages of seventeen and twenty, enrolled in the Foundations of Physical Education course at Michigan State University in the fall of 1961.

Tests Used

The activity test battery, used to measure strength, power, agility, and endurance, consisted of the vertical jump, dominant and non-dominant hand grip strength, Harvard

Step Test, agility run, trunk flexion, trunk extension, situps, and pushups. A description and suggested testing procedure for these tests is found in Physical Activity in Modern Living.[1]

The body typing method used was the one developed by Sheldon, Stevens, and Tucker in Varieties of Human Physique[2] with modifications by Cureton in the Physical Fitness Workbook.[3] It was generally agreed by most authorities in the field that this was the best subjective method of measuring body type. In 1941, Cureton had eleven graduate assistants help him with the body typing of students in certain Physical Education classes. Using the same method as stated above, he found that the reliability of the body typing by the graduate assistants ranged from .70 to .93.[4] In another study by Sills in 1950, three faculty members body typed 158 students enrolled in Physical Education on the basis of front, side,

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[1] W. D. Van Huss and others, Physical Activity in Modern Living. (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1960), pp. 91-92.

[2] W. H. Sheldon, S. S. Stvens, and W. B. Tucker, The Varieties of Human Physique. (New York: Harper Brothers, 1940).

[3] T. K. Cureton, Physical Fitness Workbook. (St. Louis: C. V. Mosby Company, 1947), pp. 103-113.

[4] T. K. Cureton, "Body Build as a Framework of Reference for Interpreting Physical Fitness and Athletic Performance," Research Quarterly. XII (May, 1941), p. 319.

and back views. Again using the Sheldon method, Sills found the reliability of the instructors body typing to be .917 for endomorphy, .904 for mesomorphy, and .946 for ectomorphy.[5, 6]

Testing Procedure

The Foundations classes contained an average of forty-five students. Most of these classes were conducted in the gymnasium where the instructors introduced the students to new sports and activities or administered the activity test battery and the PF Plan. The other classes were spent in lecture rooms where the instructors related body functions to physical fitness, gave examinations, etc.

When the battery of activity tests was given, the class was divided up and sent to the different stations where each of the tests was being administered. After a student finished one test, he moved on to the next station and the next test. One station was set up where the body typing took place. The students, clad in a pair of shorts, stood facing the instructor, then turned sideways, and then faced back to the front. The students remained in each position

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[5]F. D. Wills, "A Factor Analysis of Somatotypes and Their Relationship to Achievement in Motor Skills," Research Quarterly, XXI (December, 1950), p. 427.

[6]See Appendix D for a comparison of Sheldon's body type frequency distribution to the ones in this study.

for a period of ten to fifteen seconds while the instructor subjectively determined their body types. The testing period usually lasted for about three days.

When the students were finished with the testing and body typing, the PF Plan was started. A lecture pertaining to how the class was to be organized, how the plan would be administered, and how the students would determine their percentile rankings was given on the first day. The PF Plan itself was started on the next day as each student began work according to his percentile ranking. The classes were spread out and then the instructors kept time as the students performed the exercises during the allotted time periods. Each student was responsible for recording the date next to the level he achieved on that day.

Near the end of the term, each section was visited by the investigators and the questionnaire was administered. This took approximately fifteen minutes and during that time the students recorded their activity test scores, their body type, and their weekly PF Plan performance in addition to some information which was desired by the Physical Education Department.[7]

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[7]See Appendix C for a copy of the questionnaire and the coding plan.

Analysis of Data

All of the questionnaires were checked for the completeness and clarity with which they had been answered. If any empty blanks were found, they were filled with an "0" which signified no information. The information on the questionnaires was then punched into eighty colum IBM cards and verified for accuracy. Due to the large number of cases, all of the statistical tabulations were conducted using IBM equipment.

All of the subjects were first placed in one of the nineteen body type groupings. Then all of the activity test and PF Plan scores were sorted from high to low for both the entire population and each of the body type groupings. This was done to facilitate the computing of percentile tables by means of an actual score count. Following this, the mean and a one standard deviation range were computed for all of the activity test and PF Plan scores for each body type grouping.[8]

As a result of these tabulations and computations, percentile tables for all of the activity tests and the PF Plan for the entire population and each body type grouping,

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[8] See Appendix C for a more detailed description of the IBM procedure and statistical analysis.

as well as profile charts for each body type grouping on the same tests, are presented in the following chapter.

CHAPTER IV

ANALYSIS AND PRESENTATION OF DATA

The following tables and charts are the products of the tabulated information from the questionnaires. They were statistically analyzed and the results and interpretations are presented in this chapter. First, each profile chart was analyzed in terms of how that body type grouping compared to the total population and then the body type groupings were compared with each other in terms of each test.

Individual Profile Charts

Shown in Chart I is the performance of the mesomorphic endomorph body type grouping on the activity tests and the first four weeks of the PF Plan. Due to the excess body weight with a tendency toward huskiness, which was a characteristic of this group, the scores on the vertical jump, pulse rate, agility run, trunk flexion, trunk extension, situps, and pushups were low as expected. Even though these individuals should be quite strong, they cannot lift their excess weight very far off the ground. Again in the pulse rate measurement, weight was a handicap as the mesomorphic endomorph must expend

CHART I

PROFILE CHART OF BODY TYPE GROUP #4 (MESOMORPHIC ENDOMORPH) PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE FP PLAN

	ACTIVITY TESTS								FP PLAN				
Percentile*	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches ±	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	35.0 in.	200 lbs.	200 lbs.	20	15.0 secs.	+9.0 ins.	32.0 ins.	99	70	80	49	49	51	60
95	27.0 in.	161 lbs.	146 lbs.	42	16.9 secs.	+7.9 ins.	26.8 ins.	75	41	19	22	26	32	37
90	25.6 in.	153 lbs.	140 lbs.	45	17.2 secs.	+6.8 ins.	25.8 ins.	69	37	17	20	24	27	32
85	24.6 in.	148 lbs.	133 lbs.	48	17.5 secs.	+6.3 ins.	24.9 ins.	61	35	16	19	22	25	30
80	24.0 in.	143 lbs.	130 lbs.	50	17.7 secs.	+5.8 ins.	24.3 ins.	56	32	15	18	21	24	28
75	23.6 in.	140 lbs.	125 lbs.	52	17.9 secs.	+5.4 ins.	23.7 ins.	51	31	14	17	20	23	26
70	23.0 in.	137 lbs.	122 lbs.	54	18.0 secs.	+5.0 ins.	23.1 ins.	49	30	14	16	19	22	25
65	22.8 in.	134 lbs.	121 lbs.	56	18.2 secs.	+4.6 ins.	22.6 ins.	45	29	13	16	19	21	24
60	22.6 in.	131 lbs.	120 lbs.	57	18.3 secs.	+4.3 ins.	22.0 ins.	42	27	13	15	18	20	23
55	22.1 in.	130 lbs.	116 lbs.	58	18.4 secs.	+4.1 ins.	21.5 ins.	41	26	12	15	17	20	22
50	21.8 in.	128 lbs.	115 lbs.	60	18.7 secs.	+3.8 ins.	20.9 ins.	39	25	12	14	16	19	21
45	21.6 in.	126 lbs.	111 lbs.	61	18.9 secs.	+3.4 ins.	20.3 ins.	37	25	11	13	16	18	20
40	20.8 in.	123 lbs.	110 lbs.	62	19.1 secs.	+3.1 ins.	19.7 ins.	35	24	11	13	15	17	19
35	20.3 in.	120 lbs.	109 lbs.	64	19.3 secs.	+2.7 ins.	19.0 ins.	33	23	10	13	15	16	18
30	20.0 in.	119 lbs.	104 lbs.	65	19.5 secs.	+2.3 ins.	18.1 ins.	31	22	10	12	13	15	17
25	19.3 in.	115 lbs.	101 lbs.	65	19.7 secs.	+1.8 ins.	17.3 ins.	30	21	9	11	13	15	16
20	18.8 in.	111 lbs.	100 lbs.	67	20.1 secs.	+1.3 ins.	16.3 ins.	28	19	8	11	12	14	16
15	18.0 in.	110 lbs.	97 lbs.	69	20.3 secs.	+0.6 ins.	14.9 ins.	25	18	8	10	11	13	14
10	16.7 in.	106 lbs.	92 lbs.	71	20.7 secs.	-0.5 ins.	13.3 ins.	23	16	7	9	10	12	13
5	15.3 in.	100 lbs.	90 lbs.	75	21.6 secs.	-2.7 ins.	11.5 ins.	19	13	6	7	9	10	11
0	6.5 in.	85 lbs.	85 lbs.	99	29.6 secs.	-9.0 ins.	1.0 ins.	2	2	1	1	1	1	1
N	1733	1741	1716	1695	1698	1769	1682	1727	1700	1708	1589	1587	1593	1589

*Percentiles developed by actual IBM card counts rather than by formula.

MEAN

ONE STANDARD DEVIATION

* INCLUDES BODY TYPES - 721, 731, 621, 631, 632, 641, 642, 643, 651, 652, 521, 531, 532, 541, 542, 543, 421, 431, 432.

Table I

PERCENTILE TABLES OF BODY TYPE GROUP #4 (MESOMORPHIC ENDOMORPH) PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE FP PLAN

	Activity Tests Battery								FP Plan				
Percentile	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches ±	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	26.0 in.	193 lbs.	184 lbs.	35	17.3 secs.	+9.0 ins.	29.0 ins.	75	35	20	21	25	29	36
95	23.1 in.	160 lbs.	152 lbs.	46	18.0 secs.	+7.7 ins.	26.4 ins.	55	32	15	17	21	26	31
90	22.4 in.	151 lbs.	139 lbs.	51	18.2 secs.	+6.8 ins.	25.3 ins.	48	30	14	16	20	23	26
85	22.1 in.	147 lbs.	133 lbs.	53	18.4 secs.	+5.9 ins.	24.7 ins.	45	29	13	15	19	21	24
80	21.2 in.	141 lbs.	128 lbs.	55	18.6 secs.	+5.0 ins.	24.3 ins.	41	26	12	14	17	20	23
75	20.5 in.	140 lbs.	123 lbs.	56	18.7 secs.	+4.7 ins.	23.7 ins.	39	25	12	14	16	19	22
70	20.3 in.	135 lbs.	121 lbs.	58	18.8 secs.	+4.5 ins.	23.1 ins.	38	25	11	13	15	18	21
65	20.0 in.	131 lbs.	120 lbs.	61	19.0 secs.	+4.2 ins.	22.6 ins.	36	23	10	13	14	17	20
60	19.8 in.	130 lbs.	118 lbs.	62	19.2 secs.	+4.0 ins.	22.1 ins.	35	23	10	12	14	16	18
55	19.0 in.	126 lbs.	114 lbs.	64	19.4 secs.	+3.6 ins.	21.5 ins.	33	22	9	12	13	15	17
50	18.4 in.	123 lbs.	112 lbs.	65	19.5 secs.	+3.4 ins.	20.7 ins.	30	21	9	11	13	14	16
45	18.0 in.	121 lbs.	111 lbs.	66	20.0 secs.	+3.1 ins.	19.7 ins.	29	20	8	10	12	14	14
40	17.7 in.	121 lbs.	109 lbs.	66	20.1 secs.	+2.7 ins.	19.1 ins.	28	20	8	10	11	13	13
35	17.3 in.	120 lbs.	105 lbs.	67	20.4 secs.	+2.3 ins.	18.5 ins.	26	19	7	9	11	12	13
30	16.8 in.	117 lbs.	103 lbs.	68	20.8 secs.	+1.9 ins.	17.9 ins.	24	18	7	9	10	11	12
25	16.3 in.	113 lbs.	102 lbs.	70	21.2 secs.	+1.2 ins.	16.9 ins.	23	17	6	8	10	11	12
20	16.0 in.	111 lbs.	100 lbs.	71	21.5 secs.	-0.3 ins.	16.0 ins.	20	16	6	7	9	10	11
15	14.8 in.	110 lbs.	96 lbs.	72	22.3 secs.	-1.6 ins.	13.7 ins.	19	15	5	6	8	9	10
10	14.3 in.	104 lbs.	89 lbs.	76	22.6 secs.	-2.9 ins.	12.4 ins.	17	13	5	6	7	8	9
5	12.2 in.	96 lbs.	78 lbs.	88	23.4 secs.	-4.4 ins.	11.1 ins.	13	10	4	5	6	6	7
0	6.8 in.	80 lbs.	50 lbs.	99	29.0 secs.	-6.0 ins.	4.0 ins.	2	3	1	3	4	4	4
N	114	114	111	103	109	111	106	109	112	110	102	102	102	104

more energy to perform the Harvard Step Test than the average person. Difficulty in stopping and starting a large bulk accounted for the poor scores in the agility run. The extra weight also affected the range of motion which accounted for the limited flexibility. The inability to raise and lower the body was exhibited in the low situp and pushup scores. However, even though the mesomorphic endomorph's scores on dominant and non-dominant hand grip strength were somewhat higher than their other scores, it would be expected that they would be even above average in strength. Since body weight does not enter into this test, all of the subject's strength could be put to the task at hand. Due to the overall low scores on the activity tests, the mesomorphic endomorph group should have performed at a low level on the PF Plan; which was the case.

The strong mesomorph group, illustrated in Chart II, performed at the 55th percentile level in the vertical jump and pulse rate, the 60th percentile in non-dominant hand grip strength and the agility run, the 65th percentile in dominant hand grip strength and situps, and the 70th percentile in pushups. This above average performance was expected due to a great amount of strength combined with average weight which was common to this grouping. The

CHART II

PROFILE CHART OF BODY TYPE GROUP #9 (STRONG MESOMORPH)* PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE FP PLAN

ACTIVITY TESTS — FP PLAN

Percentile*	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches ±	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	35.0 in.	200 lbs.	200 lbs.	88	15.0 secs.	+9.0 ins.	32.0 ins.	99	70	84	89	89	91	60
95	27.0 in.	161 lbs.	146 lbs.	48	16.9 secs.	+7.9 ins.	26.8 ins.	75	41	19	82	86	88	87
90	25.6 in.	153 lbs.	140 lbs.	45	17.2 secs.	+6.8 ins.	25.8 ins.	69	37	17	80	84	87	82
85	24.6 in.	148 lbs.	133 lbs.	48	17.5 secs.	+6.3 ins.	24.9 ins.	61	35	16	19	82	85	80
80	24.0 in.	141 lbs.	130 lbs.	50	17.7 secs.	+5.8 ins.	24.3 ins.	58	32	15	78	81	84	88
75	23.6 in.	138 lbs.	125 lbs.	52	17.9 secs.	+5.4 ins.	23.7 ins.	51	31	14	17	80	83	86
70	23.0 in.	137 lbs.	122 lbs.	54	18.0 secs.	+5.0 ins.	23.1 ins.	49	30	14	16	19	82	85
65	22.8 in.	135 lbs.	121 lbs.	56	18.2 secs.	+4.6 ins.	22.6 ins.	47	29	13	16	18	81	84
60	22.6 in.	131 lbs.	118 lbs.	57	18.3 secs.	+4.3 ins.	22.0 ins.	46	27	13	15	18	80	83
55	22.4 in.	130 lbs.	116 lbs.	59	18.6 secs.	+4.1 ins.	21.5 ins.	44	26	12	15	17	80	82
50	21.8 in.	126 lbs.	113 lbs.	60	18.7 secs.	+3.8 ins.	20.9 ins.	39	25	12	14	16	79	81
45	21.8 in.	122 lbs.	111 lbs.	61	18.9 secs.	+3.4 ins.	20.1 ins.	37	25	11	13	16	18	80
40	20.8 in.	121 lbs.	110 lbs.	62	19.1 secs.	+3.1 ins.	19.5 ins.	35	20	11	13	15	17	19
35	20.3 in.	120 lbs.	109 lbs.	63	19.3 secs.	+2.7 ins.	18.8 ins.	33	23	10	13	14	16	18
30	20.0 in.	119 lbs.	108 lbs.	64	19.5 secs.	+2.2 ins.	18.1 ins.	31	22	10	12	13	15	17
25	19.3 in.	115 lbs.	101 lbs.	65	19.7 secs.	+1.8 ins.	17.3 ins.	30	20	9	12	13	15	16
20	18.2 in.	111 lbs.	100 lbs.	67	20.1 secs.	+1.2 ins.	16.3 ins.	28	19	9	11	12	14	15
15	18.0 in.	110 lbs.	97 lbs.	69	20.3 secs.	+0.6 ins.	14.9 ins.	25	18	8	10	11	13	14
10	16.7 in.	106 lbs.	92 lbs.	71	20.7 secs.	-0.5 ins.	13.3 ins.	23	16	7	9	10	12	13
5	15.3 in.	100 lbs.	90 lbs.	75	21.6 secs.	-2.7 ins.	11.5 ins.	19	13	6	7	9	10	11
0	6.5 in.	85 lbs.	85 lbs.	99	29.6 secs.	-9.0 ins.	1.0 ins.	2	2	1	1	1	1	1
N	1733	1701	1716	1695	1698	1769	1682	1727	1700	1708	1580	1597	1595	1609

*Percentiles developed by actual IBM card counts rather than by formula.

MEAN

ONE STANDARD DEVIATION

* INCLUDES BODY TYPES - 373, 262, 363, 151, 252, 353.

Table II

PERCENTILE VALUES OF BODY TYPE GROUP #9 (STRONG MESOMORPH) PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE FP PLAN

Activity Tests Battery — FP Plan

Percentile	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches ±	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	36.0 in.	190 lbs.	175 lbs.	30	16.0 secs.	+9.0 ins.	28.0 ins.	85	59	82	87	89	89	90
95	28.0 in.	168 lbs.	156 lbs.	39	16.6 secs.	+8.3 ins.	26.7 ins.	82	43	80	89	92	89	92
90	26.2 in.	161 lbs.	146 lbs.	44	17.0 secs.	+7.3 ins.	25.7 ins.	78	40	19	82	85	82	87
85	25.5 in.	158 lbs.	140 lbs.	47	17.2 secs.	+6.9 ins.	24.8 ins.	75	38	17	80	84	80	85
80	24.7 in.	150 lbs.	135 lbs.	50	17.5 secs.	+6.3 ins.	24.3 ins.	66	37	16	80	83	86	84
75	24.1 in.	145 lbs.	131 lbs.	52	17.6 secs.	+6.0 ins.	23.8 ins.	59	36	16	10	82	85	89
70	24.0 in.	141 lbs.	129 lbs.	54	17.8 secs.	+5.7 ins.	23.3 ins.	53	34	15	18	81	84	86
65	23.9 in.	140 lbs.	125 lbs.	55	17.9 secs.	+5.3 ins.	22.8 ins.	51	32	15	17	80	83	85
60	23.4 in.	137 lbs.	121 lbs.	57	18.0 secs.	+5.0 ins.	22.2 ins.	47	31	14	17	19	82	85
55	22.9 in.	135 lbs.	120 lbs.	58	18.1 secs.	+4.7 ins.	21.7 ins.	42	31	14	16	19	82	84
50	22.7 in.	133 lbs.	118 lbs.	60	18.2 secs.	+4.3 ins.	21.2 ins.	41	30	13	16	18	81	84
45	22.5 in.	130 lbs.	115 lbs.	61	18.5 secs.	+4.0 ins.	20.7 ins.	40	30	13	15	18	80	83
40	22.0 in.	126 lbs.	111 lbs.	62	18.6 secs.	+3.8 ins.	20.1 ins.	38	28	12	15	17	80	82
35	21.8 in.	124 lbs.	110 lbs.	63	18.7 secs.	+3.5 ins.	19.4 ins.	36	27	12	14	17	19	81
30	20.8 in.	122 lbs.	108 lbs.	64	19.0 secs.	+3.2 ins.	18.7 ins.	33	26	11	14	16	18	80
25	20.3 in.	120 lbs.	103 lbs.	65	19.2 secs.	+2.8 ins.	17.8 ins.	31	25	11	13	16	18	19
20	20.0 in.	115 lbs.	101 lbs.	66	19.5 secs.	+2.4 ins.	16.8 ins.	30	24	10	13	15	17	19
15	18.5 in.	111 lbs.	97 lbs.	68	19.7 secs.	+1.8 ins.	15.3 ins.	29	23	9	12	14	16	18
10	18.0 in.	105 lbs.	90 lbs.	72	20.1 secs.	-0.3 ins.	13.1 ins.	26	20	8	11	14	15	17
5	16.6 in.	97 lbs.	75 lbs.	79	20.8 secs.	-3.0 ins.	8.2 ins.	23	18	7	10	12	13	14
0	10.0 in.	95 lbs.	85 lbs.	84	23.1 secs.	-8.0 ins.	0.0 ins.	13	9	4	6	9	10	10
N	188	186	184	186	185	180	184	188	189	189	184	180	180	187

strong mesomorph was found to be slightly below average in both trunk flexion and trunk extension. However, this was not too surprising since the heavily muscled body of the strong mesomorph is often not as flexible as that of the ectomorphic body types. In addition to these high test scores, the strong mesomorphs also performed at a high level on the PF Plan, averaging above the 65th percentile level.

The moderate mesomorph grouping came the closest to average of any of the eight groupings studied. This fact is shown in Chart III where their performance curve closely approximates the 50th percentile level. The low vertical jump score was an unexpected finding since this group should possess a fair amount of strength and power with very little excess weight. This group would be a bit heavier and not quite as strong as the strong mesomorph and as a result, slightly below average agility run, trunk flexion, and trunk extension scores might be expected. Their performance on situps and pushups reached the 60th percentile level while their strength was only average. It was easy to see why the PF Plan performance of the moderate mesomorph group also fell along the 50th percentile since they came very close to being a mean group for the

CHART III

PROFILE CHART OF BODY TYPE GROUP #10 (MODERATE MESOMORPH)* PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE PP PLAN

	ACTIVITY TESTS									PP PLAN				
Percentile°	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1;30 Recovery	Agility Run Secs.	Trunk Flex. Inches +	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	29.0 in.	200 lbs.	200 lbs.	26	15.0 secs.	+9.0 ins.	32.0 ins.	99	70	24	29	29	31	40
95	27.0 in.	161 lbs.	146 lbs.	42	16.9 secs.	+7.9 ins.	26.8 ins.	75	41	19	22	26	32	37
90	25.6 in.	153 lbs.	140 lbs.	45	17.2 secs.	+6.8 ins.	25.8 ins.	69	37	17	20	24	27	32
85	24.6 in.	146 lbs.	135 lbs.	48	17.5 secs.	+6.3 ins.	24.9 ins.	61	35	16	19	22	25	30
80	24.0 in.	141 lbs.	130 lbs.	50	17.7 secs.	+5.8 ins.	24.3 ins.	54	32	15	18	21	24	28
75	23.6 in.	140 lbs.	125 lbs.	52	17.9 secs.	+5.4 ins.	23.7 ins.	51	31	14	17	20	23	26
70	23.0 in.	137 lbs.	122 lbs.	54	18.0 secs.	+5.0 ins.	23.1 ins.	49	30	14	16	19	22	25
65	22.8 in.	134 lbs.	121 lbs.	56	18.2 secs.	+4.6 ins.	22.6 ins.	45	29	13	16	19	21	24
60	22.6 in.	131 lbs.	120 lbs.	57	18.3 secs.	+4.3 ins.	22.0 ins.	42	27	13	15	18	20	23
55	22.1 in.	130 lbs.	116 lbs.	58	18.6 secs.	+4.1 ins.	21.5 ins.	41	26	12	15	17	20	23
50	21.8 in.	128 lbs.	114 lbs.	60	18.7 secs.	+3.8 ins.	20.9 ins.	39	25	12	14	16	19	22
45	21.8 in.	122 lbs.	111 lbs.	61	19.1 secs.	+3.7 ins.	20.7 ins.	37	25	11	13	16	18	20
40	20.7 in.	121 lbs.	110 lbs.	62	19.2 secs.	+3.4 ins.	19.6 ins.	35	20	11	13	15	17	19
35	20.3 in.	120 lbs.	107 lbs.	63	19.3 secs.	+3.1 ins.	18.8 ins.	33	23	10	13	14	16	18
30	20.0 in.	119 lbs.	104 lbs.	64	19.5 secs.	+2.8 ins.	18.1 ins.	31	22	10	12	13	15	17
25	19.3 in.	115 lbs.	101 lbs.	65	19.7 secs.	+1.8 ins.	17.3 ins.	30	20	9	11	13	15	16
20	18.2 in.	111 lbs.	100 lbs.	67	20.1 secs.	+1.2 ins.	16.3 ins.	28	19	9	11	12	14	15
15	18.0 in.	110 lbs.	97 lbs.	69	20.3 secs.	+0.6 ins.	14.9 ins.	25	18	8	10	11	13	14
10	16.7 in.	106 lbs.	92 lbs.	71	20.7 secs.	-0.5 ins.	13.3 ins.	23	16	7	9	10	12	13
5	15.3 in.	100 lbs.	90 lbs.	75	21.6 secs.	-2.7 ins.	11.5 ins.	19	13	6	7	9	10	11
0	6.5 in.	95 lbs.	85 lbs.	99	29.6 secs.	-9.0 ins.	1.0 ins.	2	2	1	1	1	1	1
N	1733	1741	1716	1685	1698	1769	1682	1727	1700	1708	1580	1597	1583	1589

°Percentiles developed by actual IBM card counts rather than by formula.

MEAN

ONE STANDARD DEVIATION

* INCLUDES BODY TYPES - 242, 343, 232.

Table III

PERCENTILE TABLES OF BODY TYPE GROUP #10 (MODERATE MESOMORPH) PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE PP PLAN

	Activity Test Battery									PP Plan				
Percentile	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1;30 Recovery	Agility Run Secs.	Trunk Flex. Inches +	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	29.0 in.	180 lbs.	198 lbs.	31	15.9 secs.	+9.0 ins.	30.0 ins.	75	52	20	24	26	48	60
95	26.2 in.	157 lbs.	143 lbs.	42	17.0 secs.	+7.6 ins.	27.4 ins.	73	42	18	21	25	31	36
90	24.9 in.	150 lbs.	139 lbs.	46	17.3 secs.	+6.9 ins.	25.9 ins.	68	39	17	20	24	27	32
85	24.3 in.	145 lbs.	131 lbs.	49	17.5 secs.	+6.5 ins.	25.1 ins.	59	37	16	18	22	25	29
80	23.6 in.	142 lbs.	129 lbs.	51	17.8 secs.	+6.0 ins.	24.7 ins.	52	36	15	18	21	24	27
75	23.2 in.	140 lbs.	125 lbs.	54	17.9 secs.	+5.6 ins.	24.2 ins.	50	33	14	17	20	23	26
70	22.8 in.	136 lbs.	122 lbs.	56	18.0 secs.	+5.3 ins.	23.7 ins.	48	32	14	16	19	22	25
65	22.6 in.	133 lbs.	120 lbs.	57	18.2 secs.	+4.9 ins.	22.8 ins.	46	30	13	16	19	22	24
60	22.5 in.	132 lbs.	117 lbs.	58	18.4 secs.	+4.6 ins.	22.3 ins.	43	29	13	15	18	21	23
55	22.2 in.	130 lbs.	115 lbs.	59	18.6 secs.	+4.3 ins.	21.5 ins.	41	28	13	15	18	20	23
50	21.7 in.	126 lbs.	113 lbs.	60	18.7 secs.	+4.0 ins.	20.6 ins.	40	27	12	14	17	20	22
45	21.2 in.	122 lbs.	111 lbs.	61	19.1 secs.	+3.7 ins.	19.9 ins.	39	26	12	14	16	19	21
40	20.7 in.	121 lbs.	110 lbs.	62	19.2 secs.	+3.4 ins.	19.3 ins.	37	25	11	13	16	18	20
35	20.3 in.	121 lbs.	107 lbs.	63	19.4 secs.	+3.1 ins.	18.8 ins.	35	25	11	13	15	17	19
30	19.9 in.	120 lbs.	103 lbs.	65	19.5 secs.	+2.7 ins.	18.1 ins.	34	24	10	12	14	16	18
25	19.1 in.	118 lbs.	101 lbs.	66	19.8 secs.	+2.3 ins.	17.6 ins.	32	23	10	12	13	15	17
20	18.2 in.	111 lbs.	100 lbs.	68	20.0 secs.	+2.0 ins.	16.9 ins.	30	21	9	11	13	14	15
15	18.0 in.	110 lbs.	96 lbs.	71	20.5 secs.	+1.6 ins.	15.6 ins.	28	20	8	10	12	13	14
10	17.8 in.	105 lbs.	91 lbs.	73	20.6 secs.	+0.6 ins.	14.8 ins.	27	19	7	9	11	12	13
5	16.8 in.	100 lbs.	85 lbs.	76	21.3 secs.	-1.6 ins.	13.3 ins.	22	17	6	8	10	11	12
0	7.5 in.	80 lbs.	75 lbs.	87	23.0 secs.	-8.0 ins.	8.0 ins.	13	7	3	4	5	6	7
N	172	171	170	159	168	174	157	169	170	167	156	153	152	160

entire population.

The endomorphic mesomorph group, shown in Chart IV, should have been the strongest of all the groups studied. In spite of this fact, their vertical jump score was slightly below average due to the excess weight carried. As expected, the grip strength scores paralleled the 65th percentile. Their pulse rate score at the 60th percentile was rather surprising, since the extra weight carried by this group might logically result in a lower score. The lower scores on the agility run, trunk flexion, and trunk extension were expected also because of the endomorphic tendencies of this group. This also was probably the cause of the situp scores being only slightly above average, but the great strength of this group resulted in pushup scores at the 65th percentile. Since the overall curve of this group ranged from the 65th percentile level to the 35th, its performance on the PF Plan would have been expected to fall around the 50th percentile or slightly higher, which was the case.

The ectomorphic mesomorphs performed better on all the tests than any other group studied. It is shown in Chart V that every test fell in the 60th to 65th percentile range except for trunk flexion, at the 50th percentile level, and trunk extension, at the 40th percentile level. The vertical jump,

CHART IV

PROFILE CHART OF BODY TYPE GROUP #11 (ENDOMORPHIC MESOMORPH)* PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE FP PLAN

	ACTIVITY TESTS									FP PLAN			
Percentile*	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches +	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	35.0 in.	200 lbs.	200 lbs.	28	15.0 secs.	+9.0 ins.	32.0 ins.	99	70	24	29	29	31	40
95	27.0 in.	161 lbs.	146 lbs.	42	16.9 secs.	+7.9 ins.	26.8 ins.	75	41	19	22	26	28	37
90	25.6 in.	153 lbs.	140 lbs.	45	17.2 secs.	+6.8 ins.	25.8 ins.	69	37	17	20	24	27	32
85	24.6 in.	148 lbs.	133 lbs.	48	17.5 secs.	+6.3 ins.	24.9 ins.	61	35	16	19	22	25	30
80	24.0 in.	141 lbs.	130 lbs.	50	17.7 secs.	+5.8 ins.	24.3 ins.	58	32	15	18	21	24	28
75	23.6 in.	140 lbs.	125 lbs.	52	17.9 secs.	+5.4 ins.	23.7 ins.	51	31	14	17	20	23	26
70	23.0 in.	137 lbs.	122 lbs.	54	18.0 secs.	+5.0 ins.	23.1 ins.	49	30	14	16	19	22	25
65	22.8 in.	134 lbs.	121 lbs.	56	18.2 secs.	+4.6 ins.	22.6 ins.	45	28	13	16	19	21	24
60	22.6 in.	131 lbs.	120 lbs.	57	18.3 secs.	+4.3 ins.	22.0 ins.	42	27	13	15	18	20	23
55	22.1 in.	130 lbs.	116 lbs.	58	18.6 secs.	+4.1 ins.	21.5 ins.	41	26	12	14	17	19	22
50	21.8 in.	126 lbs.	113 lbs.	60	18.7 secs.	+3.8 ins.	20.9 ins.	39	25	11	14	16	19	21
45	21.0 in.	122 lbs.	111 lbs.	61	18.9 secs.	+3.4 ins.	20.1 ins.	37	25	11	13	16	18	20
40	20.8 in.	121 lbs.	110 lbs.	62	19.1 secs.	+3.1 ins.	19.6 ins.	35	24	11	13	15	17	19
35	20.3 in.	120 lbs.	109 lbs.	63	19.3 secs.	+2.7 ins.	18.8 ins.	33	23	10	13	14	16	18
30	20.0 in.	119 lbs.	104 lbs.	64	19.5 secs.	+2.2 ins.	18.1 ins.	31	22	10	12	13	15	17
25	19.3 in.	115 lbs.	101 lbs.	65	19.7 secs.	+1.8 ins.	17.3 ins.	30	20	9	11	13	15	16
20	18.8 in.	111 lbs.	100 lbs.	67	20.1 secs.	+1.2 ins.	16.3 ins.	28	19	9	11	12	14	15
15	18.0 in.	110 lbs.	97 lbs.	69	20.3 secs.	+0.6 ins.	14.9 ins.	25	18	8	10	11	13	14
10	16.7 in.	106 lbs.	92 lbs.	71	20.7 secs.	-0.5 ins.	13.3 ins.	23	16	7	9	10	12	13
5	15.3 in.	100 lbs.	90 lbs.	75	21.6 secs.	-2.7 ins.	11.5 ins.	19	13	6	7	9	10	11
0	6.5 in.	45 lbs.	25 lbs.	99	29.6 secs.	-9.0 ins.	1.0 ins.	2	2	1	1	1	1	1
N	1733	1741	1716	1645	1698	1769	1682	1727	1740	1708	1580	1597	1583	1609

*Percentiles developed by actual IBM card counts rather than by formula.

———— MEAN

– – – – – ONE STANDARD DEVIATION

* INCLUDES BODY TYPES - 271, 371, 472, 261, 361, 362, 461, 463, 563, 251, 351, 352, 451, 452, 453, 241, 341, 342.

Table IV

PERCENTILE TABLES OF BODY TYPE GROUP #11 (ENDOMORPHIC MESOMORPH) PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE FP PLAN

	Activity Test Battery									FP Plan				
Percentile	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches +	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	30.5 in.	200 lbs.	200 lbs.	30	16.2 secs.	+9.0 ins.	28.0 ins.	81	53	20	27	37	46	53
95	26.7 in.	171 lbs.	154 lbs.	42	17.0 secs.	+7.8 ins.	26.6 ins.	70	47	19	23	29	35	41
90	25.4 in.	161 lbs.	142 lbs.	43	17.4 secs.	+6.9 ins.	25.1 ins.	69	39	18	21	26	29	33
85	24.5 in.	157 lbs.	141 lbs.	46	17.6 secs.	+6.5 ins.	24.6 ins.	60	37	16	19	23	26	31
80	24.3 in.	151 lbs.	137 lbs.	49	17.8 secs.	+6.0 ins.	24.0 ins.	53	35	15	18	21	25	30
75	24.0 in.	147 lbs.	132 lbs.	50	17.9 secs.	+5.5 ins.	23.3 ins.	51	33	14	18	21	24	28
70	23.5 in.	143 lbs.	130 lbs.	52	18.0 secs.	+5.0 ins.	22.8 ins.	49	32	14	17	20	23	27
65	23.1 in.	141 lbs.	128 lbs.	54	18.2 secs.	+4.7 ins.	22.4 ins.	45	31	14	16	19	22	26
60	22.9 in.	140 lbs.	121 lbs.	56	18.6 secs.	+4.4 ins.	22.1 ins.	41	31	13	16	19	22	25
55	22.6 in.	136 lbs.	121 lbs.	58	18.6 secs.	+4.2 ins.	21.4 ins.	40	29	13	15	18	21	24
50	22.3 in.	133 lbs.	120 lbs.	59	18.8 secs.	+3.8 ins.	20.7 ins.	40	28	12	15	18	20	23
45	22.0 in.	131 lbs.	118 lbs.	60	19.0 secs.	+3.4 ins.	20.0 ins.	38	26	12	14	17	19	22
40	21.1 in.	129 lbs.	116 lbs.	61	19.1 secs.	+3.0 ins.	19.1 ins.	35	26	12	14	16	18	21
35	20.6 in.	124 lbs.	111 lbs.	62	19.2 secs.	+2.6 ins.	18.7 ins.	33	25	11	13	15	18	20
30	20.3 in.	121 lbs.	110 lbs.	63	19.4 secs.	+2.2 ins.	18.0 ins.	31	24	10	13	14	17	19
25	19.8 in.	120 lbs.	110 lbs.	65	19.6 secs.	+1.7 ins.	17.4 ins.	30	23	10	12	14	16	18
20	19.2 in.	118 lbs.	106 lbs.	67	19.8 secs.	+0.9 ins.	16.8 ins.	28	21	9	12	13	15	17
15	18.3 in.	112 lbs.	101 lbs.	70	20.1 secs.	+0.1 ins.	15.7 ins.	27	20	9	11	13	14	16
10	17.1 in.	111 lbs.	100 lbs.	71	20.5 secs.	-0.2 ins.	14.1 ins.	23	19	8	10	12	13	14
5	16.2 in.	107 lbs.	91 lbs.	75	21.3 secs.	-3.8 ins.	12.5 ins.	21	14	6	9	10	11	13
0	9.0 in.	92 lbs.	82 lbs.	82	29.6 secs.	-8.0 ins.	5.0 ins.	13	9	3	6	7	8	1
N	165	165	163	153	160	167	146	166	165	165	151	146	145	161

CHART V

PROFILE CHART OF BODY TYPE GROUP #12 (ECTOMORPHIC MESOMORPH)* PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE PT PLAN

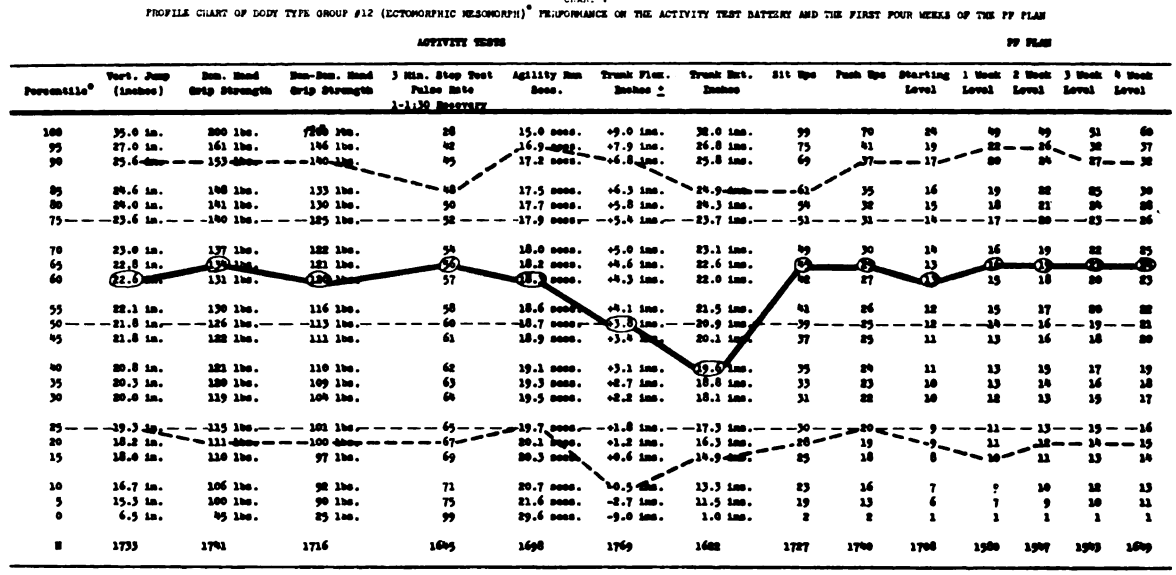

Table V

PERCENTILE TABLES OF BODY TYPE GROUP #12 (ECTOMORPHIC MESOMORPH) PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE PT PLAN

	Activity Test Battery									PT Plan				
Percentile	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches + −	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	35.0 in.	200 lbs.	175 lbs.	30	15.0 secs.	+9.0 ins.	31.0 ins.	99	70	84	89	89	91	93
95	28.0 in.	174 lbs.	151 lbs.	39	16.5 secs.	+8.4 ins.	27.2 ins.	76	43	80	85	90	97	96
90	26.8 in.	161 lbs.	145 lbs.	43	16.9 secs.	+7.5 ins.	26.1 ins.	75	40	18	22	86	91	96
85	26.0 in.	151 lbs.	141 lbs.	45	17.0 secs.	+6.8 ins.	25.4 ins.	74	37	17	81	85	88	92
80	25.2 in.	149 lbs.	133 lbs.	48	17.3 secs.	+6.5 ins.	24.8 ins.	64	36	17	80	83	86	91
75	24.6 in.	144 lbs.	130 lbs.	49	17.5 secs.	+6.1 ins.	24.1 ins.	57	35	16	19	82	85	90
70	24.3 in.	141 lbs.	126 lbs.	50	17.6 secs.	+5.8 ins.	23.4 ins.	52	33	15	18	82	85	88
65	24.1 in.	140 lbs.	122 lbs.	53	17.8 secs.	+5.4 ins.	22.8 ins.	51	32	15	18	21	24	27
60	23.5 in.	138 lbs.	121 lbs.	55	17.9 secs.	+5.1 ins.	22.3 ins.	47	31	14	17	20	23	25
55	23.0 in.	135 lbs.	121 lbs.	56	18.0 secs.	+4.8 ins.	21.7 ins.	45	30	14	16	19	22	24
50	22.7 in.	132 lbs.	119 lbs.	57	18.1 secs.	+4.4 ins.	21.2 ins.	42	29	13	16	19	21	24
45	22.4 in.	130 lbs.	116 lbs.	59	18.2 secs.	+4.0 ins.	20.2 ins.	40	28	13	15	18	20	22
40	22.1 in.	126 lbs.	111 lbs.	60	18.5 secs.	+3.7 ins.	19.5 ins.	37	26	12	15	17	19	21
35	21.6 in.	122 lbs.	110 lbs.	61	18.7 secs.	+3.4 ins.	18.8 ins.	35	26	12	14	16	19	21
30	21.0 in.	121 lbs.	109 lbs.	63	19.0 secs.	+3.1 ins.	18.2 ins.	33	25	11	13	16	18	20
25	20.7 in.	120 lbs.	105 lbs.	65	19.1 secs.	+2.6 ins.	17.1 ins.	31	24	11	13	15	17	19
20	20.2 in.	115 lbs.	102 lbs.	66	19.3 secs.	+2.0 ins.	15.5 ins.	30	23	10	12	14	16	17
15	19.3 in.	111 lbs.	100 lbs.	69	19.7 secs.	+1.4 ins.	14.3 ins.	27	21	10	12	13	14	16
10	18.1 in.	106 lbs.	93 lbs.	70	20.1 secs.	+0.8 ins.	12.9 ins.	24	19	9	10	12	13	15
5	16.1 in.	100 lbs.	82 lbs.	73	21.0 secs.	-1.0 ins.	9.9 ins.	21	15	7	9	11	11	12
0	6.7 in.	79 lbs.	70 lbs.	98	23.0 secs.	-9.0 ins.	1.0 ins.	12	5	3	3	4	5	6
N	293	291	288	277	287	297	277	290	296	289	259	257	256	274

pulse rate, agility run, situp, and pushup scores were expected due to the adequate strength, small body weight, and flexibility exhibited by this group. However, groups with ectomorphic tendencies usually do not demonstrate such great strength. An average score on trunk flexion was looked for, but perhaps a higher score on trunk extension could have been expected for this group. As anticipated from the test scores, the PF Plan performance of this group ranged from the 60th to the 65th percentile level.

Shown in Chart VI is the performance of the ectomorph-mesomorph group. This was another group closely paralleling the 50th percentile, twice rising well above it and once dipping below it. With an even balance between ectomorphic and mesomorphic characteristics, this group could have been expected to possess an average amount of strength, power, and flexibility with above average endurance. Most of the test scores bear this out. However, the agility run score at the 50th percentile level should have been higher for this group, as should trunk flexion. Nevertheless, there seemed to be a tendency for all of the groups studied to score rather low on both trunk flexion and trunk extension. The ectomorph-mesomorph group was one of the few to score above the 50th percentile on trunk extension although this was to be expected.

CHART VI

PROFILE CHART OF BODY TYPE GROUP #13 (ECTOMORPH-MESOMORPH)* PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE PP PLAN

	ACTIVITY TESTS									PP PLAN				
Percentile*	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches +	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	35.0 in.	200 lbs.	200 lbs.	28	15.0 secs.	+9.0 ins.	32.0 ins.	99	70	26	29	29	51	60
95	27.0 in.	161 lbs.	146 lbs.	42	16.9 secs.	+7.9 ins.	26.8 ins.	75	41	19	22	26	32	37
90	25.6 in.	153 lbs.	140 lbs.	45	17.2 secs.	+6.8 ins.	25.8 ins.	69	37	17	20	24	27	32
85	24.6 in.	148 lbs.	135 lbs.	48	17.5 secs.	+6.1 ins.	24.9 ins.	61	35	16	19	22	25	30
80	24.0 in.	141 lbs.	130 lbs.	50	17.7 secs.	+5.6 ins.	24.3 ins.	58	32	15	18	21	24	28
75	23.6 in.	140 lbs.	125 lbs.	52	17.9 secs.	+5.4 ins.	23.7 ins.	51	31	14	17	20	23	26
70	23.0 in.	137 lbs.	122 lbs.	54	18.0 secs.	+5.0 ins.	23.1 ins.	49	30	14	16	19	22	25
65	22.8 in.	134 lbs.	121 lbs.	54	18.2 secs.	+4.6 ins.	22.6 ins.	45	29	13	16	19	21	24
60	22.6 in.	131 lbs.	120 lbs.	57	18.3 secs.	+4.3 ins.	22.0 ins.	42	27	13	15	18	20	23
55	22.1 in.	130 lbs.	116 lbs.	58	18.6 secs.	+4.1 ins.	21.5 ins.	41	26	12	15	17	19	22
50	21.8 in.	126 lbs.	112 lbs.	60	18.7 secs.	+3.8 ins.	20.9 ins.	39	25	12	14	16	19	21
45	21.8 in.	122 lbs.	111 lbs.	61	18.9 secs.	+3.4 ins.	20.1 ins.	37	25	11	13	16	18	20
40	20.8 in.	121 lbs.	110 lbs.	62	19.1 secs.	+3.1 ins.	19.6 ins.	35	24	11	13	15	17	19
35	20.3 in.	120 lbs.	109 lbs.	63	19.3 secs.	+2.7 ins.	18.8 ins.	33	23	10	13	14	16	18
30	20.0 in.	119 lbs.	108 lbs.	63	19.5 secs.	+2.2 ins.	18.1 ins.	31	22	10	12	13	15	17
25	19.3 in.	115 lbs.	101 lbs.	65	19.7 secs.	+1.8 ins.	17.3 ins.	30	20	9	11	13	15	16
20	18.2 in.	111 lbs.	100 lbs.	67	20.1 secs.	+1.2 ins.	16.3 ins.	28	19	9	11	12	14	15
15	18.0 in.	110 lbs.	97 lbs.	69	20.3 secs.	+0.6 ins.	14.9 ins.	25	18	8	10	11	13	14
10	16.7 in.	106 lbs.	92 lbs.	71	20.7 secs.	-0.5 ins.	13.3 ins.	23	16	7	9	10	12	13
5	15.3 in.	100 lbs.	90 lbs.	75	21.6 secs.	-2.7 ins.	11.5 ins.	19	13	6	7	9	10	11
0	6.5 in.	95 lbs.	85 lbs.	99	23.6 secs.	-9.0 ins.	1.0 ins.	2	2	1	1	1	1	1
N	1735	1741	1716	1695	1698	1769	1682	1727	1700	1708	1588	1587	1583	1609

*Percentiles developed by actual IBM card counts rather than by formula.

MEAN

ONE STANDARD DEVIATION

* INCLUDES BODY TYPES - 144, 155, 233, 244, 255, 355.

Table VI

PERCENTILE TABLES OF BODY TYPE GROUP #13 (ECTOMORPH-MESOMORPH) PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE PP PLAN

	Activity Test Battery									PP Plan				
Percentile	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches +	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	38.0 in.	200 lbs.	162 lbs.	30	15.0 secs.	+9.0 ins.	30.0 ins.	81	60	21	26	32	40	51
95	27.6 in.	160 lbs.	146 lbs.	39	16.9 secs.	+7.6 ins.	26.9 ins.	78	37	18	23	25	36	39
90	25.7 in.	152 lbs.	140 lbs.	44	17.2 secs.	+6.8 ins.	25.7 ins.	71	35	17	20	24	28	32
85	24.5 in.	144 lbs.	132 lbs.	46	17.6 secs.	+6.1 ins.	24.9 ins.	64	32	16	19	23	26	29
80	24.3 in.	142 lbs.	129 lbs.	47	17.8 secs.	+5.6 ins.	24.3 ins.	61	31	15	18	22	25	28
75	24.0 in.	141 lbs.	125 lbs.	49	17.9 secs.	+5.3 ins.	23.8 ins.	59	31	14	18	21	24	27
70	23.4 in.	140 lbs.	121 lbs.	52	18.0 secs.	+5.0 ins.	23.3 ins.	52	30	14	17	20	23	26
65	23.1 in.	135 lbs.	120 lbs.	54	18.1 secs.	+4.6 ins.	22.9 ins.	50	28	13	16	19	22	25
60	22.9 in.	132 lbs.	119 lbs.	55	18.3 secs.	+4.4 ins.	22.4 ins.	47	27	13	15	18	21	24
55	22.6 in.	131 lbs.	115 lbs.	56	18.6 secs.	+4.1 ins.	21.8 ins.	45	26	13	15	17	20	23
50	22.4 in.	126 lbs.	112 lbs.	57	18.6 secs.	+3.7 ins.	21.4 ins.	43	25	12	14	17	20	22
45	22.0 in.	125 lbs.	111 lbs.	59	18.7 secs.	+3.4 ins.	20.9 ins.	41	25	12	14	16	19	21
40	21.3 in.	121 lbs.	110 lbs.	61	19.0 secs.	+3.1 ins.	20.4 ins.	40	24	11	13	16	18	20
35	20.9 in.	120 lbs.	106 lbs.	62	19.1 secs.	+2.7 ins.	20.0 ins.	35	24	11	13	15	17	20
30	20.4 in.	119 lbs.	102 lbs.	63	19.3 secs.	+2.3 ins.	19.5 ins.	33	23	10	13	15	17	19
25	20.1 in.	115 lbs.	101 lbs.	63	19.5 secs.	+1.9 ins.	18.8 ins.	31	22	10	12	14	16	19
20	19.5 in.	111 lbs.	97 lbs.	64	19.6 secs.	+1.4 ins.	18.3 ins.	30	21	9	11	14	16	18
15	19.2 in.	110 lbs.	93 lbs.	66	20.0 secs.	+0.8 ins.	17.4 ins.	28	20	8	11	13	15	16
10	18.6 in.	105 lbs.	91 lbs.	68	20.2 secs.	+0.2 ins.	16.5 ins.	25	18	7	10	12	13	15
5	17.0 in.	100 lbs.	90 lbs.	70	21.1 secs.	-1.5 ins.	14.2 ins.	22	16	6	9	11	11	12
0	11.0 in.	93 lbs.	70 lbs.	79	22.9 secs.	-6.0 ins.	9.0 ins.	13	12	4	5	8	9	10
N	138	134	133	129	131	133	125	138	133	131	123	121	120	129

The PF Plan performance first paralleled the 50th percentile and then rose above it.

The mesomorphic ectomorph group contained more subjects than any other group in the study. Their performance is shown in Chart VII. In general, they scored below average on most of the tests in the battery, although this was to be expected. Perhaps the agility run, trunk flexion, and trunk extension scores should have been somewhat higher due to the flexibility and agility usually exhibited by this group. Since all of the scores of the mesomorphic ectomorphs fell between the 55th percentile level and the 35th percentile level, its PF Plan performance would be expected to fall slightly below the 50th percentile, which it did.

The performance of the final group studied, which was classified as balanced because it tended to exhibit the same degree for each body type component, is shown in Chart VIII. While this group was slightly above average in strength, most of its other scores fell below average with trunk flexion down at the 30th percentile level. This score and the pushup score, which fell at the 35th percentile level, seem to be slightly below what might be expected for this grouping. The PF Plan scores, which ranged from the 35th percentile up to the 50th percentile, were also slightly below what one might

CHART VII

PROFILE CHART OF BODY TYPE GROUP #18 (MESOMORPHIC ECTOMORPH)* PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE PF PLAN

	ACTIVITY TESTS									PF PLAN				
Percentile*	Vert. Jump (Inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches +	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	35.0 in.	200 lbs.	200 lbs.	88	15.0 secs.	+9.0 ins.	32.0 ins.	99	70	20	49	69	51	60
95	27.0 in.	161 lbs.	146 lbs.	82	16.9 secs.	+7.9 ins.	26.8 ins.	75	41	19	22	26	32	37
90	25.6 in.	153 lbs.	148 lbs.	69	17.2 secs.	+6.8 ins.	25.8 ins.	69	37	17	20	24	27	32
85	24.6 in.	148 lbs.	133 lbs.	68	17.5 secs.	+6.3 ins.	24.9 ins.	61	35	16	19	22	25	30
80	24.0 in.	141 lbs.	130 lbs.	50	17.7 secs.	+5.8 ins.	24.3 ins.	58	32	15	18	21	24	28
75	23.6 in.	140 lbs.	125 lbs.	58	17.9 secs.	+5.4 ins.	23.7 ins.	51	31	14	17	20	23	26
70	23.0 in.	137 lbs.	122 lbs.	54	18.0 secs.	+5.0 ins.	23.1 ins.	49	30	14	16	19	22	25
65	22.8 in.	134 lbs.	121 lbs.	56	18.2 secs.	+4.6 ins.	22.6 ins.	45	29	13	16	19	21	24
60	22.6 in.	131 lbs.	120 lbs.	57	18.3 secs.	+4.3 ins.	22.0 ins.	42	27	13	15	18	20	23
55	22.1 in.	130 lbs.	116 lbs.	59	18.6 secs.	+4.1 ins.	21.5 ins.	41	26	12	15	17	20	22
50	21.8 in.	126 lbs.	113 lbs.	60	18.7 secs.	+3.8 ins.	20.9 ins.	38	23	11	13	16	18	20
45	21.3 in.	120 lbs.	106 lbs.	61	18.8 secs.	+3.3 ins.	19.9 ins.	36	23	11	13	15	17	19
40	20.9 in.	116 lbs.	104 lbs.	61	19.1 secs.	+2.9 ins.	19.3 ins.	34	22	10	12	14	16	18
35	20.4 in.	115 lbs.	101 lbs.	62	19.3 secs.	+2.6 ins.	18.7 ins.	32	20	10	12	14	15	17
30	20.1 in.	111 lbs.	100 lbs.	64	19.5 secs.	+2.2 ins.	18.1 ins.	31	20	9	12	13	15	16
25	19.4 in.	111 lbs.	99 lbs.	65	19.7 secs.	+1.7 ins.	17.1 ins.	30	19	9	11	13	14	16
20	18.7 in.	108 lbs.	95 lbs.	67	20.0 secs.	+1.3 ins.	15.7 ins.	27	18	8	10	12	13	15
15	18.2 in.	102 lbs.	91 lbs.	69	20.4 secs.	+0.7 ins.	14.4 ins.	24	17	7	9	11	13	14
10	17.1 in.	100 lbs.	88 lbs.	71	20.8 secs.	+0.0 ins.	12.8 ins.	23	14	6	9	10	12	13
5	15.1 in.	98 lbs.	81 lbs.	76	21.5 secs.	-2.6 ins.	11.3 ins.	19	13	5	7	9	10	11
0	9.0 in.	73 lbs.	70 lbs.	90	23.5 secs.	-7.0 ins.	1.0 ins.	12	4	2	3	4	5	1
N	1733	1781	1716	1695	1698	1769	1682	1787	1780	1788	1588	1587	1583	1589

*Percentiles developed by actual IBM card counts rather than by formula.

MEAN

ONE STANDARD DEVIATION

* INCLUDES BODY TYPES - 127, 137, 126, 136, 146, 236, 246, 256, 346, 125, 135, 145, 235, 245, 345, 134, 234.

Table VII

PERCENTILE TABLES OF BODY TYPE GROUP #18 (MESOMORPHIC ECTOMORPH) PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE PF PLAN

	Activity Test Battery									PF Plan				
Percentile	Vert. Jump Inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1:30 Recovery	Agility Run Secs.	Trunk Flex. Inches + -	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	38.0 in.	180 lbs.	170 lbs.	83	15.1 secs.	+9.0 ins.	32.0 ins.	75	57	19	34	45	45	49
95	26.8 in.	151 lbs.	133 lbs.	68	16.9 secs.	+7.5 ins.	26.9 ins.	75	38	17	20	25	28	35
90	25.4 in.	142 lbs.	130 lbs.	66	17.3 secs.	+6.5 ins.	26.0 ins.	63	34	16	19	22	25	30
85	24.6 in.	137 lbs.	124 lbs.	49	17.6 secs.	+5.9 ins.	25.1 ins.	57	31	15	18	21	24	27
80	24.0 in.	134 lbs.	123 lbs.	51	17.8 secs.	+5.4 ins.	24.4 ins.	53	30	14	17	20	23	26
75	23.4 in.	131 lbs.	120 lbs.	53	17.9 secs.	+5.0 ins.	23.8 ins.	51	28	14	16	19	22	25
70	23.1 in.	130 lbs.	117 lbs.	55	18.0 secs.	+4.7 ins.	23.0 ins.	46	27	13	15	18	21	24
65	22.8 in.	126 lbs.	115 lbs.	56	18.1 secs.	+4.4 ins.	22.4 ins.	45	26	13	15	17	20	23
60	22.5 in.	124 lbs.	111 lbs.	57	18.3 secs.	+4.1 ins.	21.9 ins.	41	25	12	14	17	19	22
55	22.2 in.	121 lbs.	111 lbs.	59	18.5 secs.	+3.8 ins.	21.3 ins.	40	25	12	14	16	18	21
50	21.8 in.	121 lbs.	110 lbs.	60	18.6 secs.	+3.5 ins.	20.7 ins.	38	23	11	13	16	18	20
45	21.3 in.	120 lbs.	106 lbs.	61	18.8 secs.	+3.3 ins.	19.9 ins.	36	23	11	13	15	17	19
40	20.9 in.	116 lbs.	104 lbs.	61	19.1 secs.	+2.9 ins.	19.3 ins.	34	22	10	12	14	16	18
35	20.4 in.	115 lbs.	101 lbs.	62	19.3 secs.	+2.6 ins.	18.7 ins.	32	20	10	12	14	15	17
30	20.1 in.	111 lbs.	100 lbs.	64	19.5 secs.	+2.2 ins.	18.1 ins.	31	20	9	12	13	15	16
25	19.4 in.	111 lbs.	99 lbs.	65	19.7 secs.	+1.7 ins.	17.1 ins.	30	19	9	11	13	14	16
20	18.7 in.	108 lbs.	95 lbs.	67	20.0 secs.	+1.3 ins.	15.7 ins.	27	18	8	10	12	13	15
15	18.2 in.	102 lbs.	91 lbs.	69	20.4 secs.	+0.7 ins.	14.4 ins.	24	17	7	9	11	13	14
10	17.1 in.	100 lbs.	88 lbs.	71	20.8 secs.	+0.0 ins.	12.8 ins.	23	14	6	9	10	12	13
5	15.1 in.	98 lbs.	81 lbs.	76	21.5 secs.	-2.6 ins.	11.3 ins.	19	13	5	7	9	10	11
0	9.0 in.	73 lbs.	70 lbs.	90	23.5 secs.	-7.0 ins.	1.0 ins.	12	4	2	3	4	5	1
N	402	404	398	388	400	409	383	403	404	395	371	356	357	365

CHART VIII

PROFILE CHART OF BODY TYPE GROUP #19 (BALANCED)* PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE FP PLAN

	Activity Tests										FP Plan				
Percentile*	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1;30 Recovery	Agility Run Secs.	Trunk Flex. Inches ±	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	35.0 in.	200 lbs.	200 lbs.	28	15.0 secs.	+9.0 ins.	32.0 ins.	99	70	24	49	49	51	60
95	27.0 in.	161 lbs.	166 lbs.	42	16.9 secs.	+7.9 ins.	26.8 ins.	73	41	19	22	26	32	37
90	25.6 in.	153 lbs.	148 lbs.	49	17.2 secs.	+6.8 ins.	25.8 ins.	69	37	17	20	24	27	32
85	24.6 in.	148 lbs.	133 lbs.	48	17.5 secs.	+6.3 ins.	24.9 ins.	61	35	16	19	22	25	30
80	24.0 in.	141 lbs.	130 lbs.	50	17.7 secs.	+5.8 ins.	24.3 ins.	59	32	15	18	21	24	28
75	23.6 in.	140 lbs.	125 lbs.	52	17.9 secs.	+5.4 ins.	23.7 ins.	51	31	14	17	20	23	26
70	23.0 in.	137 lbs.	122 lbs.	54	18.0 secs.	+5.0 ins.	23.1 ins.	49	30	14	16	19	22	25
65	22.8 in.	134 lbs.	121 lbs.	56	18.2 secs.	+4.6 ins.	22.6 ins.	45	29	13	16	19	21	24
60	22.6 in.	131 lbs.	120 lbs.	57	18.3 secs.	+4.3 ins.	22.0 ins.	42	27	13	15	18	20	23
55	22.1 in.	130 lbs.	118 lbs.	58	18.6 secs.	+4.1 ins.	21.5 ins.	41	26	12	15	17	20	22
50	21.8 in.	126 lbs.	113 lbs.	60	18.7 secs.	+3.8 ins.	20.9 ins.	37	25	12	14	16	19	21
45	21.8 in.	122 lbs.	111 lbs.	61	18.9 secs.	+3.4 ins.	20.3 ins.	37	25	11	13	16	18	20
40	20.6 in.	121 lbs.	110 lbs.	62	19.1 secs.	+3.1 ins.	19.6 ins.	35	24	11	13	15	17	19
35	20.3 in.	120 lbs.	109 lbs.	63	19.3 secs.	+2.7 ins.	18.8 ins.	33	23	10	13	14	16	18
30	20.0 in.	119 lbs.	104 lbs.	64	19.5 secs.	+2.3 ins.	18.1 ins.	31	22	10	12	13	15	17
25	19.3 in.	115 lbs.	101 lbs.	65	19.7 secs.	+1.8 ins.	17.3 ins.	30	20	9	11	13	15	16
20	18.2 in.	111 lbs.	100 lbs.	67	20.1 secs.	+1.2 ins.	16.3 ins.	28	19	9	11	12	14	15
15	18.0 in.	110 lbs.	97 lbs.	69	20.3 secs.	+0.6 ins.	14.9 ins.	25	18	8	10	11	13	14
10	16.7 in.	106 lbs.	92 lbs.	71	20.7 secs.	-0.5 ins.	13.3 ins.	23	16	7	9	10	12	13
5	15.3 in.	100 lbs.	90 lbs.	75	21.6 secs.	-2.7 ins.	11.5 ins.	19	13	6	7	9	10	11
0	6.5 in.	45 lbs.	25 lbs.	99	29.6 secs.	-9.0 ins.	1.0 ins.	2	2	1	1	1	1	1
N	1733	1741	1716	1695	1698	1769	1682	1727	1700	1708	1580	1597	1589	1609

*Percentiles developed by actual IBM card counts rather than by formula.

MEAN

ONE STANDARD DEVIATION

* INCLUDES BODY TYPES - 333, 344, 434, 443, 444, 445, 454, 544.

Table VIII

PERCENTILE TABLES OF BODY TYPE GROUP #19 (BALANCED) PERFORMANCE ON THE ACTIVITY TEST BATTERY AND THE FIRST FOUR WEEKS OF THE FP PLAN

	Activity Test Battery										FP Plan				
Percentile	Vert. Jump (inches)	Dom. Hand Grip Strength	Non-Dom. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1;30 Recovery	Agility Run Secs.	Trunk Flex. Inches ±	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	30.0 in.	179 lbs.	180 lbs.	35	16.0 secs.	+9.0 ins.	28.0 ins.	78	44	19	24	28	40	45
95	27.1 in.	163 lbs.	153 lbs.	45	16.9 secs.	+8.7 ins.	26.8 ins.	69	37	17	21	25	29	35
90	25.6 in.	160 lbs.	142 lbs.	49	17.3 secs.	+7.3 ins.	25.6 ins.	63	34	16	19	23	26	30
85	24.6 in.	152 lbs.	138 lbs.	52	17.9 secs.	+6.4 ins.	24.9 ins.	56	31	15	18	22	25	29
80	24.3 in.	148 lbs.	131 lbs.	54	18.1 secs.	+5.8 ins.	24.4 ins.	52	29	14	17	20	24	27
75	23.7 in.	143 lbs.	126 lbs.	55	18.2 secs.	+5.3 ins.	23.9 ins.	51	27	14	17	20	22	26
70	23.0 in.	140 lbs.	123 lbs.	56	18.5 secs.	+4.8 ins.	23.3 ins.	48	26	13	16	19	22	24
65	22.6 in.	135 lbs.	121 lbs.	57	18.6 secs.	+4.3 ins.	22.7 ins.	43	26	13	15	18	21	24
60	22.3 in.	132 lbs.	120 lbs.	58	18.8 secs.	+3.9 ins.	22.1 ins.	41	25	13	15	17	20	22
55	21.9 in.	131 lbs.	118 lbs.	60	19.0 secs.	+3.6 ins.	21.7 ins.	40	24	12	14	16	19	21
50	21.3 in.	130 lbs.	114 lbs.	61	19.1 secs.	+3.3 ins.	21.2 ins.	40	23	12	14	15	18	20
45	20.8 in.	125 lbs.	112 lbs.	62	19.3 secs.	+3.0 ins.	20.7 ins.	37	22	11	13	15	17	19
40	20.4 in.	121 lbs.	110 lbs.	63	19.5 secs.	+2.4 ins.	20.1 ins.	35	21	11	13	14	16	18
35	19.6 in.	120 lbs.	108 lbs.	64	19.7 secs.	+1.8 ins.	19.4 ins.	33	20	10	12	14	16	18
30	19.1 in.	117 lbs.	104 lbs.	65	20.0 secs.	+1.2 ins.	18.6 ins.	31	20	10	11	13	15	17
25	18.5 in.	112 lbs.	102 lbs.	68	20.2 secs.	+0.6 ins.	17.0 ins.	28	19	9	11	12	14	16
20	18.1 in.	111 lbs.	100 lbs.	69	20.5 secs.	-0.2 ins.	16.3 ins.	25	18	8	10	12	13	14
15	17.2 in.	110 lbs.	98 lbs.	71	20.7 secs.	-1.2 ins.	15.7 ins.	24	17	7	9	11	12	13
10	16.0 in.	108 lbs.	92 lbs.	72	21.0 secs.	-2.6 ins.	14.7 ins.	21	15	6	8	10	11	13
5	11.8 in.	102 lbs.	90 lbs.	75	22.0 secs.	-4.7 ins.	12.8 ins.	18	13	5	7	9	10	11
0	9.5 in.	60 lbs.	70 lbs.	88	23.0 secs.	-9.0 ins.	5.0 ins.	13	9	1	1	1	1	3
N	139	141	141	133	135	142	132	140	141	139	129	128	128	136

expect of the balanced group.

In general, all of the body type groupings performed as previous studies indicated they would. There were a few exceptions; the most notable being the low scores made by most of the groups on the trunk flexion and trunk extension tests.

Comparison of Profile Charts

Comparisons of the eight body type groupings on all of the activity tests and the first four weeks of the PF Plan are shown in Charts IX and X.

Vertical Jump. Most of the body type groupings performed on the vertical jump test as expected. The strong mesomorphs and mesomorphs with ectomorphic characteristics scored highest on this test due to their great strength and power with an average or below average amount of weight to lift off the ground. The endomorphic mesomorph group scored slightly higher than anticipated but this was probably due to the fact that they possessed the greatest amount of strength which simply overpowered their excess weight. The moderate mesomorph, mesomorphic ectomorph, and balanced groups possessed less strength and in most cases more weight which accounted for their below average scores. The mesomorphic endomorphs

scored the lowest of all, which was anticipated due to an excess in body weight.

Grip Strength. As expected, the endomorphic mesomorph group was the strongest one studied. The extra weight of this group's members did not handicap them in these tests. Following closely behind were the strong mesomorphs and the ectomorphic mesomorphs; the latter group did surprisingly well in spite of its ectomorphic characteristics which usually belie a slight weakness. The mesomorphic endomorph, moderate mesomorph, balanced, and ectomorph-mesomorph groups all scored about average in strength, which was to be expected. The mesomorphic ectomorphs scored lowest on the strength tests as their ectomorphic component would lead one to expect.

Pulse Rate. Both the ectomorphic mesomorph and the ectomorph-mesomorph groups scored highest on pulse rate following the Harvard Step Test. The endomorphic mesomorphs followed closely behind in pulse rate which was quite surprising due to the endomorphic characteristics exhibted by this group. The strong mesomorphs and the mesomorphic ectomorphs scores fell slightly above average and it would seem that these two groups should be reversed with the endomorphic mesomorph group in pulse rate standing. Average scores were

turned in by the moderate mesomorph and balanced groups while the mesomorphic endomorphs fell well below average, which was looked for due to the excess weight carried by this group.

Agility Run. The strong mesomorphs and the ectomorphic mesomorphs scored well above the other groups on the agility run. This was not surprising since these two groups possessed well muscled bodies with no extra weight to hamper their reactions and change of direction. Average scores were turned in by the ectomorph-mesomorph group and following immediately behind were the moderate mesomorphs, endomorphic mesomorphs, and the mesomorphic ectomorphs. One might have expected the ectomorph-mesomorphs and the mesomorphic ectomorphs to perform at a slightly higher level. The balanced grouping came next and the group which scored lowest was, of course, the mesomorphic endomorph with excess weight which hampered body movements.

Trunk Flexion. The highest scores on trunk flexion were found in the ectomorphic mesomorph group. It was interesting to note that their scores were only average for the total population. This was probably due to the fact that all but one of the ectomorphic body type groups, who normally score well on this test, were not included in this comparison because of the small number of cases in these groups. The

strong and moderate mesomorph groups followed with slightly below average scores, which was anticipated. Rather unexpected was the low scoring of the ectomorph-mesomorph and mesomorphic ectomorph groups, whose ectomorphic characteristics should have enabled them to score higher on this flexibility test. The endomorphic mesomorphs, mesomorphic endomorphs, and balanced groups were poorest in this comparison since their physiques bore an excess of weight.

Trunk Extension. The ectomorph-mesomorph group scored highest on the trunk extension test. Although its score was only slightly above average, this can be explained by the fact that all of the groups' scores fell close together. The moderate mesomorph and the balanced group followed with scores slightly below average as expected. The other five body type groupings' scores were bunched closely together directly below. It would seem that the mesomorphic endomorph performed slightly above what might have been expected due to the lack of flexibility and strength, where body weight is concerned, which is characterized by this group. Also, the ectomorphic mesomorphs and the mesomorphic ectomorphs would have been expected to score higher due to less body weight and more flexibility, which is common to the ectomorphs.

Situps. The strong mesomorphs, ectomorphis mesomorphs,

and ectomorph-mesomorphs scored highest on the situp test as anticipated. These groups combined great strength with average flexibility and body weight to account for these scores. The moderate mesomorphs also did well with the endomorphic mesomorphs following. Only average scores were turned in by the mesomorphic ectomorph and balanced groups, although the former group might be expected to perform better due to its flexibility. Lastly, the mesomorphic endomorphs scored well below the other groups, as was looked for.

Pushups. The highest scores on the pushup test were recorded by the strong mesomorph group while the endomorphic mesomorphs and the ectomorphic mesomorphs followed closely behind as anticipated. Next came the moderate mesomorphs and then the ectomorph-mesomorphs. Well below average came the mesomorphic ectomorph and balanced groups with the mesomorphic endomorphs lowest, as expected. This test came the closest to matching the performance looked for as a result of previous studies.

PF Plan. The performance by each body type grouping on the PF Plan was not at all surprising, as each group followed closely its mean performance on the activity test battery. The strong mesomorphs and the ectomorphic mesomorphs performed at the highest levels on the plan. The endormorphic mesomorph

and ectomorph-mesomorph groups performed slightly above average while the moderate mesomorphs followed closely behind. Slightly below average in performance on the PF Plan were the mesomorphic ectomorph and balanced groups. Lastly, matching their earlier performance on the activity tests, the mesomorphic endomorphs performed at the lowest level on the PF Plan.

Summary of Findings

1. Mesomorphs and mesomorphs with endomorphic characteristics were the strongest of the body type groups studied while ectomorphs and ectomorphs with endomorphic characteristics were the weakest of all the body type groups when the lifting of body weight was involved.

2. Mesomorphs and mesomorphs with ectomorphic characteristics were the most flexible of the body type groups studied while endomorphs and mesomorphs with endomorphic characteristics were the least flexible.

3. Mesomorphs and mesomorphs with ectomorphic characteristics possessed the greatest agility of the body type groups studied while endomorphs possessed the least agility.

4. Mesomorphs, mesomorphs with ectomorphic

characteristics, and ectomorphs with mesomorphic characteristics had the best endurance of the body type groups studied while endomorphs had the poorest endurance.

5. Mesomorphs and mesomorphs with ectomorphic characteristics constitute the most natural physically fit body type groupings while those high in endomorphic characteristics constitute the least physically fit groupings.

6. Ectomorphy, with an accompaning lack of strength, was a handicap in certain areas of physical fitness.

7. Endomorphy, with an accompanying excess of weight, was a severe handicap in physical fitness.

CHART IX

COMPARISON OF PROFILE CHARTS FOR BODY TYPE GROUPS #4, #7, #10, and #11*

Percentile*	Vert. Jump (inches)	Rm. Hand Grip Strength	Rm-Rm. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1/30 Recovery	Agility Run Secs.	Trunk Flex. Inches +	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	35.0 in.	200 lbs.	200 lbs.	28	15.0 secs.	+9.0 ins.	32.0 ins.	99	70	20	29	29	31	60
95	27.0 in.	161 lbs.	196 lbs.	42	16.9 secs.	+7.9 ins.	26.8 ins.	75	41	19	22	26	32	37
90	25.6 in.	153 lbs.	180 lbs.	45	17.2 secs.	+6.8 ins.	25.8 ins.	69	37	17	20	24	27	32
85	24.6 in.	148 lbs.	133 lbs.	48	17.5 secs.	+6.3 ins.	24.9 ins.	61	35	16	19	22	25	30
80	24.0 in.	141 lbs.	130 lbs.	50	17.7 secs.	+5.8 ins.	24.3 ins.	56	32	15	18	21	24	28
75	23.6 in.	140 lbs.	125 lbs.	52	17.9 secs.	+5.0 ins.	23.7 ins.	51	31	14	17	20	23	26
70	23.0 in.	137 lbs.	122 lbs.	54	18.0 secs.	+5.0 ins.	23.1 ins.	49	30	14	16	19	22	25
65	22.8 in.	135 lbs.	121 lbs.	56	18.2 secs.	+4.6 ins.	22.6 ins.	47	29	13	16	18	21	24
60	22.6 in.	131 lbs.	118 lbs.	57	18.3 secs.	+4.3 ins.	22.0 ins.	46	27	13	15	18	20	23
55	22.1 in.	130 lbs.	116 lbs.	58	18.6 secs.	+4.1 ins.	21.5 ins.	41	26	12	15	17	19	22
50	21.8 in.	128 lbs.	113 lbs.	60	18.7 secs.	+3.8 ins.	20.9 ins.	39	25	11	14	16	18	21
45	21.5 in.	122 lbs.	111 lbs.	61	18.9 secs.	+3.6 ins.	20.3 ins.	37	25	11	13	15	18	20
40	20.9 in.	121 lbs.	110 lbs.	62	19.1 secs.	+3.1 ins.	19.8 ins.	35	24	11	13	15	17	19
35	20.3 in.	120 lbs.	109 lbs.	63	19.3 secs.	+2.7 ins.	18.8 ins.	33	23	10	13	14	16	18
30	20.0 in.	119 lbs.	108 lbs.	64	19.5 secs.	+2.4 ins.	18.1 ins.	31	22	10	12	13	15	17
25	19.3 in.	115 lbs.	101 lbs.	65	19.7 secs.	+1.8 ins.	17.3 ins.	30	20	9	11	13	15	16
20	18.2 in.	111 lbs.	100 lbs.	67	20.1 secs.	+1.2 ins.	16.3 ins.	28	19	9	11	12	14	15
15	18.0 in.	110 lbs.	97 lbs.	69	20.3 secs.	+0.6 ins.	14.9 ins.	25	18	8	10	11	13	14
10	16.7 in.	106 lbs.	92 lbs.	71	20.7 secs.	-0.5 ins.	13.3 ins.	23	16	7	9	10	12	13
5	15.3 in.	100 lbs.	90 lbs.	75	21.6 secs.	-2.7 ins.	11.5 ins.	19	13	6	7	9	10	11
0	6.5 in.	95 lbs.	85 lbs.	99	29.6 secs.	-9.0 ins.	1.0 ins.	2	2	1	1	1	1	1
N	1733	1741	1716	1695	1698	1769	1682	1727	1700	1708	1588	1597	1583	1609

*Percentiles developed by actual IBM card counts rather than by formula.

———— #4 (MESOMORPHIC ENDOMORPH) • INCLUDES BODY TYPES - 721, 731, 621, 631, 632, 641, 642, 643, 651, 652, 521, 531, 532, 541, 542, 543, 421, 431, 432.

– – – – – #7 (STRONG MESOMORPH) • INCLUDES BODY TYPES - 373, 262, 363, 151, 252, 353.

+ + + + + #10 (ENDOMORPHIC MESOMORPH) • INCLUDES BODY TYPES - 242, 343, 232.

..... #11 (ENDOMORPHIC MESOMORPH) • INCLUDES BODY TYPES - 271, 371, 472, 261, 361, 362, 461, 463, 563, 251, 351, 352, 451, 452, 453, 241, 341, 342.

CHART X

COMPARISON OF PROFILE CHARTS FOR BODY TYPE GROUPS #12, #13, #18, and #19

Percentile*	Vert. Jump (inches)	Rm. Hand Grip Strength	Rm-Rm. Hand Grip Strength	3 Min. Step Test Pulse Rate 1-1/30 Recovery	Agility Run Secs.	Trunk Flex. Inches +	Trunk Ext. Inches	Sit Ups	Push Ups	Starting Level	1 Week Level	2 Week Level	3 Week Level	4 Week Level
100	35.0 in.	200 lbs.	200 lbs.	28	15.0 secs.	+9.0 ins.	32.0 ins.	99	70	20	29	29	31	60
95	27.0 in.	161 lbs.	196 lbs.	42	16.9 secs.	+7.9 ins.	26.8 ins.	75	41	19	22	26	32	37
90	25.6 in.	153 lbs.	180 lbs.	45	17.2 secs.	+6.8 ins.	25.8 ins.	69	37	17	20	24	27	32
85	24.6 in.	148 lbs.	133 lbs.	48	17.5 secs.	+6.3 ins.	24.9 ins.	61	35	16	19	22	25	30
80	24.0 in.	141 lbs.	130 lbs.	50	17.7 secs.	+5.8 ins.	24.3 ins.	56	32	15	18	21	24	28
75	23.6 in.	140 lbs.	125 lbs.	52	17.9 secs.	+5.0 ins.	23.7 ins.	51	31	14	17	20	23	26
70	23.0 in.	137 lbs.	122 lbs.	54	18.0 secs.	+5.0 ins.	23.1 ins.	49	30	14	16	19	22	25
65	22.8 in.	135 lbs.	121 lbs.	56	18.2 secs.	+4.6 ins.	22.6 ins.	47	29	13	16	18	21	24
60	22.6 in.	131 lbs.	118 lbs.	57	18.3 secs.	+4.3 ins.	22.0 ins.	46	27	13	15	18	20	23
55	22.1 in.	130 lbs.	116 lbs.	58	18.6 secs.	+4.1 ins.	21.5 ins.	41	26	12	15	17	19	22
50	21.8 in.	128 lbs.	113 lbs.	60	18.7 secs.	+3.8 ins.	20.9 ins.	39	25	11	14	16	18	21
45	21.5 in.	122 lbs.	111 lbs.	61	18.9 secs.	+3.6 ins.	20.3 ins.	37	25	11	13	15	18	20
40	20.9 in.	121 lbs.	110 lbs.	62	19.1 secs.	+3.1 ins.	19.8 ins.	35	24	11	13	15	17	19
35	20.3 in.	120 lbs.	109 lbs.	63	19.3 secs.	+2.7 ins.	18.8 ins.	33	23	10	13	14	16	18
30	20.0 in.	119 lbs.	108 lbs.	64	19.5 secs.	+2.4 ins.	18.1 ins.	31	22	10	12	13	15	17
25	19.3 in.	115 lbs.	101 lbs.	65	19.7 secs.	+1.8 ins.	17.3 ins.	30	20	9	11	13	15	16
20	18.2 in.	111 lbs.	100 lbs.	67	20.1 secs.	+1.2 ins.	16.3 ins.	28	19	9	11	12	14	15
15	18.0 in.	110 lbs.	97 lbs.	69	20.3 secs.	+0.6 ins.	14.9 ins.	25	18	8	10	11	13	14
10	16.7 in.	106 lbs.	92 lbs.	71	20.7 secs.	-0.5 ins.	13.3 ins.	23	16	7	9	10	12	13
5	15.3 in.	100 lbs.	90 lbs.	75	21.6 secs.	-2.7 ins.	11.5 ins.	19	13	6	7	9	10	11
0	6.5 in.	95 lbs.	85 lbs.	99	29.6 secs.	-9.0 ins.	1.0 ins.	2	2	1	1	1	1	1
N	1733	1741	1716	1695	1698	1769	1682	1727	1700	1708	1588	1597	1583	1609

*Percentiles developed by actual IBM card counts rather than by formula.

———— #12 (ECTOMORPHIC MESOMORPH) • INCLUDES BODY TYPES - 172, 174, 162, 163, 263, 264, 364, 152, 153, 154, 253, 254, 354, 142, 143, 243, 132.

– – – – – #13 (ECTOMORPH-MESOMORPH) • INCLUDES BODY TYPES - 144, 155, 233, 244, 255, 355.

+ + + + + #18 (MESOMORPHIC ECTOMORPH) • INCLUDES BODY TYPES - 127, 137, 126, 136, 146, 236, 246, 256, 346, 125, 135, 145, 235, 245, 345, 134, 234.

..... #19 (BALANCED) • INCLUDES BODY TYPES - 333, 344, 434, 443, 444, 445, 454, 544.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to examine the relationship of body type to performance on the activity test battery and the PF Plan by freshmen men at Michigan State University.

A battery of activity tests, designed to measure strength, power, agility, and endurance, was given to all of the Foundations of Physical Education male students at Michigan State University in the fall of 1961. In addition, each student was body typed, using the Sheldon method, by the individual instructors. Then, on the basis of percentile rankings determined by the activity tests, the students were placed on the PF Plan which continued for an eight week period. At the end of this time, data were collected from each student on his activity test and the PF Plan scores as well as the body type given him by his instructor, through the use of a questionnaire. The data were then placed on IBM cards for statistical tabulation and analysis. As a result of this work, percentile tables and profile

charts were set up for the activity test battery and the first four weeks of the PF Plan for each of the eight body type groupings studied.

Conclusions

The following conclusions were based on the results of this study:

1. There was a definite relationship between body type and performance on the activity test battery and the PF Plan by freshmen men at Michigan State University.

2. Consideration should be given to body types in placing students on one of the starting charts of the PF Plan.

Recommendations

The following recommendations should prove helpful to anyone continuing this study or conducting one similar to it.

1. This study should be continued in following years until there are enough cases in each body type grouping to present accurate tables and charts for each one.

2. The method of body typing should be improved. Each student should be body typed by a small team of instructors or their photographs should be sent to Sheldon and his associates.

3. The activity tests should be very closely supervised and the method of administration should be standardized to raide the reliability of the test battery.

4. The administration of the PF Plan should be more rigidly controlled to ensure the students participation in the exercises.

5. Another similar study should be conducted to examine this same relationship. A smaller number of body type groupings should be identified for the ease of making comparisons and each group should contain an equal number of students secured through a random sample technique covering the entire Foundations Program. All of the tests and the PF Plan should be rigidly controlled and the study should be continued until all of the groups reach their finishing level on the PF Plan.

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APPENDICES

APPENDIX A

The PF Plan
Explanation of Level Numbering

THE P-F PLAN*

What is it?

This is the Physical Fitness Plan (P-F Plan) that enables you to obtain a high level of fitness by yourself, at your own rate of progress, in only eleven minutes a day.

The P-F Plan uses five basic exercises that will enable you to advance to your own predetermined level of fitness without expensive equipment or unnecessary discomfort. These five exercises are a balanced set covering the major muscle groups of the body, designed to bring a high level of fitness to any healthy person.

Why the P-F Plan?

Exercising until it hurts is not necessary in order to acquire an adequate level of physical fitness. As a matter of fact, greater benefits may be derived from exercise by avoiding this discomfort.

There are two main ways in which the discomfort of muscle stiffness and soreness can be avoided:

---warming up properly thus eliminating pulled muscles, tendons, etc.
---starting any exercise program with exercises that involve a low level of activity and progressing to more advanced levels by easy stages.

This is a scientifically derived plan designed to take these two ideas into account by:

---the arrangement of the exercises; and
---the manner in which these exercises are performed.

As an illustration, the first exercise requires you to touch the floor. This type of activity loosens up the large muscles in the body, especially in the legs and back. By starting very slowly without straining and gradually increasing the speed and force of pushing down, warmup is accomplished while actually doing the exercise. All five exercises can be done in this manner until the eleven minutes have elapsed.

What is the Plan?

This plan is composed of five exercises performed always in the same order and within the maximum time limit of eleven minutes. There are five charts arranged in progression of difficulty. As you progress from chart to chart there are slight changes in each exercise requiring a greater amount of activity and effort.

Following is an explanation of the way in which the charts should be used. Consult Starting Chart 1 or 2 to better understand the meaning of the following terms:

---

*Adapted from the 5BX Plan for Physical Fitness; RCAF Pamphlet 30/1, by permission of the Queen's Printer, Ottawa, Canada.

EXERCISE

The numbers 1, 2, 3, 4, and 5 can be seen directly under this heading. The column headed 1 represents exercise 1 (toe touch), 2 (sit ups), etc. The figures in each column indicate the number of times that the exercise is to be repeated in the time allotted for that exercise.

PERCENTILE LEVEL (%ile Level)

The numbers in this column are used to determine your P-F starting point and goal. They are in groups such as 9-12 or 61-63.

MINUTES FOR EACH EXERCISE

At the bottom of each chart the allotted time for each exercise is given. These times remain the same for each chart. Total time for exercises 1 through 5 is eleven minutes.

DATE(S) ATTEMPTED OR DATE OR COMPLETION

These columns are used to record the date that you were able to complete that particular level within the specified time and/or the date (or dates) that each level was attempted.

Where do you Start? Where do you Progress to?

This is how you determine your starting point and the final level you should progress to:

1. On page 95 of your text, Physical Activity in Modern Living, you have your "Profile for Physical Tests".

2. Circle your score in each column to determine your percentile rank for each test.

3. Total the percentile scores you obtained.

4. Divide this total by the number of tests scored. This gives your average percentile level.

5. Consult Starting Charts 1 or 2, as the case may be, and find the percentile level you possess. This is your starting point.

6. Now consult P-F Charts 1, 2, or 3 and locate the Percentile Level you possess. As an example, if your average was forty-six on P-F Goal Chart 2, on the left you will see the percentile grouping 46-48. The score of forty-six falls in this category. Thus your own Goal in fitness is established. During the term you should attempt to reach or exceed your predicted P-F Goal, proceeding step by step from the starting point.

If your Percentile Level is lower than fifty, you will notice that you will be starting on Chart 1. If your level is above fifty you will be starting somewhere on Chart 2. Now start at your own level on Starting Chart 1 or 2 and repeat each exercise in the allotted time or do the five exercises in eleven minutes. Move upward on the same chart to the next level only after you can complete all the

required movements at your present level within eleven minutes. Continue to progress upward in this manner until you can complete all the required movements at the highest level on the chart within eleven mumutes. Now start at the bottom of the next chart, and continue in this fashion upwards through the levels, and from chart to chart until you reach your level or Goal determined by your test scores.

How to Begin.

Check your daily schedule and determine the time most convenient for you to do the exercises. On the days the exercises are not done in class you are expected to do them on your own initiative. It should be the same time each day. It is recommended that you spend at least one day at each level and possibly more. If you feel stiff or sore, or if you are unduly breathless at any time, ease up and slow down your rate of progression. If you reach your GOAL without any undue stress you can set a higher goal of fitness if you desire.

A NOTE OF CAUTION

---Even if you feel able to start at a higher level and progress at a faster rate than indicated--DON'T DO IT--Start at your level on the chart indicated and work up from level to level as recommended.
---For best results from the P-F Plan the exercises must be done regularly. Remember, it may take you a period of several months or more of daily exercises to attain the level recommended for you, but once you have attainted it, only 3 periods of exercise per week will maintain this level of physical fitness.
---If for any reason (illness, injury, etc.) you stop for five days or more doing the plan regularly and you wish to begin again, do not recommence at the level you had attained previously. Do drop back several levels--until you find one you can do without undue strain and procede up from there.

MAKE THE P-F PLAN A HABIT

This exercise plan plus regular participation in a few wholesome recreational activities could provide you with a lifetime of physical efficiency and enjoyment.

STARTING CHART 1*

CHART 1

%ile Level	EXERCISE 1	2	3	4	5	Date(s) Attempted or Date Completed
45-49	30	23	33	20	500	12
41-44	28	21	31	19	480	11
37-40	26	20	29	18	470	10
33-36	26	18	27	17	455	09
29-32	24	17	25	16	445	08
25-28	22	16	23	15	440	07
21-24	20	15	21	14	425	06
17-20	19	14	19	13	410	05
13-16	18	13	17	12	395	04
9-12	16	12	15	11	380	03
5- 8	15	11	14	10	360	02
0- 4	14	10	13	9	335	01
Minutes for each exercise	2	1	1	1	6	

1 Feet astride, arms upward.
—Touch floor and press (bounce) ~~dive then stretch upward and~~ backward bend.
—Keep legs straight.

2 Back lying, feet 6" apart, arms at sides.
—"Sit up" to vertical position, keep feet on floor even if it is necessary to hook them under a chair.

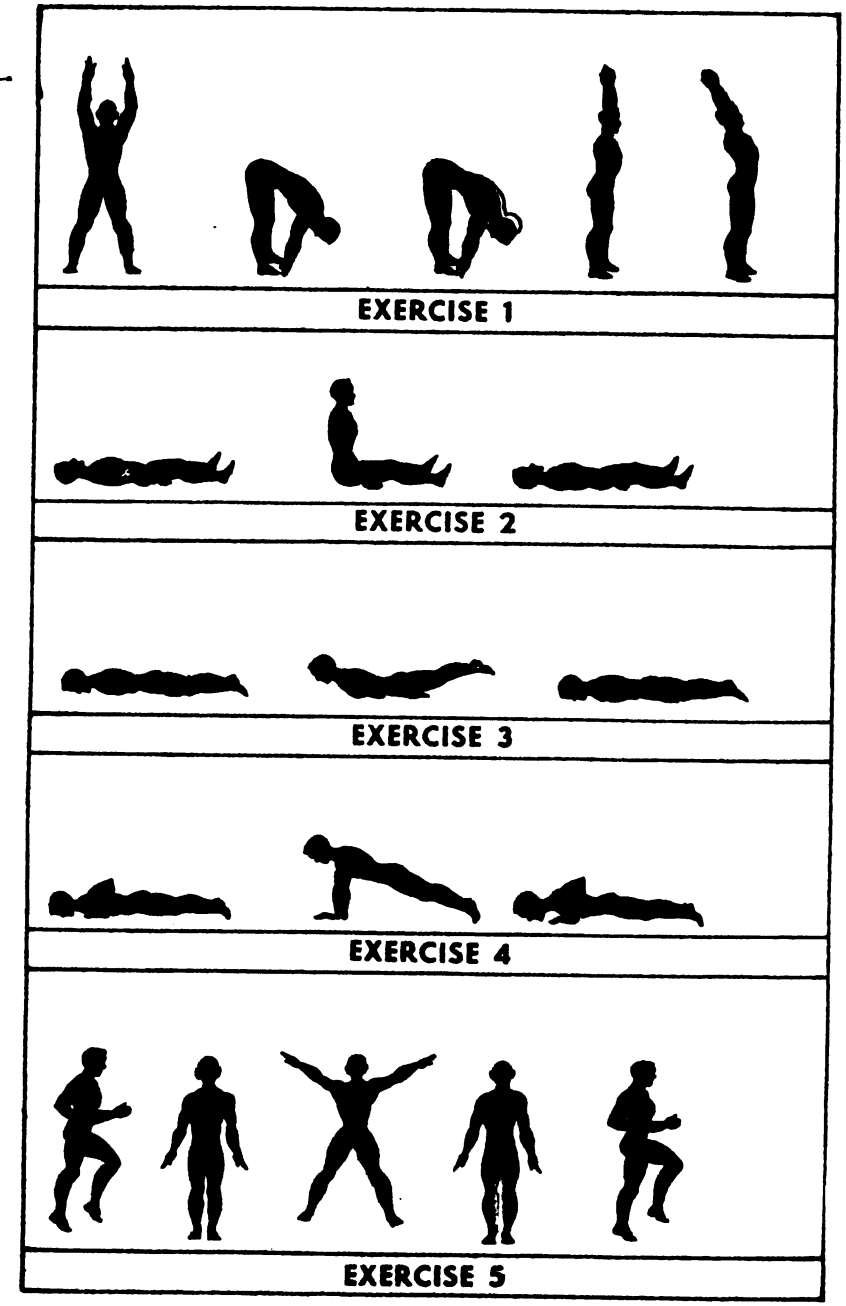
3 Front lying, palm placed under thighs.
—Raise head, shoulders, and both legs.
—Keep legs straight, both thighs must clear the palms.

4 Front lying, hands under the shoulder, palms flat on floor.
—Straighten arms to lift body with only palms and toes on the floor. Back straight.
—Chest must touch floor for each completed movement after arms have been fully extended.

5 Stationary run—(count a step each time left foot touches floor—Lift feet approximately 4 inches off floor). After every 75 steps, do 10 "astride jumps". Repeat this sequence until required number of steps is completed.

~~Astride jumps~~—Feet together, arms at side.

Jump to feet astride with arms swinging sideways to slightly above shoulder height—return to starting position.
Keep arms straight.



*Starting chart if under the 50th percentile.

P-F GOAL CHART 1

%ile Level	EXERCISE 1	2	3	4	5	Date(s) Attempted or Date Completed
34-36	30	22	50	42	400	36
31-33	30	22	49	40	395	35
28-30	30	22	49	37	390	34
25-27	28	21	47	34	380	33
22-24	28	21	46	32	375	32
19-21	28	21	46	30	365	31
16-18	28	19	44	28	355	30
13-15	26	19	43	26	345	29
10-12	26	19	43	24	335	28
7- 9	24	18	41	21	325	27
4- 6	24	18	40	19	315	26
0- 3	24	18	40	17	300	25
Minutes for each exercise	2	1	1	1	6	

Average Percentile Score on the tests taken indicates your approximate fitness goal. Underline your goal and work towards it.

1 Feet astride, arms upward. Touch floor outside left foot, between feet, press once then outside right foot, circle bend backwards as far as possible, reverse direction after half the number of counts.

—Keep legs straight, arms above head and make full circle, bending backward past vertical each time.

2 Back lying, legs straight, feet together, arms straight overhead.

—Sit up and touch the toes keeping the arms and legs straight. Use chair to hook feet under only if necessary.

—Keep arms in contact with the sides of the head throughout the movement.

3 Front lying, hands and arms stretched sideways.

—Lift head, shoulders, arms, chest and both legs as high as possible.

—Keep legs straight, raise chest and both thighs completely off floor.

4 Front lying, palms of hands flat on floor, approximately 1 foot from ears directly to side of head.

—Straighten arms to lift body.

—Chest must touch floor for each completed movement.

5 Stationary run—(count a step each time left foot touches floor—lift knees waist high).

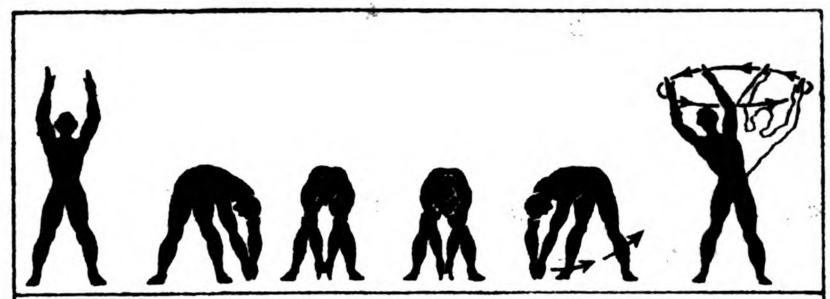
Every 75 steps do 10 "squat jumps".

Repeat this sequence until required number of steps is completed.

Squat jumps—Right foot slightly forward, knees bent, finger tips touching floor outside feet.

—Jump to upright position at same time reverse position of feet—return to starting position with left foot forward.

—Touch finger tips to floor—feet must completely clear floor. Keep back upright and straight at all times.



EXERCISE 1

EXERCISE 2

EXERCISE 3

EXERCISE 4

EXERCISE 5

STARTING CHART 2*

%ile Level	EXERCISE 1	2	3	4	5	Date(s) Attempted or Date Completed
95-100	30	32	47	24	550	24
91-94	30	31	45	22	540	23
87-90	30	30	43	21	525	22
83-86	28	28	41	20	510	21
79-82	28	27	39	19	500	20
75-78	28	26	37	18	490	19
71-74	26	25	35	17	480	18
67-70	26	24	34	17	465	17
63-66	26	23	33	16	450	16
59-62	24	22	31	15	430	15
55-58	24	21	30	15	415	14
50-54	24	20	29	15	400	13
Minutes for each exercise	2	1	1	1		

1 Feet astride, arms upward.

—Touch floor 6" outside left foot, again between feet and press once then 6" outside right foot, bend backward as far as possible, repeat, reverse direction after half the number of counts.

—Legs straight at all times.

2 Back lying, feet 6" apart, arms clasped behind head.

—Sit up to vertical position, keep feet on floor, hook feet under chair, etc., only if necessary.

3 Front lying, hands interlocked behind the back.

—Lift head, shoulders, chest and both legs as high as possible.

—Keep legs straight, and raise chest and both thighs completely off floor.

4 Front lying, hands under the shoulders, palms flat on floor.

—Touch chin to floor in front of hands—touch forehead to floor behind hands before returning to up position.

—There are three definite movements, chin, forehead, arms straightened. DO NOT do in one continuous movement.

5 Stationary run—(count a step each time left foot touches floor—Lift feet approximately 4 inches off floor). After every 75 steps do 10 "bobbing jumps". Repeat this sequence until required number of steps is completed.

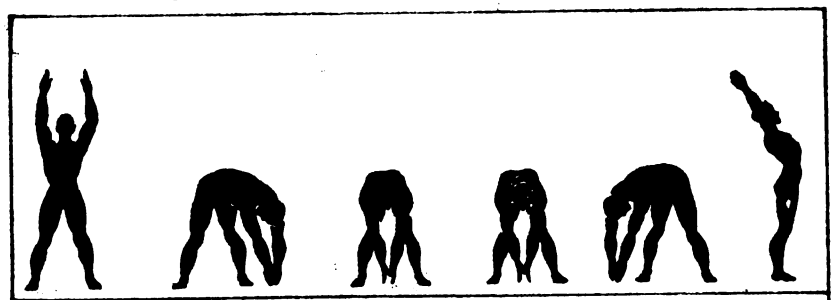
Bobbing jumps—Feet together, hands on hips, knees bent to sit on heels.

Straighten to upright position, raising heel off floor, return to starting position each time.

Keep feet in contact with floor—the back upright and straight at all times.

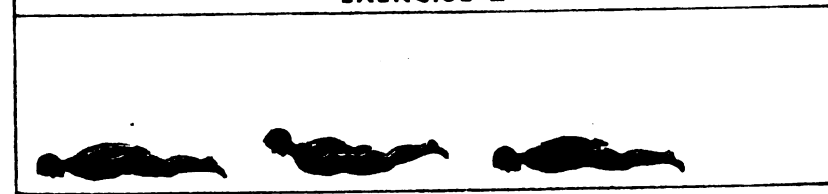
*Starting chart if over the 50th percentile.

CHART 2



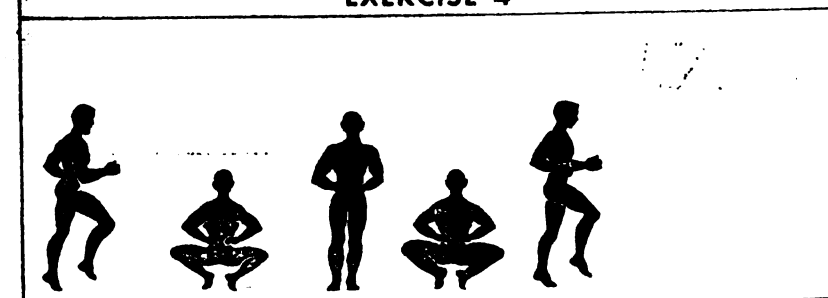
EXERCISE 1

EXERCISE 2



EXERCISE 3

EXERCISE 4



EXERCISE 5

P-F GOAL CHART 2

%ile Level	EXERCISE 1	2	3	4	5	Date(s) Attempted or Date Completed
70-72	30	40	50	44	500	48
67-69	30	39	49	43	485	47
64-66	30	38	48	42	475	46
61-63	28	36	47	40	465	45
58-60	28	35	46	39	455	44
55-57	28	34	45	38	445	43
52-54	26	32	44	36	435	42
49-51	26	31	43	35	420	41
46-48	26	30	42	34	410	40
43-45	24	28	41	32	400	39
40-42	24	27	40	31	385	38
37-39	24	26	39	30	375	37
Minutes for each exercise	2	1	1	1	6	

Average Percentile Score on the tests taken indicates your approximate fitness goal. Underline your goal and work towards it.

1 Feet astride, arms upward, hands clasped, arms straight.
—Touch floor outside left foot, between feet, press once then outside right foot, circle bend backwards as far as possible.
Reverse direction after half the number of counts.
—Keep legs and arms straight at all times.

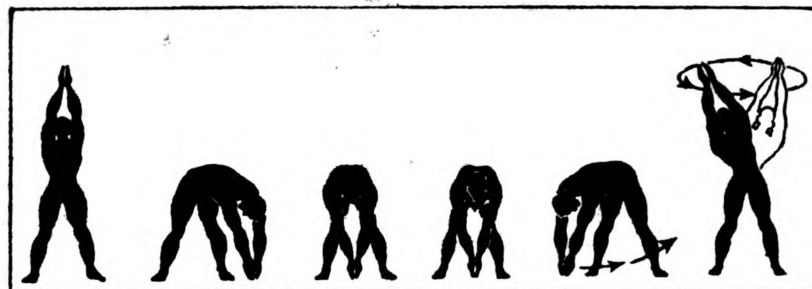
2 Back lying, legs straight, feet together, hands clasped behind head.
—Sit up and raise legs in bent position at same time twist to touch right elbow to left knee. This completes one movement.
Alternate the direction of twist each time.
—Keep feet off floor when elbow touches knee.

3 Front lying, arms extended overhead.
—Raise arms, head, chest and both legs as high as possible.
—Keep legs and arms straight, chest and both thighs completely off floor.

4 Front lying, hands under shoulder, palms flat on floor.
—Push off floor and clap hands before returning to starting position.
—Keep body straight during the entire movement. Hand clap must be heard.

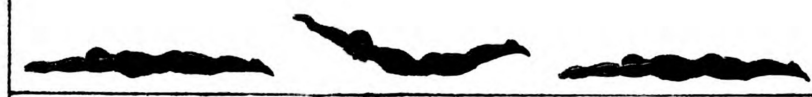
5 Stationary run—(count a step each time left foot touches floor—lift knees waist high).
Every 75 steps do 10 "spread eagle jumps".
Repeat this sequence until required number of steps is completed.
Spread eagle jumps—Feet together knees bent, sit on heels.
Finger tips touch floor.
—Jump up to feet astride swing arms overhead in mid-air, return directly to starting position on landing.
—Raise hands above head level, spread feet at least shoulder width apart in astride position before landing.

CHART 2



EXERCISE 1

EXERCISE 2



EXERCISE 3

EXERCISE 4

EXERCISE 5

P-F GOAL CHART 3

%ile Level	EXERCISE 1	2	3	4	5	Date(s) Attempted or Date Completed
100	30	50	40	40	600	60
99	30	48	39	39	580	59
98	30	47	38	38	555	58
97	28	45	37	36	530	57
94-96	28	44	36	35	525	56
91-93	28	43	35	34	515	55
88-90	28	41	34	32	505	54
85-87	28	40	33	31	495	53
82-84	26	39	32	30	485	52
79-81	24	37	31	28	475	51
76-78	24	36	30	27	460	50
73-75	24	35	29	26	450	49
Minutes for each exercise	2	1	1	1	6	

Average Percentile Score on the tests taken indicates your approximate fitness goal. Underline your goal and work towards it.

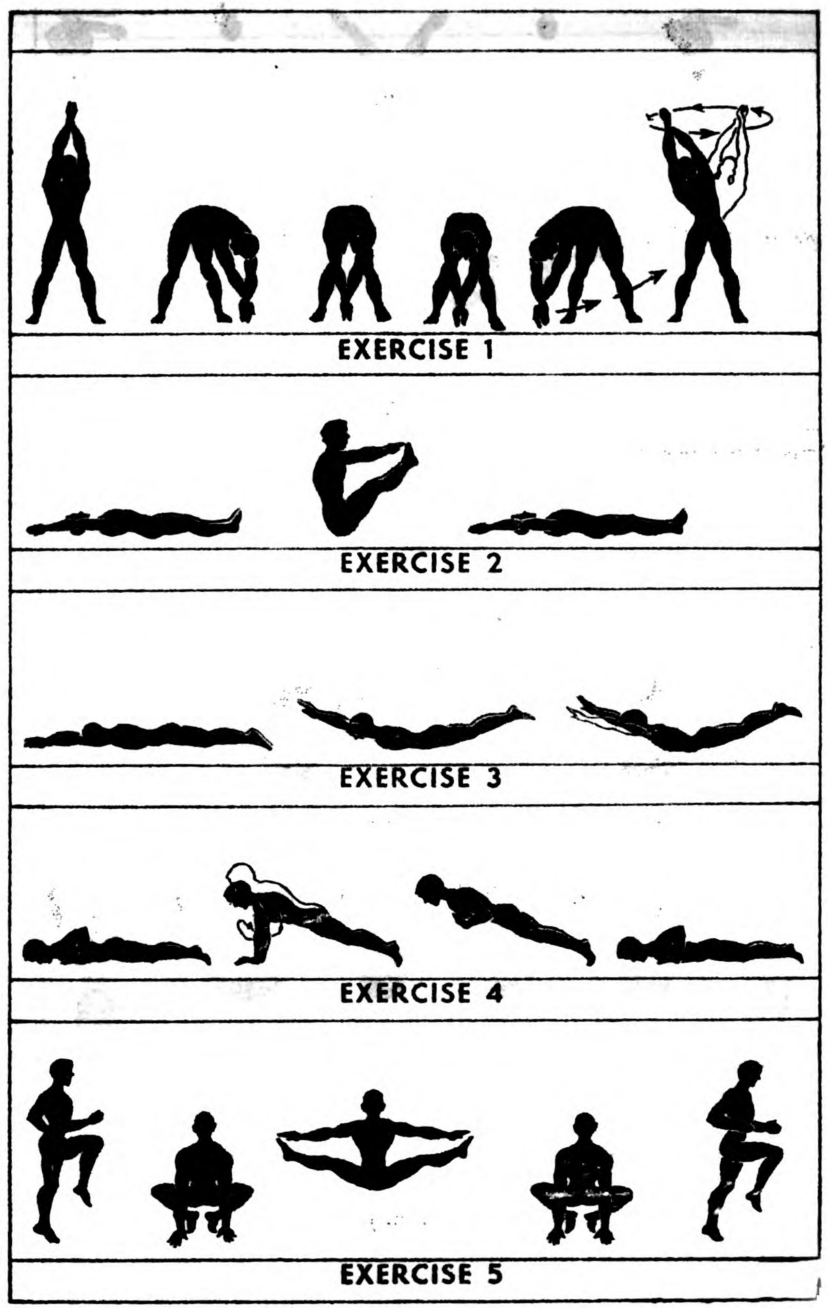
1 Feet astride, arms upward, hands reverse clasped, arms straight.
—Touch floor outside left foot, between feet, press once then outside right foot, circle bend backwards as far as possible. Reverse direction after half the number of counts.
—Keep legs and arms straight, hands tightly reverse clasped at all times.

2 Back lying, legs straight, feet together, arms straight over the head.
—Sit up and at the same time lifting both legs to touch the toes in a pike (V) position.
—Keep feet together, legs and arms straight, all of the upper back and legs clear floor, fingers touch toes each time.

3 Front lying, arms extended over head.
—Raise arms, head, chest and both legs as high as possible then press back once.
—Keep legs and arms straight—chest and both thighs completely off floor.

4 Front lying, hands under shoulders, palms flat on floor.
—Push off floor and slap chest before returning to starting position.
—Keep body straight during the entire movement, chest slap must be heard.

5 Stationary run—(count a step each time left foot touches floor—lift knees waist high).
Every 75 steps do 10 "jack jumps". Repeat this until required number of steps is completed.
Jack jumps—Feet together, knees bent, sit on heels, finger tips touch floor.
—Jump up, raise legs waist high, keep legs straight and touch toes in midair.
—Keep legs straight, raise feet level to "standing waist height". Touch toes each time.



EXPLANATION OF LEVEL NUMBERING

The PF Plan consisted of five charts with twelve levels of achievement on each chart. Since the students were required to record their level achievement on the questionnaire, a simple method of numbering each level had to be devised.

Due to the fact that there were a total of sixty levels of achievement on the five charts of the PF Plan, the levels were numbered in the following manner:

Chart	Numbering
Starting Chart #1 (0 to 49th percentile)	01 to 12
Starting Chart #2 (50th to 100th percentile)	13 to 24
Goal Chart #1 (0 to 36th percentile)	25 to 36
Goal Chart #2 (37th to 72nd percentile)	37 to 48
Goal Chart #3 (73rd to 100th percentile)	49 to 60

*See examples in the enclosed PF Plan.

APPENDIX B

A Letter from William Orban on the Formulation of the 5BX Plan

A LETTER FROM WILLIAM ORBAN

UNIVERSITY OF SASKATCHEWAN

School of
Physical Education — Saskatoon, Canada

October 6, 1961.

Mr. Michael G. Crain,
320 Oakhill
East Lansing, Michigan

Dear Mr. Crain:

This is in reply to your letter of October 3, 1961 concerning information about the 5BX Physical Fitness Plan for the Air Force.

Naturally, I am very pleased that you are finding some value and use for this plan and hope that you have success with your research in this area.

There was over two years of research that went into the devlopment of this Plan. When I was commissioned to do this work the only counsel I got was that they wanted some physical fitness program which would get the combat pilots in good top physical condition. Naturally, I knew that the only way to get in condition was to exercise and therefore I set out to make a survey of all the Air Force personnel in the R. C. A. F. The purpose of this survey was to find out why people did not, or did not want to, do physical exercise to keep fit. Once we had this information in we then analyzed it to determine what were the basic causes for people not exercising. When we had reduced the number to relatively few primary causes, we then set about to try and resolve the reasons why people did not exercise by designing a plan that would circumvent these objections.

Briefly, we decided that the only way we could get people to exercise was to develop a plan that would be simple, would not require any instructor, would not require any apparatus, but could be done in the individuals own time and which would

not be too difficult for anyone at any level of condition and which would not cause undue discomfort due to stiffness and soreness at the onset of the training program.

Thus, we knew we had to get a group of exercises that were few in number that would produce the desired results even if done relatively incorrectly. The first project, then, was to determine what exercises would be suitable for such a program. We spent the two and a half months with a team of about ten professional people at an R. C. A. F. station which had 120 college students training on it. We then set about selecting the exercises. The procedure we used was to determine the series of exercises which would be progressively more difficult and yet which would not change appreciably in their performance, and at the same time even if the exercises were left to the individual they would get some benefit from them. What we did then was to demonstrate, very briefly, an exercise to the students and then have them perform it. We observed them as they performed these exercises and then would subjectively determine whether the exercise was achieving the desired result or not. In this process we tried hundreds of exercises discarding practically all of them because of their unsuitability for this particular program we had in mind, up to this point it may be argued that our approach was very unscientific and too subjective in its method. However, once we did determine the number of exercises and the type of exercises which would be of value, we then subjected the students to repeating these a given number of times to make sure that they could be counted in a uniform manner. The results of these were recorded by the students themselves and then were tabulated and analyzed to determine whether they had any value as far as objectivity was concerned.

A second project which utilized a similar population of about the same number was conducted the following year. During this time we tested the individuals in a variety of physical fitness tests and then subjected them to the 5BX program. At the end of the 12 week period working up progressively from the very low level of the plan up to the high level, we determined the improvements that were brought on by this program. Records were kept and statistically analyzed and this used proper procedures and methods for this kind of work. I should have mentioned that all the tables that were used in this process were very arbitrary and were more or less guess

work in that we were interested in progression and the development of high level of fitness and did not have the tables with which to work. However, at the completion of this project we set one week aside in which through random sampling techniques we had the cadets perform each of the exercises in each of the tables and make a record of the number of repetitions which they could complete in the required time. This then was taken and statistically treated in order to determine the distribution and scores from which finally emerged the tables as they are in the 5BX program.

Unfortunately I left the air force just at the completion of the work and did not have time to make the scientific report on the research that was involved. However, the material and raw data are available at the Air Force Headquarters and they may be looked at if one desires doing so by contacting Wing Commander Tett. I also have the data but because of the nature of the work and my servance with the Air Force, I am not permitted to give any of this information out.

However, I will send you any information which you desire even to the point of giving you some actual figures without giving you a full report if you so desire.

I would be very interested in the results of your work and would certainly appreciate a copy of this study when it is completed. Please convey my kindest regards to Professor Van Huss and Professor Montoye. With kindest regards, I am,

Sincerely,

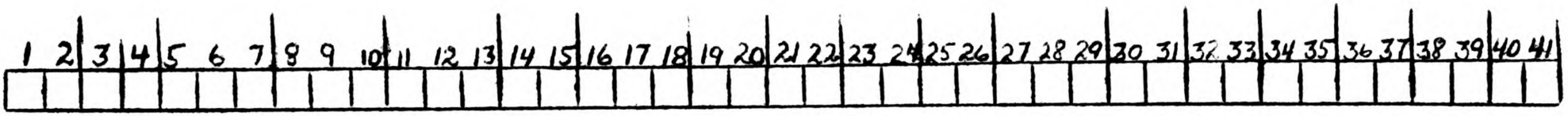
William A. Orban /s/

William A. Orban
Director

WARO3/4

APPENDIX C

The Questionnaire
Coding Plan
IBM Procedure and Statistical Analysis



DIRECTIONS: Fill in the above boxes with the numbers that correspond to your answers. DO NOT write your name on this question sheet. These questions will not be used in formulating your grade and are being collected only for the purpose of assisting in a research study.

BOX #	
1-2	College enrolled in: (11) No Preference, (12) Agriculture, (13) Business, (14) Communication Arts, (15) Education, (16) Engineering, (17) Home Economics, (18) Science and Arts, (19) Veterinary Medicine
3	In your opinion, is the Foundations course: (1) of great value, (2) of average value, (3) of little value?
4	Do you intend to take more than the one required year of physical education? (1) Yes, (2) No
5-7	Score on vertical jump to the nearest half-inch. (22.5", 16.0", 06.5", 09.0")
8-10	Score on dominant hand grip to the nearest pound.
11-13	Score on non-dominant hand grip to the nearest pound.
14-15	Pulse rate/30 seconds following exercise. (step test)
16-18	Score on agility run to the nearest tenth of a second.
19-20	Score on trunk flexion test to the nearest inch.
21-22	Score on trunk extension test to the nearest inch.
23-24	Number of bent knee situps done to recorded cadence.
25-26	Number of pushups done to recorded cadence.
27-29	Body type given by instructor. (Give halves to lower number. e.g. 3½ converts to 3 etc.)
30-31	Starting level for PF plan.
32-33	PF level on which you were working after one week.
34-35	PF level on which you were working after two weeks.
36-37	PF level on which you were working after three weeks.
38-39	PF level on which you were working after four weeks.
40-41	PF level on which you were working after five weeks.

1. DO NOT BEGIN TO FILL IN THE ANSWERS UNTIL YOU HAVE RECEIVED FULL INSTRUCTIONS.

2. DO NOT PUT MORE THAN ONE DIGIT IN ANY OF THE ANSWER BOXES.

CODING PLAN

Columns	Information
1-2	College enrolled in: (11) No Preference, (12) Agriculture, (13) Business, (14) Communciation Arts, (15) Education, (16) Engineering, (17) Home Economics, (18) Science and Arts, (19) Veterinary Medicine.
3	Value of Foundations Course: (1) Great Values, (2) Average Value, (3) Little Value.
4	Take more than one required year of Physical Education? (1) Yes, (2) No.
5-7	Vertical jump score to nearest half inch: (22.5, 16.0, 06.5, 09.0).
8-10	Dominant Hand Grip Strength score to nearest pound: (200, 157, 089).
11-13	Non-Dominant Hand Grip Strength score to nearest pound.
14-15	30 second Pulse Rate: (95, 61, 38).
16-18	Agility Run score to nearest tenth of a second: (20.7, 19.4, 14.9).
19-20	Trunk Flexion score to nearest inch: Column 19- (1) Positive Score, (2) Negative Score; Column 20- The Score (9, 4,1).
21-22	Trunk Extension score to nearest inch: (27,21, 16).
23-24	Number of Bent Knee Situps: (75, 52, 39).
25-26	Number of Pushups: (56, 37, 23).
27-29	Body Type: (642, 462, 264, 246).
30-31	Starting Level on the PF Plan : (09).
32-33	One Week PF Plan Level Achievement: (15).

Columns	Information
34-35	Two week PF Plan Level Achievement: (24).
36-37	Three week PF Plan Level Achievement: (30).
38-39	Four Week PF Plan Level Achievement: (37).
40-41	Five week PF Plan Level Achievement: (Very few students had reached this point and as a result, these columns were not included in the study).
42-43	Body Type Grouping Numbers (04, 11, 18).

IBM PROCEDURE

Step	Procedure
1.	Data from questionnaires punched into 80 column IBM cards and verified for accuracy.
2.	Scores for entire population were sorted from high to low for each test and the PF Plan.
3.	Individual body types were sorted out and placed into their respective groupings (cards with no body type were pulled out).
4.	Body type grouping numbers were punched into columns 42-43 of the IBM cards.
5.	Several "impossible" scores were noted in the data.
6.	The "impossible" scores were sorted and pulled out.
7.	Step no. 2 was repeated.
8.	Step no. 2 was repeated for each body type grouping.
9.	For each test and the PF Plan, the N (number of scores), the Sum of X (sum of the scores), the $\bar{X}$ (mean), and the Sum of X^2 (sum of the scores squared) were computed for each body type grouping.
10.	Step no. 9 was repeated for columns 19-20 to take into account the presence of negative scores.

STATISTICAL ANALYSIS

Step

1. Before viewing the data, it was decided that no body type grouping which contained less than fifty cases would be dealt with (as a result, body type groupings #1, #2, #3, #5, #6, #7, #8, #14, #15, #16, and #17 were not included in the study).

2. Percentile rankings for each of the tests and the PF Plan were computed for the entire population by means of an actual score count.

3. Percentile rankings for each of the tests and the PF Plan were computed for each of the body type groupings used in the study by means of an actual score count.

4. The mean and standard deviation for each of the tests and the PF Plan were computed for each of the body type groupings used in the study (S. D. $= \sqrt{\frac{\text{Sum of } X^2 - X^2}{N}}$).

APPENDIX D

A Body Type Grouping Frequency Table
A Table of the Body Type Groups and the Body Types Within Each Group

BODY TYPE GROUPING FREQUENCY TABLE

Group No.	MSU---1876	Sheldon--2000[1]
#1	0	4
#2	10	64
#3	23	48
#4*	120	117
#5	46	60
#6	4	63
#7	0	27
#8	4	10
#9*	143	154
#10*	187	89
#11*	174	164
#12*	315	175
#13*	143	83
#14	1	9
#15	28	148
#16	41	100
#17	10	87
#18*	428	182
#19*	158	377

*Body type groupings used in the study.

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[1]W. H. Sheldon, S. S. Stevens, and W. B. Tucker, The Varieties of Human Physique. (New York and London: Harper Brothers., 1940).

The body type groupings and the body types within each group were taken from The Varieties of Human Physique[2] by Sheldon, Stevens, and Tucker. In addition, other body types identified in this study were added to these groupings.

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[2] Ibid.