HIELSCHER, PATRICIA ANN. The Equivalency of Cooper's 12-Minute Test and a 1¼-Mile Run for Junior High School Girls. (1970)
Directed by: Dr. Rosemary McGee. pp. 88

It was the purpose of this study to determine the equivalency of Cooper's 12-Minute Test and a 1¼-Mile Run Test. The two tests were administered to 502 girls enrolled in Jefferson Davis Junior High School, Jacksonville, Florida.

Although a significant relationship of .57 was found to exist between the 12-Minute Test and the 1¼-Mile Run Test, the coefficient was not deemed high enough to justify substituting the 1¼-Mile Run Test for the 12-Minute Test. It was concluded that the 12-Minute Test and the 1¼-Mile Run Test were not equivalent for this age group. A mean time of 14:06 minutes on the 1¼-Mile Run Test was comparable to the mean distance of .89 of a mile on the 12-Minute Test. Therefore, the 1¼-Mile Run Test was not equivalent to the 12-Minute Test.

It was concluded further that these junior high school girls did not possess an average level of cardiovascular fitness. Based on Cooper's fitness standards, 324 girls of the 502 tested placed in the lowest fitness category for women below 30 years of age.

THE EQUIVALENCY OF COOPER'S 12-MINUTE TEST AND A 1¼-MILE RUN FOR JUNIOR HIGH SCHOOL GIRLS

by

Patricia Ann Hielscher

A Thesis Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Master of Science in Physical Education

Greensboro
July, 1970

Approved by

Rosemary McGee

Thesis Adviser

APPROVAL SHEET

This thesis has been approved by the following committee of the Faculty of the Graduate School at The University of North Carolina at Greensboro.

Thesis Adviser Rosemary McGee

Oral Examination Committee Members Gail Hennis

Joseph E. Bryson

Frank Blevins

July 13, 1970
Date of Examination

ACKNOWLEDGEMENTS

To her thesis adviser, Dr. Rosemary McGee, the writer wishes to express deep gratitude for her untiring assistance and patience. Her inspiration and guidance made this work a meaningful experience and the completion of this study possible.

To Miss Delores Ellison, whose cooperation and interest was so essential to the success of this study, the writer is deeply indebted.

To the Women's Physical Education Department at Jefferson Davis Junior High School, Jacksonville, Florida, the writer expresses her sincere appreciation for their valuable assistance in the testing and collection of the data.

To the students at Jefferson Davis Junior High School who served as subjects for this study, the writer expresses her appreciation.

To the many friends who showed interest, gave encouragement and moral support, the writer expresses her thanks.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

> For physical fitness is not only one of the most important keys to a healthy body; it is the basis of dynamic and creative intellectual activity. The relationship between the soundness of the body and the activities of mind is subtle and complex. Much is not yet understood. But we do know what the Greeks knew: that intelligence and skill can only function at the peak of their capacity when the body is healthy and strong; that hardy spirits and tough minds usually inhabit sound bodies.
>
> President John F. Kennedy (59:16)

Throughout history people have been concerned with the health and fitness of their nation. Although the term "fitness" in the United States has had many and varied definitions, many have agreed that "fitness" is a desirable attribute and is conducive to a healthier and more productive life.

Exercise and fitness go together; they are complementary. Both can be experienced in various forms. The key to productivity, however, is purpose. There are many kinds of exercises and various levels or categories of fitness. The purpose for which an individual exercises or the kind of fitness one wishes to develop must be ascertained.

The publication of Aerobics by Kenneth H. Cooper in 1968 did much to define and delineate exercise and fitness for many individuals. Cardio-respiratory fitness was the product advertised to those individuals who would enter the "aerobic" program.

Extensive research data concerning oxygen consumption, thought by many to be the key to endurance training, were simplified from a four-year exercise testing program involving over 15,000 men and women, to a program meaningful to the general public. The "aerobic" program proposed by Cooper was well founded and supported by research. The Cooper program has been well received by the public; the 12-Minute Test has been administered throughout the nation. For the first time, exercise questions concerned with "How much? How long? and What kind?" could be answered and supported by research findings.

Cardio-respiratory fitness testing has taken on new dimensions due to Cooper's research. Certainly physical educators have gained new and valuable insights into fitness testing, exercise and endurance training. Despite such gains, data for women are lacking. Suitable distance charts and age tables are non-existent for women under thirty. The administration of the 12-Minute Test has presented problems; accurate distance recording has been difficult. While a 1½-Mile Test for Men has been developed (7:31), based on data accumulated on the 12-Minute Test, little work has been undertaken to establish a distance test for women. Some work has been undertaken at the college level but no data are available for junior high school girls. Perhaps fitness levels might be determined easier by a distance test (1¼-Mile Run) rather than through a timed test (12-Minute Test).

If such a distance test were developed for junior high school girls, and equivalent to the 12-Minute Test, fitness

testing in the public schools would have greater meaning. Fitness levels would be based on maximum oxygen consumption; the test would be easier to administer, less time consuming and more accurately recorded; and the experience would have greater meaning for the individual participant.

CHAPTER II

STATEMENT OF PROBLEM

The purpose of this study was to determine the equivalency of Cooper's 12-Minute Test and a 1¼-Mile Run for junior high school girls. The data were studied in the following ways:

1. by correlating the raw scores on each test by age groups and by the total group,
2. by comparing the mean performance on the two tests by age groups and by the total group,
3. by establishing T-score norms for each test,
4. by comparing the performance on the 12-Minute Test with the standards established by Cooper.

DEFINITIONS

aerobic - a process occurring with oxygen; the process occurs when the supply of oxygen to the tissues is sufficient to bring about the complete oxidation of lactic acid into carbon dioxide and water

aerobics - "refers to a variety of exercises that stimulate heart and lung activity for a time period sufficiently long to produce beneficial changes in the body" (7:15)

aerobic capacity - the maximum amount of oxygen the body can process in a given amount of time (7)

junior high school - grades 7-9

maximum oxygen intake (maximal oxygen uptake) - the maximum amount of oxygen the body is able to utilize for oxidation purposes for a given amount of time; oxygen consumption is usually measured in milliliters per kilogram of total body weight per minute

maximum effort (maximal effort)-a work load of sufficient intensity to cause complete exhaustion; often measured in terms of maximal oxygen uptake

submaximal effort - a work load of great intensity which ceases before exhaustion

CHAPTER III

REVIEW OF LITERATURE

Some discussion of pertinent fitness definitions will be presented first in this chapter. A review of some fitness measures of both cardiovascular and motor types will follow. The last section will be an evaluation of aerobics, Cooper's involvement with it, and some related research.

DEFINITIONS

Fitness

The term "fitness" has caused much controversy, concern, and unrest among physical educators due to the impossibility of finding a definition acceptable to the experts. Such definitions vary in scope because fitness is a multifactor term or, as Dr. Scheele stated, "a many splintered thing." (71:66) The dictionary defined fitness as the "state or quality of being fit or fitted." (24:957) Barrow and McGee defined fitness as "that state which characterizes the degree to which a person is able to function." (2:547) Steinhaus implied that the fundamental purpose of fitness was to assure survival (30); Cureton believed that physical fitness, emotional fitness, mental fitness and social fitness were but aspects of total fitness. (8)

Scott and French provided the following definition for fitness:

> The basic concept of fitness is that of an effective total response to work or activity of whatever intensity may be required. . . . In short, the fit person is one who is free of limiting and debilitating ailments, who has the stamina and skill to do the day's work, and who has sufficient reserve of energy not only to meet emergencies but to provide a zest for leisure time living. (28:277)

The American Association for Health, Physical Education and Recreation issued the following statement, prepared and approved by one hundred delegates attending the AAHPER Fitness Conference in September 1956:

> Fitness is that state which characterizes the degree to which the person is able to function. Fitness is an individual matter. It implies the ability of each person to live most effectively within his potentialities. Ability to function depends upon the physical, mental, emotional, social and spiritual components of fitness, all of which are related to each other and are mutually interdependent. (31:8)

The Fitness Conference also listed seven mutually interdependent components of fitness:

1. Optimum organic health consistent with heredity and the application of present health knowledge;
2. Sufficient coordination, strength, and vitality to meet emergencies, as well as the requirements of daily living;
3. Emotional stability to meet the stresses and strains of modern life;
4. Social consciousness and adaptability with respect to the requirements of group living;
5. Sufficient knowledge and insight to make suitable decisions and arrive at feasible solutions to problems;
6. Attitudes, values, and skills which stimulate satisfactory participation in a full range of daily activities;
7. Spiritual and moral qualities which contribute the fullest measure of living in a democratic society. (31:8-9)

Physical Fitness

Just as the total concept of "fitness" has many connotations, numerous attempts have been made to define "physical fitness."

Youth Physical Fitness: Suggested Elements of a School Centered Program included the following definition:

> Physical fitness itself is a broad quality involving medical and dental supervision and care, immunization and other protection against disease, proper nutrition, adequate rest, relaxation, good health practices, sanitation, and other aspects of healthful living. Exercise is an essential element to achieving physical fitness. Strength, stamina, endurance and other desirable physical qualities are best developed through vigorous activity. Physical fitness is achieved through a sensible balance of all these provisions adapted to age, maturity, and capability of the individual. (26:iii)

Cureton stated that "physical fitness is one phase of total fitness. It does not include all of the aspects of emotional fitness, mental fitness, or social fitness." (8:18) Clarke defined physical fitness as "the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies." (5:14) Thus, concluded Clarke:

> Physical fitness, therefore, is an essential quality in man. School children, as well as their parents, may not need the muscular development and strength required of their pioneering forefathers, whose very lives often depended upon them; but, in intellectual as in physical work, a sound heart and lungs, good digestion, and a vigorous, well-developed physique are still great assets for effective accomplishment and for living a satisfying life. (5:14)

The multifaced concept of physical fitness has been further illustrated by Karpovich:

> Strictly speaking, physical fitness means that a person possessing it meets certain physical requirements. These requirements may be anatomical (structural), physiological (functional), or both. Anatomical fitness may require a person to be of a certain height or weight, or have specified dimensions of various parts of the body. Physiological fitness may require a person to be able to withstand certain temperatures or altitudes, or able to perform specific physical tasks involving muscular effort. A person may be perfectly fit to meet some of these requirements and yet be unfit for others. A person physically fit in all respects does not exist. (17:220-221)

Hunsicker, author of the pamphlet Physical Fitness, drew upon research material believed to represent views of most experts:

> Fitness consists in the ability of the organism to maintain the various internal equilibria as closely as possible to the resting state during strenuous exertion and to restore promptly after exercise any equilibriums which have been disturbed. . . . The fit individual will be less embarrassed, physiologically speaking, than the unfit individual when both are given the same task, and furthermore, the fit individual will recover faster from the task than the unfit. (15:5)

Hunsicker also presented the following characteristics of the fit individual, supported by studies in physiology of exercise designed to note differences between fit and unfit individuals:

1. A lower resting pulse rate;
2. A lower oxygen consumption for the same work output;
3. A larger stroke volume of the heart (more blood ejected per contraction);
4. A faster return to normal of blood pressure and heart rate after exercise;
5. A capacity of displacing physiological equilibria further and for a longer time;
6. An ability to perform greater amounts of work. (15:6)

Motor Fitness

> A more limited phase of physical fitness is 'motor fitness' and since it is limited in its scope, it becomes a less elusive quality and can be defined more easily than total fitness or physical fitness. (2:125)

Mathews defined motor fitness:

> A limited phase of motor ability, emphasizing capacity for vigorous work. The aspects selected for emphasis are endurance, power, strength, ability, flexibility, and balance. More specifically, motor fitness might be referred to as efficient performance in such basic requirements as running, jumping, dodging, falling, climbing, swimming, lifting weights, carrying loads, and enduring sustained effort in a variety of situations. (19:92)

Brock, Cox and Pennock made the following statement:

> Motor fitness is the final criterion through which all other elements of physical fitness are seen and measured in man. How continuously and efficiently he performed his daily work in industry, on the farm, in the armed forces or in athletic performances, was at one time the only criterion that man had of physical fitness. He might know little or nothing about scientific facts of body structure, physiology, or functioning of the organs, strength tests on the dynamometer, or organic efficiency tests. But he could understand an outstanding performance displaying power, speed and endurance. (41:407)

Barrow and McGee viewed motor fitness as "a readiness or preparedness for performance with special regard for big muscle activity without undue fatigue." (2:548) Cureton discussed motor fitness in Physical Fitness Appraisal and Guidance:

> Motor fitness is a limited phase of motor ability which emphasizes: 1/ endurance, 2/ power, 3/ strength, 4/ agility, 5/ flexibility, 6/ balance. It emphasizes the fundamental or gross big muscle movements that are dominated by kinesthetic sense, and suppleness of the major tissues and joints . . . those aspects which are fundamental to athletic or work skills rather than the higher refinements pertaining to specialized small muscle skills which require years to perfect. Specifically, it means the capacity for efficient performance in the basic requirements of running, jumping, dodging, falling, climbing, swimming, lifting weights, carrying loads, and enduring under sustained effort in a variety of situations. (8:21)

Clarke defined motor fitness as "a limited phase of general motor ability, with emphasis placed on the underlying elements of vigorous physical activity, but does not include primary elements of coordination and skills." (5:202)

PHYSICAL FITNESS MEASUREMENT

Three principle approaches for objective testing of physical fitness have been accepted by most physical educators. Cureton defined these areas as (a) appraisal of physique, (b) appraisal of organic efficiency, and (c) appraisal of motor fitness. (8) The latter two shall be discussed here.

Measures of Cardiovascular Fitness

Physical educators long have been concerned with cardiovascular measurement. Various tests, cardio-vascular-respiratory in nature, have been experimented with in the United States since 1884 and early attempts promoted to measure such qualities as "functional health, physiological efficiency, organic condition and circulatory endurance." (5:179) The tests described below reflect the elements frequently measured, i.e., pulse rate at rest, after exercise and after rest following exercise, systolic and diastolic blood pressures, and venous pressures, and give insight into some of the better known early attempts at cardiovascular measurement.

Crampton Blood-Ptosis Test

One of the earliest of the cardiovascular tests was proposed in 1905 and was designed to evaluate the general condition of an individual. Clarke described the testing procedures:

1. The subject reclines until his pulse rate reaches a steady rate. A constant rate is reached when two repeated 15-second counts are the same.

2. While still in the reclining position, his heart rate is taken for one minute; then, his systolic blood pressure is taken.
3. The subject stands. When his pulse rate has reached a steady state, and while standing, heart rate and systolic blood pressure tests are again taken. (5:181)

This simple test is based on changes in heart rate and systolic blood pressure upon standing from a reclining position and is scored from a chart based on such changes. The efficiency of the Crampton Blood-Ptosis Test is now a matter of some question and dispute. (5, 8, 20, 21)

Foster Test

Foster sought to develop a simple, fairly accurate test of physical fitness based upon recuperation of the heart rate after running in place. Foster assumed that the increase in heart rate after exercise was proportional to the amount of work done. His test included the following procedures: normal standing pulse for 60 seconds, run in place 15 seconds at 180 steps per minute, pulse rate counted for 15 seconds immediately after exercise and 45 seconds after exercise, score based on relation of the three pulse rates. (52) In 1920 a series of efficiency tests for boys and for girls was adopted for use in the Michigan schools. The Foster Test was adapted to mass testing for the Michigan Test. (70)

Schneider Test

The Schneider Test was devised during World War I to test whether or not aviators were functionally fit to fly. The testing procedures are described as follows: the subject

reclines for five minutes before the reclining pulse rate and systolic pressures are taken; the subject stands and the pulse rate and systolic pressures are taken again; the subject then engages in a chair stepping exercise, taking 5 steps in 15 seconds; upon completion of the exercise the subject stands at ease during the subsequent pulse counts. Pulse counts are taken for 15 seconds immediately following the exercise, and for 15 seconds at one minute, 1½ minutes, and 2 minutes. Norm charts determine the final score. (3) Hindman attempted to improve the method of scoring on the Schneider Test by assigning interpolated values to the Schneider scoring tables. (57)

Tuttle Pulse-Ratio Test

In 1931 Tuttle introduced the Pulse-Ratio Test as the technique to be employed in rating physical efficiency. Testing procedures were as follows: the subject sits until the pulse is stabilized; the pulse is counted for 30 seconds, doubled, and recorded as the normal pulse; subject performs exercise for 1 minute and the number of steps are recorded; subject sits down immediately after exercise and the pulse is counted for 2 minutes; the first pulse ratio is determined by dividing the total pulse for 2 minutes by the normal pulse for 1 minute. A second pulse-ratio is obtained after the pulse returns to normal. The subject performs exercise for 1 minute and the second ratio is determined by dividing the total 2 minute pulse by the original normal pulse for 1 minute; the number of steps needed for 2.5

ratio is computed through use of a formula or chart. (78) The pulse-ratio test has been used in later studies. (72, 79, 80)

McCurdy-Larson Test of Organic Efficiency

In 1935 McCurdy and Larson published the results of data collected on infirmary subjects and varsity swimmers. Their test consisted of the following parts:

1. sitting diastolic pressure
2. breath-holding 20-seconds after standard exercise
3. difference between standing normal pulse rate and pulse rate 2 minutes after exercise
4. sitting pulse pressure
5. standing pulse pressure. (61:15)

The exercise taken involved walking over and back on the three step chairs. The amount of exercise to be taken was based on sex, age and weight. The breath-holding test was done seated and consisted of taking a very deep breath 15 seconds after the conclusion of the exercise, and blowing for as long a period of time as possible, beginning 20 seconds after the exercise. The test was scored on tables which weighted the test according to multiple regression loadings. (61) Standards for boys, ages 10½ to 17 years, are available. (48)

Harvard Step Test and Various Revisions

The Harvard Step Test was originally constructed for college men and measured the general capacity of the cardio-vascular system to adapt to hard work and recover. The directions for administering the test were as follows: subject steps up and down 30 times a minute on a bench 20 inches high; exercise continues

for 5 minutes unless subject must stop due to exhaustion; duration of exercise is recorded in seconds. At the end of the exercise the subject sits down immediately; the pulse is counted 1-1½ minutes, 2-2½ minutes, 3-3½ minutes after stepping ceases. The score is computed from a formula and the final score is determined from established norms. (42) Many variations of the Step Test have been reported.

Brouha and Gallagher proposed a simple method for testing the dynamic fitness of high school girls. The Harvard Step Test was recommended with the following exceptions: bench 18 inches high, exercise of 4 minute duration. (43) Clarke proposed an adaptation of the Harvard Step Test to be used with college women. Like the Brouha and Gallagher revision, the Harvard Step Test was recommended with the same exceptions: bench 18 inches high, exercise of 4 minute duration. (44)

Skubic and Hodgkins proposed a three minute step test for girls and women. The following modifications were made in the Harvard Step Test: rate of stepping reduced to 24 steps per minute, bench height lowered to 18 inches, pulse taken for 30 seconds after 1 minute of rest following exercise. (73) In later studies, Skubic and Hodgkins developed national norms for their Cardiovascular Efficiency Test. Norms were prepared separately for junior high, senior high and college women. (74, 75) A study by Gallagher and Brouha proposed a revision of the Step Test for high school boys. (54)

Other Cardiovascular Tests

Other cardiovascular-respiratory tests have been reported in the literature. They merit citing for reference purposes: Barach Test (39), Barringer Test (20), McCloy's Test of Present Condition (20), Meylan's Test (63), and the Tigerstedt Cardiovascular Test. (22)

Measures of Motor Fitness

The early 1940's and World War II brought the terms physical fitness and total fitness into general use (28) and introduced the term motor fitness. (5) At this time, the Armed Services placed great emphasis on the ability of the individual to endure and directed "their physical education programs to the development of what was called 'physical fitness'." (23:53) However, "the answer on how to measure fitness was not available in the early 40's when the problem of testing fitness suddenly took on new importance." (28:279) Many groups responded in attempts to measure aspects of fitness: the United States Office of Education, state departments of public instruction, various armed service branches, state and national physical education associations, and independent research workers. (28) Cureton reacted to these efforts in 1947 when he made the following statement:

> Finding the best simple test of physical fitness has been like looking for the holy grail. There have been many attempts to find such a test. The literature abounds with various proposals, some worth while, others of little worth. (8:29)

The tests discussed here illustrate some of the items frequently

used, i.e., sit-ups, pull-ups, push-ups, the shuttle run, and have been chosen as representative of the many motor fitness tests that have emerged.

Motor Fitness Tests of the Armed Forces

The various branches of the Armed Forces have developed motor fitness tests. These tests are similar in terms of test items, scoring, administration and are adapted to mass testing procedures for short periods of time with minimum use of equipment. One characteristic present in many of the test items is the requirement for each subject to perform the given task until exhaustion. The following fitness tests are representative of the various branches of the Armed Forces.

The Navy Standard Physical Fitness Test included five test items: squat thrusts, sit-ups, push-ups, pull-ups, and squat jumps. (5) In 1965 three tests were accepted for measuring the physical fitness of Army personnel: Physical Combat Proficiency Test, Army Minimum Physical Fitness Test, and Airborne Trainee Physical Fitness Test. Items included in these tests were the 40-yard low crawl, dodge run and jump, one mile run, horizontal ladder travel by hands, squat bender, push-ups, sit-ups, squat thrusts, and dodge run and jump. (5)

The United States Coast Guard Academy administered physical fitness tests twice a year. All cadets had to achieve the minimum standards in the following events:

Test Item	Minimum Score
Pull-ups	6
Floor push-ups	27
Sit-ups in 2 minutes	47
Modified squat jumps	52
300-yard shuttle run	59 seconds
Swimming	100 yards

(5:217)

The Marine Corps Physical Readiness Test was scored on a pass or fail basis. All men up to 40 years of age had to meet a minimum standard in the following events:

Test Item	Minimum Score
Pull-ups	3
Floor push-ups	21
Sit-ups in 2 minutes	25
Squat thrusts in 1 minute	15
Half-mile run	Continuous; no time limit

(5:217)

The United States Air Force Physical Fitness Test included the following items: unlimited sit-ups, pull-ups, 300-yard shuttle run outdoors, and a 250-yard shuttle run indoors. (5) The JCR Test, a 3-item battery, was developed using men from the Air Corps. The test items included a vertical jump, chinning, and a shuttle run. Norms are available. This test was discontinued in 1943 when the Army adopted the Army Air Forces Physical Fitness test. (68)

Basic Fitness Test

The Basic Fitness Test was the result of a physical fitness study undertaken at Yale University from 1958-1962, sponsored by the Office of Naval Research. Over 20,000 young people representing 45 cities from throughout the United States participated and contributed performance records for the establishment of national norms. Nine physical fitness factors were measured in the recommended ten-item test battery. Separate norms for girls and boys based on age are available for 15-18 year olds; some norms are available for the 12-14 age group. The test items included the extent flexibility test, dynamic flexibility test, shuttle run, softball throw, hand grip, pull-ups, leg lifts, cable jump test, balance test and 600 run-walk. (12, 13)

Motor Fitness Test for Oregon Schools

The Revised Motor Fitness Test for Oregon Schools provided a 3-item test battery for three separate age groups, grades 4-12. Test items for girls, grades 4-12, included a flexed arm hang, the standing broad jump, and crossed arm curls. Test items for boys, grades 4-6, included push-ups, standing broad jump, and sit-ups. Test items for boys, grades 7-12, included the jump and reach, pull-ups, and the potato race. (29)

CAHPER Fitness-Performance Test Manual

In 1963 the Research Committee of the Canadian Association for Health, Physical Education and Recreation undertook a project to design a physical fitness test and establish national norms

for Canadian boys and girls, 7-17 years of age. Approximately 11,000 subjects participated in the research study testing in 1964-65. Norms were developed based on age. The test items included the one minute speed sit-up, standing broad jump, shuttle run, flexed arm hang, 50-yard run, 300-yard run. (4)

AAHPER Youth Fitness Test

The AAHPER Youth Fitness Test probably has been used by more physical education teachers across the country than any other single test battery. The AAHPER Youth Fitness Test underwent revision in 1963-1965 for the establishment of new national norms. The test battery consisted of seven items designed to measure the physical fitness status of boys and girls in grades 5-12. The test items included pull-ups for boys, flexed arm-hang for girls, sit-ups, shuttle run, standing broad jump, 50-yard dash, softball throw, and 600-yard run-walk. Two sets of norms were available: by age and by classification index based on age, height and weight. (1) Numerous studies have been conducted on the AAHPER battery to study its reliability, validity, administration procedures and norms. (33, 60, 67, 69, 84, 88)

North Carolina Fitness Test

The North Carolina Fitness Test was designed for boys and girls age 9-18 years. The five test items were sit-ups, side stepping, standing broad jump, pull-ups for boys, modified pull-ups for girls, and squat thrusts. Norms based on sex and age were available. (25)

New York State Physical Fitness Test

The New York State Test was designed for boys and girls grades 4-12. The 7-item battery included a posture test (each student is rated in each of 13 segments), an accuracy test (target throw), a strength test (pull-ups or push-ups), an agility test (side-stepping), a speed test (50-yard dash), balance test and an endurance test. Norms based on grade were available. (10)

Revised California Physical Performance Test

The Revised California Physical Performance Test was a five-item battery consisting of the standing broad jump, knee bent sit-ups, 50-yard dash, softball throw, knee push-ups for girls, and pull-ups for boys. Test norms based on age were available for girls and boys 10-18 years of age. (5, 16) The development of age norms was recommended by Espenschade based on findings which showed that height and weight did not influence the test scores appreciably. (51)

DGWS Physical Performance Test (also known as the NSWA Physical Performance Test)

The Research Committee of the National Section of Women's Athletics proposed a fitness test for high school girls. The test consisted of the following eight items: standing broad jump, basketball throw, potato race, sit-ups, push-ups, pull-ups, 10-second squat thrust, and 30-second squat thrust. A five-item battery was suggested if time did not permit the administration

of the eight-item battery. One set of norms was available for all senior high school girls. (62)

Purdue University Motor Fitness Test

Arnett developed a three-item test battery for use with senior high school girls. Test items included modified pull-ups, 600-yard run, and the standing broad jump. (32)

Indiana Physical Fitness Test

The Indiana Physical Fitness Test was a four-item battery for boys and girls, grades 4-12. The test items included straddle chins, push-ups for boys, push-ups modified for girls, squat thrusts, and the vertical jump. For elementary boys and girls and for high school boys the Classification Index based on age, height, and weight was used for norms; for high school girls height-weight class divisions were used. Appropriate tables of norms were available to determine the students' final scores. (2, 40, 53)

PCPF Screening Test

The President's Council on Physical Fitness proposed three simple screening tests to identify "underdeveloped" boys and girls above 10 years of age. Suggested items included pull-ups for boys, modified pull-ups for girls, sit-ups, and squat thrusts. (26)

University of Illinois Motor Fitness Test

Cureton has been instrumental in developing motor fitness tests at the University of Illinois. In 1942 and 1943 two tests

were devised: a 14-item test and an 18-item test. Cureton recognized six components of motor fitness: balance, flexibility, agility, strength, power and endurance. Items in the 14-item motor fitness screening test included: foot and toe balance, squat stand, trunk extension flexibility, trunk flexion sitting, extension press-ups, man lift and let down, leg lifts and sit-ups, medicine ball put, Illinois Agility Run, skin the cat, bar or fence vault, chinning, standing broad jump and mile run. (8) In 1945 a short screening test was devised by Cureton, Welser, and Huffman. This 7-item test included a dive and roll, medicine ball put, bar vault, chinning, leg lifts and sit-ups, breath holding and man lift. (47) In 1945 Cureton and O'Conner developed two motor fitness screening tests for high school girls. A single period test of six items was constructed which included dizziness recovery, trunk extension, kneeling jump, kneeling push-ups, basketball throw, and 30-second squat thrusts. A double period test of twelve items was also constructed and included all of the items in the 6-item test plus the foot and toe balance, trunk flexion, Illinois Agility Run, sit-ups, standing broad jump, and a step test. (66)

AEROBICS

Cooper wrote an article entitled "The Role of Exercise in Our Contemporary Society" which was published in the May 1969 issue of the Journal of Health, Physical Education and Recreation. In the search for a definition of physical fitness, it might be well to consider the following statements by Cooper:

> To a physician, physical fitness may imply merely absence of disease. To a weight lifter, physical fitness may be synonymous with large bulging muscles. To a health or physical educator, physical fitness may be equated with ability to perform a specific number of calisthenics or to run 600 yards within a certain time limit. In this paper physical fitness means only cardiovascular-pulmonary fitness, that is, a good heart, good blood vessels, and good lungs. . . . Without adequate reserves in the cardiovascular-pulmonary systems, a person is not prepared to meet the common or unusual stresses of daily living, that is, he is not physically fit. (45:22)

Aerobics has been defined by Cooper to be a "variety of exercises that stimulate heart and lung activity for a time period sufficiently long to produce beneficial changes in the body." (7:15) Like previously discussed cardiovascular measurements, the aerobics program is concerned with the measurement of cardiovascular fitness. Pulse rate and oxygen consumption have been correlated with various types of exercise and "all popular exercises have been scientifically measured for the amount of energy it costs the body to perform them." (6:6) Like the motor fitness measurements mentioned earlier, the aerobic program provides a field test, a 12-Minute Test, designed to "establish your present physical condition." (6:6) Aerobics represents a "new concept of exercise" (7:15) that utilizes normal activity to improve the capacity of the cardiovascular and pulmonary systems and, therefore, improves overall health and fitness. The aerobic program incorporates both cardiovascular and motor fitness measurements to provide a scientifically founded exercise program based on point systems. These point systems enable an individual to assess his activity needs and choose a plan of exercise to meet such needs.

Aerobic Capacity as a Measure of Fitness

In 1968 Cooper published a book entitled Aerobics. (6) Throughout the book Cooper used the term physical fitness to denote cardiovascular-respiratory fitness and he advocated measurement of fitness levels based on "the maximum amount of oxygen the body can process and consume." (6:32) Cooper has not been the first to point to maximal oxygen intake or aerobic capacity as the best measure of cardiovascular-respiratory fitness, for numerous investigations have supported the same rationale.

Newton, author of an article entitled "The Assessment of Maximal Oxygen Intake," wrote as follows:

> Not only is the maximum oxygen intake the best single indicator of the capacity of a man for sustaining hard work; it is also the most objective measure by which one gains insight into the physical fitness of an individual as reflected by his cardiovascular system. (65:164-165)

Hyde cited a study by Taylor, et al. and noted that the authors considered maximum oxygen intake "to be the most effective measure of the capacity to perform aerobic work." (86:11)

Astrand and Saltin pointed out that

> a measurement of the maximum oxygen uptake (aerobic work capacity) of a subject when performing muscular exercise gives the maximal rate of energy output by combustion within the body. (37:971)

Hettinger, Birkhead, Horvath, Issekutz, and Rodahl noted that

> the maximal oxygen uptake (or aerobic capacity) is the best measure of a person's physical fitness, providing the definition of 'physical fitness' is restricted to the capacity of the individual for prolonged heavy work. (56:153)

Astrand, in an article entitled "Human Physical Fitness with Special Reference to Sex and Age," considered aerobic capacity probably to be the best measure of a person's physical endurance. (35) Taylor, et al. ascertained that "the maximal oxygen intake appeared to offer the possibility of determining with precision one of the limiting factors in endurance performance characterized by a high level of energy expenditure." (76:73)

The Prediction of Maximum Work Capacity from Submaximum Work

Many investigators have pointed out that there is a linear relationship between oxygen uptake and heart rate during submaximal work. This relationship is dependent upon the physical condition of the individual and is independent of sex and age in most instances.

> Since the maximal pulse rate declines with age after about 20, it is necessary to make corrections for age in this prediction of maximum oxygen uptake on the basis of pulse response to submaximal work loads. (27:281)

Several investigators have attempted to predict the maximum work capacity from submaximal work loads. In 1954 the Astrand Nomogram was developed for the calculation of maximum aerobic work capacity from submaximal pulse rates and oxygen uptake values. The Nomogram was based on results gathered from experiments with healthy subjects, ages 18-30. The test was simple, quick, and relatively easy to administer and each subject had the choice of participation in a step test, a treadmill test, or a cycle test. The authors suggested that

the individual's aerobic capacity per kilogram of body weight per minute would give a good measure of physical fitness; the Nomogram took these factors into consideration. It must be remembered, however, that the Nomogram gives only a prediction of work capacity and not an exact value. (38) A corrected version of the Nomogram with special reference to age was also developed. (34)

Teraslinna and Ismail measured the maximal oxygen uptake and pulse rates during submaximal work loads and reported that the Astrand Ryhming Nomogram (corrected for age) was a satisfactory predictor of the maximal oxygen uptake. (77)

Workman and Armstrong developed an equation to predict oxygen consumption of adult males while walking on a treadmill. The prediction was made in terms of height, weight, and treadmill speed and grade. (82) One year later the authors developed a nomogram based on their equation. (81) Hyde cited a study by Asmussen and Hemmingsen that

> presented a curve and a formula from which maximum extra oxygen intake could be determined from measurements made during submaximal work. Extra oxygen intake is the increase in oxygen-uptake above the resting value. (86:12)

Issenkutz, Birkhead and Rodahl predicted maximal oxygen uptake from the respiratory quotient taken at submaximal levels. Their subjects exercised on a bicycle ergometer. The maximal oxygen uptake of each individual was predicted successfully based on the measurement of the respiratory quotient during work at a submaximal load. The authors noted, however, that prediction

of aerobic work capacity through the use of the respiratory quotient was technically more complicated and more difficult to obtain reliable values. (58)

Efforts by many other individuals have given insight into the prediction of maximal oxygen intake. Assessment has been made, for the most part, by various treadmill, bicycle ergometer, or step tests. deVries pointed out that the measurement of maximum oxygen consumption probably evaluates "cardiovascular function, respiratory function, muscular efficiency, strength, muscular endurance, and obesity." (9:205)

deVries and Kalfs compared six methods designed to estimate maximum oxygen uptake and correlated the results with measured maximal oxygen intake. The six tests used were the Sjostrand-Wahlund Test, a modification of the Sjostrand-Wahlund Test, the Harvard Step Test, the Progressive Pulse Ratio Test, a 3-minute modification of the Delta R. Q. Test, and the Astrand-Ryhming Nomogram; the Astrand-Ryhming Nomogram and the Sjostrand-Wahlund Test had the highest predictive values. (49)

Glassford, et al. conducted a study designed to compare various up-take values determined by five different tests. Twenty-four male subjects, ages 17-33, were given three direct tests of maximum oxygen uptake (Mitchell, Sproule, Chapman Test, Taylor, Buskirk, Henschel Test, and Astrand Test), one indirect test (Astrand-Ryhming Nomogram) and the Johnson, Brouha and Darling Physical Fitness Test. The data collected from the various tests were compared and the correlation coefficients between all

the tests were found to be significant (.62-.83); yet, no correlation proved to be significantly greater than any other. The Astrand-Ryhming Nomogram was found to be a good estimator of maximum oxygen uptake. (55)

Astrand and Saltin investigated maximum oxygen uptake and heart rate in various types of muscular activity. The following exercises were studied: cycling (sitting), cycling (supine), bicycle ergometer (arm and leg work), running on treadmill, skiing, swimming, and arm work (cranking). Results showed that the

> study did not confirm observations from other experiments that maximal work with arms plus legs such as in simultaneous cranking and running or in skiing gives a higher oxygen uptake than exercising the legs only, as in cycling or running. (36:979)

Hyde investigated the validity of the Astrand-Ryhming Nomogram. Secondary school age boys and girls were used as subjects. Their maximal oxygen intake was measured by the Astrand-Ryhming Predicted Maximal Oxygen Intake Test and the Astrand Actual Method. Results showed that the Astrand-Ryhming Nomogram predicted values of maximal oxygen consumption were equivalent to the values obtained on the Astrand Actual Test. (86)

Michael and Horvath gave maximum exercise tolerance tests to 30 female subjects, 17-22 years of age. Subjects exercised at progressive work loads until they could no longer perform. The mean oxygen uptake in ml./kg./min. ranged from 23.3 to 30.4. Maximum work capacity, however, could not be predicted from any one submaximal measurement. (64)

Many investigators have endorsed the measurement of maximal oxygen intake as the best indicator of cardiovascular fitness. Many of the previously cited tests have suggested various ways to assess maximal oxygen intake and in most instances involved work on a treadmill or ergometer.

The 12-Minute Test

In 1968 Kenneth H. Cooper published the 12-Minute Test in Aerobics. (6) His book contained the results of four years of intensive research involving over 15,000 people and conducted by top medical experts. Lt. General R. Bohannon made this comment:

> Dr. Cooper's research makes a significant contribution by correlating oxygen consumption and pulse rate with various types of exercise and the vigor and duration of each. (6:x)

One hundred male officers and airmen, average age of 22, were evaluated on a Treadmill Maximal Oxygen Consumption Test and on the 12-Minute Test; the obtained correlation was .897. These results indicated that maximum oxygen consumption could be estimated with considerable accuracy from results of the 12-Minute Test. (46)

Cooper's 12-Minute Test holds much promise for use by physical educators for several reasons:

1. the ease with which the test can be administered to large groups,
2. the validity of the 12-Minute Test as proven in the laboratory and on the field,

3. the use of a minimum amount of equipment,

4. no financial commitments,

5. test administrators need not be trained personnel.

The 12-Minute Test results enable an individual to assess his present physical condition (his maximum oxygen consumption) by converting the distance covered in the 12-Minute Test into milliliters of oxygen. The chart needed for this calculation is found in Table I. A classification chart has been developed based on the information from Table I. An individual is placed into one of five fitness categories dependent upon the distance covered in the 12-Minute Test and the oxygen consumed. Once an individual is classified into a fitness category, age adjusted progressive exercise programs are available and point values are assigned to various exercises such as walking/running, cycling, swimming, handball/squash/basketball and many other individual and team activities. The classification chart may be found in Table II, page 33.

Table II was formulated by Cooper without special reference to sex or age. A new chart has been developed with special considerations for age. Separate standards for men and women have been provided also. This chart may be found in Table III, page 33.

The aerobic data for women have been limited. However, Cooper has corresponded with the writer about two completed studies which used women as subjects. (83) This letter may be found in the Appendix. In a recent study conducted by John

TABLE I

PREDICTED MAXIMAL OXYGEN CONSUMPTION ON THE BASIS OF 12-MINUTE PERFORMANCE

Distance (Miles)	Laps ¼ Mile Track	Maximal Oxygen Consumption (ml/kg/min)
<1.0	<4	<25.0*
1.000	4	25.0*
1.030	...	26.0*
1.065	4¼	27.0*
1.090	...	28.2
1.125	4½	29.0
1.150	...	30.2
1.187	4 3/4	31.6
1.220	...	32.8
1.250	5	33.8
1.280	...	34.8
1.317	5¼	36.2
1.340	...	37.0
1.375	5½	38.2
1.400	...	39.2
1.437	5 3/4	40.4
1.470	...	41.6
1.500	6	42.6
1.530	...	43.8
1.565	6¼	45.0
1.590	...	46.0
1.625	6½	47.2
1.650	...	48.0
1.687	6 3/4	49.2
1.720	...	50.2
1.750	7	51.6
1.780	...	52.6
1.817	7¼	53.8
1.840	...	54.8
1.875	7½	56.0
1.900	...	57.0
1.937	7 3/4	58.2
1.970	...	59.2
2.000	8	60.2

*Insufficient data on these distances to make reliable comparisons.

TABLE II

12-MINUTE TEST CONVERSION TABLE

Fitness Category	Distance Covered	Oxygen Consumption
I. Very poor	less than 1.0	less than 25.0
II. Poor	1.0 to 1.24	25.0 to 33.7
III. Fair	1.25 to 1.49	33.8 to 42.5
IV. Good	1.50 to 1.74	42.6 to 51.5
V. Excellent	1.75 miles or more	51.6 or more

(7:28, 29)

TABLE III

12-MINUTE CONVERSION TABLE WITH SPECIAL REFERENCE TO SEX AND AGE
(Distance in Miles Covered in 12 Minutes)

Fitness Category	Age (years) Under 30	30-39	40-49	50+
I. Very poor	<1.0 <.95	<.95 <.85	<.85 <.75	<.80 <.65
II. Poor	1.0-1.24 .95-1.14	.95-1.14 .85-1.04	.85-1.04 .75- .94	.80- .99 .65- .84
III. Fair	1.25-1.49 1.15-1.34	1.15-1.39 1.05-1.24	1.05-1.29 .95-1.14	1.0- 1.24 .85-1.04
IV. Good	1.50-1.74 1.35-1.64	1.40-1.64 1.25-1.54	1.30-1.54 1.15-1.44	1.25-1.49 1.05-1.34
V. Excellent	1.75+ 1.65+	1.65+ 1.55+	1.55+ 1.45+	1.50+ 1.35+

(The second requirement in each case is for women.)
< Means less than. (7:47)

Harralson at the University of Kentucky Medical Center, 125 women, all under 30 years of age, performed the 12-Minute Test. Only nine were able to attain the good or excellent categories as stated in the new chart adjusted for women (Table III, page 33). Cooper also cited work completed by a cohort on 266 Airmen WAFs, ages 18-22. Subjects were evaluated on the 12-Minute Test before and after six weeks of training. Using the standards for men, 2.6 per cent of the WAFs were able to reach the good category after six weeks of training. Cooper and Harralson both concluded that separate standards for women are justified.

A study conducted by Johnston in 1969 cited correspondence with Miss Gay Cox of Grossmont College. At Cooper's suggestion the women at Grossmont College (ages 17-21) ran a timed 1.3 mile rather than the 12-Minute Test. The mean time was 12 minutes and 9 seconds. Based on the results of this testing, Cooper suggested the distance be altered to a mile and a quarter. (87)

Some investigators have attempted further experimentation with the 12-Minute Test. Cooper cited work conducted by a physical educator in a junior high school. The 12-Minute Test was administered to 13-14-15 year old boys; results were compared with the 600-yard run-walk test and with a maximal oxygen consumption test. Final comparisons between all three tests, administered four days apart, indicated that the 12-Minute Test yielded good consistency, and that results from the maximal oxygen consumption test gave a very good correlation with the 12-Minute Test. (6)

Dominic administered a maximum oxygen intake test to junior high school girls to validate the 12-Minute Test; she also tested the reliability of the 12-Minute Test with a test-retest method. She found the test to be reliable (.89) and valid (.619 and .667). Dominic made an important concluding remark:

> . . . if the twelve minute tests were given to both boys and girls the scoring scale would need to be adjusted for the sex and age involved. (85:37)

Johnston studied the relationship between the AAHPER Physical Fitness Test and the 12-Minute Test; subjects were 47 women physical education majors. Conclusions indicated that the two tests were related significantly but not equivalent. Both tests were indicators of motor and cardio-respiratory fitness. (87)

Doolittle and Bigbee evaluated the 12-Minute Run on 153 junior high school boys. A test-retest method found the reliability to be .94; validity was .90 as determined by the use of a bicycle ergometer test of maximum oxygen intake. The authors concluded that the 12-Minute Test was a highly reliable and valid indicator of maximum oxygen intake. (50)

In conclusion it might be noted that the New Aerobics by Cooper, released in May 1970, gave added insight into the impact and reception of the aerobic program:

> Today, the official physical fitness program of the United States Air Force is based on aerobics, with roughly 800,000 members of the Air Force participating. Several foreign military organizations are considering adopting it as their official conditioning program. What's more, aerobics is no longer exclusive to the

military. Countless people in every walk of life have found aerobics a workable way to achieve new levels of physical competence and personal well being. (7:9-10)

CHAPTER IV

PROCEDURES

INTRODUCTION

Jefferson Davis Junior High School is located in the southwest section of Jacksonville, Florida, in Duval County. The school has a student enrollment of approximately 1,600 students, grades 7-9. A large percentage of this middle class school community is composed of Armed Forces personnel. Thus, the school experiences a large student turnover from year to year. Duval County has a six-year physical education requirement for grades 7-12 and, in most instances, students receive instruction five days a week.

Four full time women physical educators are responsible for the girl's physical education program at Jefferson Davis Junior High School. Team sports (basketball, volleyball, boundball, softball, soccer) and individual/dual sports (archery, paddle tennis, horseshoes, badminton, table tennis) are part of the required instructional program. In addition to these activities, tumbling, gymnastics (horse, uneven bars, trampoline, balance beam), track and field, and rhythms (modern dance, folk dance, modern jazz) add to and complete the instructional program.

A well organized and intensive interscholastic program is an additional strength of the physical education program in Duval

County. Jefferson Davis Junior High School is an active participant in this program. The Davis teams are considered to be the strongest entries in the seven-team West Division. Their won/lost record in a variety of competitive activities witnesses to their strengths. Two other divisions complete the membership and involve the fourteen remaining junior high schools throughout the county.

Jefferson Davis Junior High School was chosen to be the testing center for this study because of the following considerations:

1. the author's personal involvement and knowledge of the physical education program in Duval County as a student and a teacher,
2. the author's personal knowledge of the physical education program at Jefferson Davis Junior High School, its content and philosophy,
3. the known and expressed interest and support of the principal at Jefferson Davis Junior High School,
4. the known interest, participation, and success of Jefferson Davis Junior High School in the county interscholastic program,
5. personal acquaintance with the department head of the girl's physical education staff.

Before testing details and procedures could be discussed, permission had to be secured from the school principal and the interest and cooperation assured from the women's physical

education department. A letter was sent to the principal and to the head of the girl's physical education department. Copies of these letters may be found in the Appendix. Both letters asked for permission to administer a 12-Minute Test and a 1¼-Mile Run Test to all girls, grades 7-9, enrolled in the Jefferson Davis Junior High School physical education program. The author personally secured permission from the principal, the department head, and from two of the three remaining teachers in the girl's physical education department. The author did not have an opportunity to meet with the fourth teacher in the girl's physical education department, so the department chairman secured her cooperation for the project. Two meetings were held with the department head to discuss the tests, testing procedures, and other details pertinent to this thesis project.

TESTING PROCEDURES

Subjects

Subjects for this study were women students at Jefferson Davis Junior High School, grades 7-9, all of whom were enrolled in the girl's physical education program comprising 20 physical education classes. Every student participated in the testing unless excused by the teacher. Students enrolled in the special education program did not participate in the testing program. No test make-ups were given. Therefore, it was possible for a student to miss one or both tests due to absence or medical

reasons. Permission to be excused from testing was granted by by the instructor.

Preliminary Arrangements

The scheduling of the girl's track unit extended over a twelve-week period; therefore, testing for this thesis was spread over a twelve-week period. Each instructor taught a three-week track unit, each at a different time and dependent upon a rotation schedule. A twelve-week block was required to insure the four instructors the track area for a three-week instructional period. The three-week track unit included instruction and participation in the following events: 50-75-100-yard dashes, a 220-yard pursuit relay, standing long jump, running long jump, high jump, and softball throw for distance.

The 12-Minute Test and the 1¼-Mile Run Test were scheduled to be administered during the second and third weeks of the three-week track units. Both tests were to be administered within a two-week period. Following the administration of the first test, the second test was to be given within 4-10 days. This allowance was made so that testing during adverse weather conditions could be avoided. The subjects received no additional training or conditioning prior to participation in the 12-Minute Test or the 1¼-Mile Run Test. Daily participation in the track unit served as activity for conditioning prior to the administration of the two tests. It should be noted, however, that all subjects were required to run one lap on the track daily as part of the track unit requirement.

For the most part, the above testing conditions were met. Adverse weather conditions interferred with instruction and participation in only one of the four three-week track units. One instructor and her five classes missed half of their track unit and because of the rotation schedule, could not make up the lost days. Therefore, the second test was administered on the first day of a new unit.

In brief summary, it can be noted that weather conditions determined the total number of days each class received instruction and participation in the three-week track units. However, weather conditions were not considered an adverse factor in the administration of the tests. Both the 12-Minute Test and the 1¼-Mile Run Test were administered within the 4-10-day time limit during the second and third week of the track unit. The one exception has been noted.

The score cards and the test instructions (copies are in the Appendix) were mailed to the department chairman. Four teachers were involved in the actual tests administrations; each teacher administered the 12-Minute Test and the 1¼-Mile Run Test to five classes. An attempt was made to control the training effect by having half the classes take one test first and the remaining classes take the other test first. Table IV outlines the testing schedule. A stopwatch was marked and designated as the test watch and used by all four instructors. All times were recorded in minutes and seconds only.

Prior to the first test day, but sometime during the first or second week of the track unit, each teacher discussed

TABLE IV

TESTING SCHEDULE

Teacher	Period	First Test	Date	Second Test	Date
Airaghi	1	1¼-Mile Run	3/9	12-Minute	3/16
Airaghi	2	1¼-Mile Run	2/12	12-Minute	2/18
Airaghi	4	1¼-Mile Run	2/12	12-Minute	2/18
Airaghi	5	1¼-Mile Run	2/6	12-Minute	2/13
Airaghi	6	1¼-Mile Run	2/5	12-Minute	2/12
Ellison	1	1¼-Mile Run	2/6	12-Minute	2/11
Ellison	2	1¼-Mile Run	2/9	12-Minute	2/13
Ellison	4	1¼-Mile Run	2/4	12-Minute	2/11
Ellison	5	1¼-Mile Run	2/5	12-Minute	2/11
Ellison	7	1¼-Mile Run	2/4	12-Minute	2/11
Crosby	1	12-Minute	2/13	1¼-Mile Run	2/17
Crosby	2	12-Minute	3/6	1¼-Mile Run	3/10
Crosby	3	12-Minute	2/13	1¼-Mile Run	2/17
Crosby	5	12-Minute	2/13	1¼-Mile Run	2/17
Crosby	7	12-Minute	2/12	1¼-Mile Run	2/17
Garvin	2	12-Minute	3/7	1¼-Mile Run	3/12
Garvin	3	12-Minute	3/6	1¼-Mile Run	3/11
Garvin	5	12-Minute	2/12	1¼-Mile Run	2/19
Garvin	6	12-Minute	2/11	1¼-Mile Run	2/19
Garvin	7	12-Minute	3/6	1¼-Mile Run	3/11

and explained to each class something about the tests that were to be administered. The following ideas were discussed with the students:

1. the author: who she was, where she went to school, why she went to school;
2. the thesis: what it was, what it involved, purpose, why it was necessary, Master's Degree;
3. the 12-Minute Test, aerobics, jogging;
4. the 1¼-Mile Run Test;
5. data: how it would be collected, tests would be compared, norms would be established (like the physical fitness norms), the best time would be the 100th percentile;
6. privilege to be used and chosen as a test school;
7. important that everyone try their best, put forth best effort to establish norms;
8. would get tests results back, would know scores;
9. no grade involved;
10. endurance needed (It might be interesting to note that two of the four instructors jogged four laps around the track without walking during class to gain insight into the difficulty and endurance demands of the tests so they would know better how their students might feel upon completion of the tests. Students were told of their instructors performance and reminded, "If I can do it, I know you can.")

Track Markings

Jefferson Davis Junior High School had an eight lane asphalt outdoor track. A white paint mark was placed on the

side of the track every 44 yards; this divided each lap into tenths or the mile (4 laps) into forthieths. Ten markers were made from three-foot broomstick handles. Poster paper was attached marked from A through J. The markers were placed around the track, 44 yards apart. See the Appendix for the conversion table of laps and distance markers into miles.

Score Cards

Seven hundred 5" x 7" index cards were printed to obtain the desired information. The use of 350 yellow and 350 white score cards enabled the instructors and the author to differentiate between those individuals who took the 12-Minute Test first and those individuals who took the 1¼-Mile Run Test first. All basic information was recorded on the score card prior to the administration of the first test. The age of the subject, on the day of the first test administration, was recorded on the card. In some instances the students were allowed to write their name, birthdate, instructor, and class period. However, the majority of the information was recorded by each teacher. All test scores were recorded by the instructor. At no time were the cards given out for the students to record their test performances.

The Tests

The 12-Minute Test. The 12-Minute Test was devised by Kenneth H. Cooper (6) and is based upon four years of research. The 12-Minute Test is designed as a "maximum test" (6:35) to

serve as an indicator of "overall cardiovascular health." (6:34) The subject determines the distance he can cover in 12 minutes. The individual is then placed into a fitness category which is dependent upon the distance covered in the 12-Minute Test. The actual test administration days were February 11, 12, 13, 18 and March 6, 7, and 16. Testing was conducted over a five-week period for the twenty classes involved. The temperature on the test days ranged from 60 to 70 degrees with little or no wind present. The 12-Minute Test was administered to ten classes first and to the remaining ten classes following their participation in the 1¼-Mile Run Test.

Each instructor was responsible for the administration of the 12-Minute Test to her physical education classes. Each class was divided into two groups for testing purposes. Each student worked with a partner. The partner was instructed to count the number of laps her runner completed and report the completed number to the runner upon completion of the test. The runner was instructed to note the flag marker she last passed upon completion of the test. During the test administration, the instructor called out the running time as the lead runners completed each lap; this gave the lead runners some idea as to the pace they were setting. One minute before the test ended, the remaining members of the class shouted "one" (indicating one minute left in the test) so that all runners could give an all-out effort for the remaining minute of testing if they so desired. Students were told not to sit down following the completion of the

12-Minute Test; all students were instructed to walk at least half a lap on the inside of the track and to walk farther if breathing had not returned to normal. Students excused from participation assisted those few students who had given an all out effort and perhaps needed assistance. As soon as the first group completed the test, the remaining group was tested. The same procedures were followed. Following the completion of the test and after each subject had walked a minimum of half a lap, the subject reported her own score to the instructor. The instructor recorded the score in her roll book. The score was later transferred to the score card by the instructor.

Below is an outline of the testing procedures for the 12-Minute Test:

1. At the beginning of the class period, the entire class completed 25 jumping jacks.
2. The class was divided into two groups for testing. Both the partner and the runner understood what they were to do. The test was administered twice during the class period so that both partners participated in the test on the same day.
3. The instructor discussed with the class the best distance achieved. The students were given an idea of how fast they had to pace themselves in order to beat the existing best distance record. They were told the running time would be called out for the lead runners so they would have some idea of the pace they were setting. Runners were also told that when one minute

of the test remained their partners would shout "one" so that they might give an all out effort for the final minute of testing.

4. The test instructions were read by the instructor.
5. The instructor gave the verbal command to start running.
6. The instructor and the remaining class members shouted "one" when eleven minutes of the test had passed.
7. The instructor stopped all runners with a whistle blast.
8. The runner noted the flag marker last passed when the test ended; the runner received the number of completed laps from her partner.
9. The runner walked a minimum distance of half a lap (more if needed) to regain normal breathing.
10. The runner reported her score to the instructor.

The 1¼-Mile Run Test

The 1¼-Mile Run Test (five laps on a 440 track) was chosen to be the test to compare with the 12-Minute Test because of previously reported information by Johnston (87) in 1969. Johnston's correspondence with Miss Gay Cox, Grossmont College, El Cajon, California, indicated that the women's distance should be altered to a mile and a quarter. This suggestion was offered by Dr. Cooper because it was felt that separate standards for men and women were needed and the original

version of the 12-Minute Test made no such provisions. Dr. Cooper felt that the distance of a mile and a quarter would probably give a mean score of 12 minutes. Since Dr. Cooper's suggestion was a deduction based on his other research, it was the purpose of this thesis to determine if the 1¼-Mile Run could be run in a mean score of 12 minutes.

Four hundred and ninety-six girls enrolled in Jefferson Davis Junior High School participated in the 1¼-Mile Run Test. The actual test administration days were February 4, 5, 6, 9, 10, 11, 12, 17 and 19 and March 9, 10, 11, and 12. Testing was conducted over a five-week period for the twenty classes participating. The temperature on test days ranged from the 60 to 70 degrees with little or no wind present. The 1¼-Mile Run Test was administered to ten classes first and to the remaining ten classes following their participation in the 12-Minute Test. On the test day, all class members took the test at the same time. The length of the class period did not permit two separate test administrations during one period. The instructor discussed the best time recorded up to that time and discussed the average time per lap needed to beat the existing record. Students were instructed to call out the lap number to the instructor each time they passed her. At the end of the fifth lap, students were instructed to shout "five" approximately 30 yards from the finish line. The instructor called out the time as each runner completed her fifth lap. Students were told to walk half a lap on the inside of the track upon completion of the test and runners who

had given an all out effort were assisted. Again the instructor called out the running time to the lead runners during the test so that they would have some idea of the pace they were setting. After all runners had completed five laps, the instructor called out each name and the student reported her time. The instructor recorded the time in her roll book and later transferred the time to the score card. Below is an outline of the testing procedures:

1. At the beginning of the class period, the entire class completed 25 jumping jacks.
2. The entire class lined up across the track. Subjects were instructed to call out the lap number each time they passed the instructor and to call out "five" 30 yards before completion of the fifth lap. The instructor would call out the time as the runner crossed the finish line.
3. The instructor discussed the best time and how fast a runner must pace herself for each lap to beat the existing time record.
4. The instructor read the test instructions.
5. The instructor gave a verbal command to start running.
6. The student called out lap number to instructor as she passed by.
7. The student called out "five" to instructor approximately 30 yards from the finish line when she neared completion of the fifth lap.

8. The instructor called out the time for each runner as the fifth lap was completed.
9. The runner walked a minimum distance of half a lap on the inside of the track.
10. The runner reported her time to the instructor as her name was called.

TREATMENT OF DATA

The following statistical treatment was given to the data collected:

1. Correlation coefficients were determined for the 12-Minute Test and the 1¼-Mile Run Test using raw scores. These correlations were for each age group and for the total group.
2. An analysis was made of the order in which the two tests were taken. The mean of those groups who took the test first was compared with the mean of those groups who took the test second. This comparison of means was done for each age group and for the total group on each test.
3. T-score norms were established for the 12-Minute Test and for the 1¼-Mile Run Test using the raw scores for the total group.
4. Mean performances on the two tests were compared using T-scores. Comparisons were made within age groups and for the total group.

5. A comparison was made of the 12-Minute Test performance results with Cooper's Fitness Categories.

CHAPTER V

ANALYSIS AND INTERPRETATION OF DATA

Cooper's 12-Minute Test was administered to 502 junior high school girls and a 1¼-Mile Run Test was administered to 496 of these same girls. All subjects were students at Jefferson Davis Junior High School, Jacksonville, Florida, and were enrolled in the required physical education program for girls, grade 7-9. The following statistical treatment was given to the data collected:

1. Each raw score on the 12-Minute Test was correlated with each raw score on the 1¼-Mile Run Test for ages 12, 13, 14, and 15, and for the total group to determine the relationship between the two tests.
2. An analysis was made of the order in which the two tests were taken. The means of those groups who took the 12-Minute Test first were compared with the means of those groups who took the 12-Minute Test second. This comparison of means was also done to study the order in which the 1¼-Mile Run Test was taken.
3. T-score norms were established for the 12-Minute Test and for the 1¼-Mile Run Test using the raw scores for the total group. The conversion of all raw scores

into T-scores was necessary so a comparison of the two tests could be made and so norms could be established.

4. Mean performances on the two tests were compared by age groups and by total groups using T-scores. These comparisons would indicate whether the work loads on the two tests were equivalent.
5. A comparison was made of the 12-Minute Test performance results with Cooper's Fitness Categories. Subjects were placed into one of five fitness categories and the total number of subjects falling into each category was determined by age group and for the total group.

Table V summarizes the number of students taking the two tests by age groups and by the order in which the tests were run. Five hundred and two subjects participated in the 12-Minute Test. Four hundred and ninety-six subjects participated in the 1¼-Mile Run Test. Of that number, 254 took the 12-Minute Test first and 248 took the 1¼-Mile Run Test first. The 12, 13, and 14-year old groups are rather adequate in size and fairly equal. The 15-year old group is less well represented.

Table VI, page 55, presents a summary of results for the 12-Minute Test. The mean performance was .89 of a mile. Based on Cooper's Fitness Categories (7:30), a distance of .95 of a mile or less places women under 30 years of age into the lowest fitness category, very poor. See Table III on page 33. The

TABLE V

SUBJECTS PARTICIPATING ON EACH TEST BY AGE GROUPS AND BY THE ORDER OF TESTING

Subjects	12-Minute Test			1¼-Mile Run Test		
	First Test	Second Test	Total	First Test	Second Test	Total
12 yr. olds	42	81	123	88	44	132
13 yr. olds	90	77	167	79	86	165
14 yr. olds	100	70	170	65	98	163
15 yr. olds	22	20	42	16	20	36
	254	248	502	248	248	496

TABLE VI

SUMMARY OF STATISTICAL FINDINGS FOR THE 12-MINUTE TEST INCLUDING AN ANALYSIS OF THE ORDER IN WHICH IT WAS TAKEN

Subjects	N	Test Order	Distance-Miles SD	Distance-Miles M	t*
Total group	502	1st/2nd	.1562	.89	
Total group	254	1st	.1528	.88	1.99*
Total group	248	2nd	.1586	.90	
12 yr. olds	42	1st	.1618	.87	1.41
12 yr. olds	81	2nd	.1619	.91	
13 yr. olds	90	1st	.1420	.89	.91
13 yr. olds	77	2nd	.1807	.91	
14 yr. olds	100	1st	.1518	.88	.26
14 yr. olds	70	2nd	.1334	.89	
15 yr. olds	22	1st	.1803	.90	.18
15 yr. olds	20	2nd	.1281	.91	

*t of 1.97 to 2.02 needed to be significant at the 5 per cent level of confidence.

groups were split to alternate the order in which the tests were run to cancel out any effects of training. Table VI shows that the mean performances were very similar whether the 12-Minute Test was run before or after running the 1¼-Mile Run Test. This was true for each age group. These results are somewhat immaterial since the alternate order would balance out any differences when the group as a whole is considered in subsequent analyses. Since this procedure was a planned part of the research design, it is interesting to see the results.

Table VI shows further that the performance did not seem to change from age group to age group. While this was not analyzed statistically, it appears to be a safe observation from studying the means.

Table VII summarizes the results of the 1¼-Mile Run Test. The mean time for 496 girls to run one and a quarter miles was 14:06 minutes. The mean performance for the entire group did not yield a mean time of 12-minutes as anticipated by Cooper. (87) This indicates that the work loads on the two tests were not the same; therefore, the 1¼-Mile Run was not equivalent to the 12-Minute Test for these junior high school girls.

These findings are somewhat contradictory to the findings reported by Johnston (87) concerning a study conducted by Cox at Grossmont College. The mean time for women (ages 17-21) for a timed 1.3 mile was 12:09 minutes, indicating that a distance of 1.25 miles would yield a mean time close to 12 minutes. Age level, motivation, fitness level, and physical/mental/emotional

TABLE VII

SUMMARY OF STATISTICAL FINDINGS FOR THE 1¼-MILE RUN TEST INCLUDING AN ANALYSIS OF THE ORDER IN WHICH IT WAS TAKEN

Subjects	N	Test Order	Time-Minutes SD	Time-Minutes M	t*
Total group	496	1st/2nd	2:21	14:06	
Total group	248	1st	2:07	13:43	3.61*
Total group	248	2nd	2:31	14:29	
12 yr. olds	88	1st	2:01	13:28	1.11
12 yr. olds	44	2nd	2:19	13:54	
13 yr. olds	79	1st	2:23	13:51	2.13*
13 yr. olds	86	2nd	2:37	14:42	
14 yr. olds	65	1st	2:02	14:00	1.81
14 yr. olds	98	2nd	2:23	14:39	
15 yr. olds	16	1st	1:16	13:26	.69
15 yr. olds	20	2nd	2:56	14:00	

* t of 1.97 to 2.03 needed to be significant at the 5 per cent level of confidence.

health are some of the factors which might explain these discrepancies.

Table VII also reports the performance of the students who ran the 1¼-Mile Run Test before or after running the 12-Minute Test. The order in which the total group ran the 1¼-Mile Run Test produced significantly different performance times. Those who ran the 1¼-Mile Run Test before running the 12-Minute Test performed significantly faster than those who ran the 1¼-Mile Run Test after taking the 12-Minute Test.

The same pattern was not true, however, for the group who ran the 12-Minute Test first; they performed significantly worse than the group who ran it second, as reported in Table VI on page 55. Apparently training effect may have been a factor. The statistics are interesting because the same conclusion is not possible when looking at each age group separately. This unexplainable result may be the function of the larger numbers when the total group was analyzed. While this significant difference did occur, it is cancelled out when the scores are grouped in a total pool for further analyses including correlations and norms. Observation of the age group means seems to show no pattern of developmental or motivational influence from age to age. This is purely an observation, however, since the study of differences between ages was not the purpose of this study.

Table VIII summarizes the relationship between the 12-Minute Test and 1¼-Mile Run Test for the various age groups

TABLE VIII

CORRELATION COEFFICIENTS BETWEEN THE 12-MINUTE TEST AND THE 1¼-MILE RUN TEST

Subjects	Number	r*
Total group	427	.5659*
12 yr. olds	115	.5321*
13 yr. olds	139	.6872*
14 yr. olds	141	.4222*
15 yr. olds	32	.5113*

*All coefficients significant at the .01 level of confidence.

and for the total group. The highest correlation existed between the tests performances of the 13-year olds (.69). All of the coefficients are significant at better than the one per cent level of confidence for the number of subjects involved. None, however, is high enough to justify interchanging the two tests. The coefficient of .57 for the total group is high enough to indicate some commonness between the two measures but not high enough to substitute one test for the other. It may be that at lesser distances and lesser times the two tests would have correlated more highly for these junior high school students. This was not the case, however, for the 12-Minute and 1¼-Mile dimensions used. The same point might be speculated if times and distances had been greater than specified.

T-score norms for the 12-Minute Test and the 1¼-Mile Run Test were based on 502 cases and 496 cases respectfully. These norms may be found in the Appendix in Table XIII. The means for the total group necessarily had T-score of 50 and standard deviations of 10. Other norms for junior high school girls would have needed to be available to make observations about the total group. It is possible to say, however, that a time of 14:06 minutes and a distance of .89 of a mile were equivalent performances for this group of girls. Table IX examines the equivalency of the two tests. The girls who ran the 1¼-Mile Run Test in 12 minutes had a T-score of 58 and the girls who ran 1.25 miles in the 12-Minute Test had a T-score of 73. This is further indication that these two measures were not equivalent for this group

TABLE IX

ANALYSIS OF THE EQUIVALENCY
OF THE TWO TESTS

T-Score	12-Minute Test	1¼-Mile Run Test
73	1.25 miles	8:27 minutes
58	1.025 miles	12:00 minutes
50	.89 miles	14:06 minutes

of girls. In fact, it looks as if the 12-Minute Test is equivalent to 1.025 mile distance at the 58th T-score. Likewise, the 1.25 mile distance is equivalent to 8:27 minutes at the 73rd T-score level. These equivalencies were possible only for students who had above average cardiovascular fitness. This was further evidence that the 1¼-Mile Run Test and the 12-Minute Test were not equivalent. Furthermore, the two tests were more difficult than Cooper anticipated.

Table X provides a summary of means, standard deviations, and significance of difference within each age on the performances on the two tests based on T-scores. Some reservations are noted in the analysis because these same scores were part of the normative population. Consequently, significant differences were not anticipated and they did not occur. It is doubtful that the differences between age groups are significant. They look very similar and it probably was justifiable to establish norms for the junior high school age range as opposed to the separate ages.

Table XI, page 64, summarizes the results of the 12-Minute Test according to the fitness categories established by Cooper. The total number of subjects falling into each category was determined by age group and for the total group. Percentages for each group were also determined. Of the 502 subjects tested, 324 or 65 per cent fell into the very poor fitness category. It is noteworthy that the percentage patterning throughout all four age groups was consistent with the total group percentage patterning within each fitness category. According to Cooper's fitness

TABLE X

MEANS, STANDARD DEVIATIONS AND SIGNIFICANCE OF DIFFERENCE BETWEEN THE MEAN PERFORMANCE ON THE 12-MINUTE TEST AND THE 1¼-MILE RUN TEST

Subjects	N	T-Scores SD	T-Scores M	t*
Total group				
12-Minute Test	502	10.00	50.00	
1¼-Mile Run	496	10.00	50.00	
12 yr. olds				
12-Minute Test	123	10.49	48.91	1.81
1¼-Mile Run	132	9.11	51.65	
13 yr. olds				
12-Minute Test	167	10.37	49.23	.39
1¼-Mile Run	165	10.77	48.78	
14 yr. olds				
12-Minute Test	170	9.30	48.30	.07
1¼-Mile Run	163	9.64	48.38	
15 yr. olds				
12-Minute Test	42	10.62	49.45	.77
1¼-Mile Run	36	10.03	51.28	

*t of 1.99 to 1.96 needed to be significant at the 5 per cent level of confidence.

TABLE XI

FITNESS CATEGORY SUMMARY BASED ON THE RESULTS OF THE 12-MINUTE TEST

Fitness Category	Distance Standards for Subjects Under 30 Yrs. of Age		Groups 12 N=123	13 N=167	14 N=170	15 N=42	Total N=502
Very poor	<.95	N	78	105	118	23	324
		%	63%	63%	69%	55%	65%
Poor	.95-1.14	N	38	52	42	16	148
		%	31%	31%	25%	38%	29%
Fair	1.15-1.34	N	6	9	10	3	28
		%	5%	5%	6%	7%	6%
Good	1.35-1.64	N	1	1	0	0	2
		%	1%	1%	-	-	-
Excellent	1.65+	N	0	0	0	0	0
		%	-	-	-	-	-

standards, these particular junior high school girls were not of average fitness. The interpretation could be made, however, that his standards were not appropriate to this age level.

These findings are similar to results reported by Cooper through personal correspondence. (83) Cooper referred to a study involving 125 women, all under 30 year of age, conducted at the University of Kentucky Medical Center. Only nine women were able to reach the good or excellent categories according to the standards developed for women under 30.

CHAPTER VI

SUMMARY AND CONCLUSIONS

It was the purpose of this study to ascertain the equivalency of Cooper's 12-Minute Test and a 1¼-Mile Run Test for junior high school girls. Both tests measure aspects of cardiovascular and motor fitness. The tests were administered to junior high school girls, enrolled in grades 7-9, at Jefferson Davis Junior High School, Jacksonville, Florida.

A review of the literature showed that data for women were lacking. While some studies have been conducted using Cooper's 12-Minute Test, few deal with women subjects and none reports the use of junior high school subjects. Therefore, this study was undertaken to determine if a 1¼-Mile Run Test would yield a mean performance of 12 minutes for junior high school girls. The following conclusions were justified:

1. Significant relationships were found to exist between the 12-Minute Test and the 1¼-Mile Run Test for each age group and for the total group. However, the relationship was not high enough to justify substituting the 1¼-Mile Run Test for the 12-Minute Test.
2. The 12-Minute Test and the 1¼-Mile Run Test were not equivalent due to the mean time of 14:06 minutes on the 1¼-Mile Run Test and a mean distance of .89 of a mile on the 12-Minute Test.

3. T-score norms were established for the two tests and are available.
4. According to Cooper's fitness standards, these particular junior high school girls did not possess an average level of cardiovascular fitness.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. BOOKS

1. American Association for Health, Physical Education and Recreation. AAHPER Youth Fitness Test Manual. Second edition. Washington: AAHPER, 1965.

2. Barrow, Harold M. and Rosemary McGee. A Practical Approach to Measurement in Physical Education. Philadelphia: Lea and Febiger, 1964.

3. Bovard, John, Frederick Cozens, and Patricia Hagman. Tests and Measurements in Physical Education. Third edition. Philadelphia: W. B. Saunders Company, 1949.

4. Canadian Association for Health, Physical Education and Recreation. The CAHPER Fitness Performance Test Manual. Toronto: The Canadian Association of Health, Physical Education and Recreation, 1966.

5. Clarke, H. Harrison. Application of Measurement to Health and Physical Education. Fourth edition. New York: Prentice-Hall, Inc., 1967.

6. Cooper, Kenneth H. Aerobics. New York: Bantam, 1968.

7. _____. The New Aerobics. New York: Bantam Books, 1970.

8. Cureton, Thomas Kirk, Jr. Physical Fitness: Appraisal and Guidance. Saint Louis: The C. V. Mosby Company, 1947.

9. deVries, Herbert A. Physiology of Exercise for Physical Education and Athletics. Dubuque, Iowa: Wm. C. Brown Company, 1966.

10. Division of Health, Physical Education and Recreation Bureau of Physical Education. The New York State Physical Fitness Test. Albany: The State Education Department, 1958.

11. Edwards, Allen L. Experimental Design in Psychological Research. New York: Rinehart and Company, Inc., 1950.

12. Fleishman, Edwin A. Examiner's Manual for the Basic Fitness Test. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1964.

13. _____. The Structure and Measurement of Physical Fitness. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1964.

14. Guilford, J. P. Fundamental Statistics in Psychology and Education. Fourth edition. New York: McGraw-Hill Book Company, 1965.

15. Hunsicker, Paul. Physical Fitness. Washington: Department of Classroom Teachers, American Educational Research Association of the National Education Association, 1963.

16. Johnson, Barry L. and Jack K. Nelson. Practical Measurements for Evaluation in Physical Education. Minneapolis: Burgess Publishing Company, 1969.

17. Karpovich, Peter V. Physiology of Muscular Activity. Sixth edition. Philadelphia: W. B. Saunders Company, 1965.

18. Lindquist, E. F. A First Course in Statistics. New York: Houghton Mifflin Company, 1942.

19. Mathews, Donald K. Measurement in Physical Education. Second edition. Philadelphia: W. B. Saunders, 1963.

20. McCloy, Charles H. Tests and Measurements in Health and Physical Education. New York: F. S. Crofts and Co., 1939.

21. McCloy, Charles H. and Norma D. Young. Tests and Measurements in Health and Physical Education. Third edition. New York: Appleton-Century-Crofts, 1954.

22. McCurdy, J. H. and L. A. Larson. The Physiology of Exercise. Third edition. Philadelphia: Lea and Febiger, 1939.

23. National Research Council of the Research Section. Measurement and Evaluation Materials in Health, Physical Education, and Recreation. Washington: AAHPER, 1950.

24. Neilson, W. A. (ed.). Webster's New International Dictionary of the English Language. Second edition. Springfield, Mass.: G. and C. Merriam Company, 1943.

25. North Carolina Association for Health, Physical Education and Recreation. North Carolina Fitness Test. Raleigh: North Carolina State Department of Publis Instruction, 1961.

26. President's Council on Physical Fitness. Youth Physical Fitness: Suggested Elements of a School Centered Program. Washington, D. C.: U. S. Government Printing Office, July, 1965.

27. Rodahl, K. and S. M. Horvath (eds.). Muscle as a Tissue. New York: McGraw Hill Book Co., Inc., 1962.

28. Scott, M. Gladys and Esther French. Measurement and Evaluation in Physical Education. Dubuque, Iowa: Wm. C. Brown Company Publishers, 1959.

29. State Department of Education. Motor Fitness Tests for Oregon Schools. Salem, Oregon: State Department of Education, 1962.

30. Steinhaus, Arthur H. Toward an Understanding of Health and Physical Education. Dubuque, Iowa: Wm. C. Brown Company Publishers, 1963.

B. PERIODICALS

31. American Association for Health, Physical Education and Recreation. AAHPER Fitness Conference. "Fitness for Youth," Journal of Health, Physical Education, and Recreation, 27:8-9, December, 1956.

32. Arnett, Chappelle. "The Purdue Motor Fitness Test Batteries for Senior High School Girls," Research Quarterly, 33:323-328, October, 1962.

33. Askew, N. R. "Reliability of the 600 Yard Run Walk Test at the Secondary Level," Research Quarterly, 37:451-454, December, 1966.

34. Astrand, I. "Aerobic Work Capacity in Men and Women with Special Reference to Age," Acta Physiologica Scandinavica, 49 (suppl. 169), 1960, cited by Herbert A. deVries, Physiology of Exercise for Physical Education and Athletics, Dubuque, Iowa: Wm. C. Brown Company Publishers, 1966.

35. Astrand, P. O. "Human Physical Fitness with Special Reference to Sex and Age," Physiological Reviews, 36:307-335, July, 1956.

36. Astrand, P. O. and Bengt Saltin. "Maximal Oxygen Uptake and Heart Rate in Various Types of Muscular Activity," Journal of Applied Physiology, 16:977-981, November, 1961.

37. _____. "Oxygen Uptake During the First Minutes of Heavy Muscular Exercise," Journal of Applied Physiology, 16:971-976, September, 1961.

38. Astrand, P. O. and I. Ryhming. "A Nomogram for Calculation of Aerobic Capacity (Physical Fitness) from Pulse Rate during Submaximal Work," Journal of Applied Physiology, 7:218-221, September, 1954.

39. Barach, J. H. "The Energy Index," Journal of the American Medical Association, 62:525, February 14, 1914.

40. Bookwalter, Karl W. "Test Manual for Indiana Motor Fitness Indices for High School and College Men," Research Quarterly, 14:356-365, December, 1943.

41. Brock, J. D., W. A. Cox, and E. W. Pennock. "Motor Fitness," Research Quarterly, 12:407-415, May, 1941.

42. Brouha, Lucien. "The Step Test: A Simple Method of Measuring Physical Fitness for Muscular Work in Young Men," Research Quarterly, 14:31-36, March, 1943.

43. Brouha, Lucien and J. R. Gallagher. "A Functional Fitness Test for High School Girls," Journal of Health and Physical Education, 14:516, 550, December, 1943.

44. Clarke, Harriet L. "A Functional Physical Fitness Test for College Women, Journal of Health and Physical Education, 14:358-359, 394-395, September, 1943.

45. Cooper, Kenneth H. "The Role of Exercise in Our Contemporary Society," Journal of Health, Physical Education and Recreation, 40:22-25, May, 1969.

46. Cooper, Maj. Kenneth H., M. C., USAF. "A Means of Assessing Maximum Oxygen Intake," Journal of the American Medical Association, 203:201-204, January 15, 1968.

47. Cureton, T. K., Lyle Welser and W. J. Huffman. "A Short Screen Test for Predicting Motor Fitness," Research Quarterly, 16:106-119, May, 1945.

48. Dane, C. Wesley. "A Study of Circulatory-Respiratory Changes as Indicated by the McCurdy-Larson Organic Efficiency Test in Relation to Physiological Age," Research Quarterly, 15:98-112, May, 1944.

49. deVries, Herbert A. and Carl E. Klafs. "Prediction of Maximal Oxygen Intake from Submaximal Tests," Journal of Sports Medicine and Physical Fitness, 5:207-214, December, 1965.

50. Doolittle, T. L. and Rollin Bigbee. "The Twelve-Minute Run-Walk: A Test of Cardiorespiratory Fitness of Adolescent Boys," Research Quarterly, 39:491-495, October, 1968.

51. Espenschade, Anna S. "Restudy of Relationships Between Physical Performance of School Children and Age, Height, and Weight," Research Quarterly, 34:144, May, 1963.

52. Foster, W. L. "A Test of Physical Efficiency," American Physical Education Review, 19:632-636, December, 1914.

53. Franklin, C. C. and N. C. Lehsten. "Indiana Physical Fitness Test for the Elementary Level Grades 4 to 8," The Physical Educator, Vol. 3, May, 1948.

54. Gallagher, J. R. and L. Brouha. "A Simple Method of Testing the Physical Fitness of Boys," Research Quarterly, 14:23-30, March, 1943.

55. Glassford, R. G., et al. "Comparison of Maximal Oxygen Uptake Values Determined by Predicted and Actual Methods," Journal of Applied Physiology, 20:509-513, May, 1965.

56. Hettinger, T., et al. "Assessment of Physical Work Capacity," Journal of Applied Physiology, 16:153-56, January, 1961.

57. Hindman, Darwin A. "Nomographs for Interpolating Scores on the Schneider Test," Research Quarterly, 1:26-33, December, 1930.

58. Issekutz, B., Jr., N. C. Birkhead and K. Rodahl. "Use of Respiratory Quotients in Assessment of Aerobic Work Capacity," Journal of Applied Physiology, 17:47-50, January, 1962.

59. Kennedy, J. F. "The Soft American," Sports Illustrated, 13:16, December 26, 1960.

60. Marmis, Cary, et al. "Reliability of the Multi-trial Items of the AAHPER Youth Fitness Test," Research Quarterly, 40:240-245, March, 1969.

61. McCurdy, J. H. and L. A. Larson. "Measurement of Organic Efficiency for the Prediction of Physical Condition," Research Quarterly, 6:11-41, May, 1935.

62. Metheny, Eleanor, et al. "Physical Performance Levels for High School Girls," Journal of Health, Physical Education, and Recreation, 16:308-311, June, 1945.

63. Meylan, George L. "Twenty Years' Progress in Tests of Efficiency," American Physical Education Review, 18:441-445, October, 1913.

64. Michael, Ernest D., Jr. and Steven M. Horvath. "Physical Work Capacity of College Women," Journal of Applied Physiology, 20:263-266, March, 1965.

65. Newton, Jerry L. "The Assessment of Maximal Oxygen Intake," Journal of Sports Medicine and Physical Fitness, 3:164-169, June-September, 1963.

66. O'Connor, Mary E. and T. K. Cureton. "Motor Fitness Tests for High School Girls," Research Quarterly, 16:302-314, December, 1945.

67. Olree, Harry, et al. "Evaluation of the AAHPER Youth Fitness Test," Journal of Sports Medicine and Physical Fitness, 5:67-71, June, 1965.

68. Phillips, B. E. "The JCR Test," Research Quarterly, 18:12, March, 1947.

69. Ponthieux, N. A. and D. G. Barker. "An Analysis of the AAHPER Youth Fitness Test," Research Quarterly, 34:525-526, December, 1963.

70. Rowe, Floyd A. "Physical Education in the State of Michigan," American Physical Education Review, 25:137-140, April, 1920.

71. Scheele, Leonard A. "Concepts of Health and Fitness Today," Journal of Health, Physical Education, and Recreation, 27:22, 66-67, September, 1956.

72. Sievers, Henry. "A Simple Method for Detecting Abnormal Hearts by the Use of the Pulse-Ratio Test," Research Quarterly, 6:31-38, May, 1935.

73. Skubic, Vera and Jean Hodgkins. "Cardiovascular Efficiency Test for Girls and Women," Research Quarterly, 34:191-198, May, 1963.

74. _____. "Cardiovascular Efficiency Test Scores for College Women in the United States," Research Quarterly, 34:454, December, 1963.

75. _____. "Cardiovascular Efficiency Test Scores for Junior and Senior High School Girls in the United States," Research Quarterly, 35:184, May, 1964.

76. Taylor, Henry L., Elsworth Buskirk and Austin Henschel. "Maximal Oxygen Intake as an Objective Measure of Cardiorespiratory Performance," Journal of Applied Physiology, 8:73-80, July, 1955.

77. Teraslinna, P. and A. H. Ismail. "The Nomogram by Astrand and Ryhming as a Predictor of Maximum Oxygen Intake," Journal of Applied Physiology, 21:513-515, March, 1966.

78. Tuttle, W. W. "The Use of the Pulse-Ratio Test for Rating Physical Efficiency," Research Quarterly, 2:5-17, May, 1931.

79. Tuttle, W. W. and J. S. Skien. "The Efficiency Rating of High School Boys as Shown by the Pulse-Ratio Test," Research Quarterly, 1:19-27, October, 1930.

80. Tuttle, W. W. and Henryetta Frey. "A Study of the Physical Efficiency of College Women as Shown by the Pulse-Ratio Test," Research Quarterly, 1:17-25, December, 1930.

81. Workman, J. M. and B. W. Armstrong. "A Nomogram for Predicting Treadmill Walking Oxygen Consumption," Journal of Applied Physiology, 19:150-151, January, 1964.

82. _____. "Oxygen Cost of Treadmill Walking," Journal of Applied Physiology, 18:798-803, July, 1963.

C. UNPUBLISHED MATERIAL

83. Cooper, Kenneth H. Personal correspondence, March 9, 1970.

84. Corroll, Victor A. "AAHPER Youth Fitness Test Items and Maximal Oxygen Intake," Unpublished Doctoral dissertation, University of Illinois, Urbana, 1967. (Microcard.)

85. Dominic, JoAnn C. "An Investigation of the Twelve-Minute Run-Walk Test as a Predictor of Circulorespiratory Fitness of Adolescent Girls," Unpublished Master's thesis, California State College, Los Angeles, 1967.

86. Hyde, Rodney C. "The Astrand-Ryhming Nomogram as a Predictor of Aerobic Capacity for Secondary School Students." Unpublished Master's thesis, University of Alberta, May, 1965. (Microcard.)

87. Johnston, Karla R. "The Relationship Between the AAHPER Youth Fitness Test and the Twelve Minute Test." Unpublished Master's thesis, University of North Carolina at Greensboro, Greensboro, 1969.

88. Sparks, R. E. "Modification of the AAHPER Youth Physical Fitness Test." Unpublished Doctoral dissertation, Springfield College, Springfield, Massachusetts, 1965. (Microcard.)

APPENDIX

THE UNIVERSITY OF NORTH CAROLINA
AT GREENSBORO

Department of Health, Physical Education
and Recreation

December 15, 1969

Miss Delores Ellison, Chairman
Women's Physical Education Department
Jefferson Davis Junior High School
Jacksonville, Florida 32210

Dear Miss Ellison:

I am currently working on my Master's degree in physical education at the University of North Carolina at Greensboro. My thesis outline has been approved and I am in the beginning stages of organizing and making certain decisions pertinent to this fitness study. I would like to administer two extended run tests and establish norms for junior high school girls. At this time very little testing has been done with this age group and norms are not available.

I have chosen Duval County to administer these tests because I am familiar with the school system and particularly the physical education programs. I personally feel that the physical education program on the junior high level is one of the best to be found.

I am writing to Mr. Johnson to seek his permission and, subsequent to his approval, I would appreciate your cooperation. I know of your interest in the area of fitness testing and I would like to work with you and your staff in the actual test administration. I will be in Jacksonville over the Christmas holidays and, pending Mr. Johnson's approval, would like to talk with you in detail about procedures for this thesis and secure your permission to proceed.

Thank you for your interest and attention in this matter. I will be in touch with you during the holidays.

Sincerely,

Pat Hielscher

Rosemary McGee
Adviser

cc: Mr. W. C. Johnson

THE UNIVERSITY OF NORTH CAROLINA
AT GREENSBORO

Department of Health, Physical Education
and Recreation

December 15, 1969

Mr. W. C. Johnson, Principal
Jefferson Davis Junior High School
7050 Melvin Road
Jacksonville, Florida 32210

Dear Mr. Johnson:

I am currently working on my Master's degree in physical education at the University of North Carolina at Greensboro. My thesis outline has been approved and I am in the beginning stages of organizing and making certain decisions pertinent to this fitness study. I would like to administer two extended run tests and establish norms for junior high school girls. At this time very little testing has been done with this age group and norms are not available.

I would like to administer these tests in Duval County and more specifically at Jefferson Davis Junior High School. I am familiar with the school system and particularly the physical education programs. My home is in Jacksonville, I attended school there and taught in the system for two years. I feel the physical education program on the junior high school level is one of the best to be found.

I know of your interest in and support of your girl's physical education program and I would like to work with your women's staff. I will be in Jacksonville over the Christmas holidays and would like to talk with you in detail about procedures for this thesis and to secure your permission to proceed.

Thank you for your interest and attention in this matter. I will be in touch with you by phone to make an appointment during the holidays.

Sincerely,

Pat Hielscher

Rosemary McGee
Adviser

cc: Delores Ellison

THE UNIVERSITY OF NORTH CAROLINA
AT GREENSBORO

Department of Health, Physical Education
and Recreation

February 12, 1970

Mr. Kenneth H. Cooper, M.D.
Lieutenant Colonel, U.S.A.F. Medical Corps
110 Inspiration Drive
San Antonio, Texas 78228

Dear Mr. Cooper:

I am presently engaged in graduate study at the University of North Carolina at Greensboro and have chosen to do a measurement study testing to see if a mile and quarter run for girls might be substituted for the 12-minute test. Testing is currently underway in Jacksonville, Florida, where approximately 700 junior high school girls are serving as subjects for both the 12-minute test and the mile and quarter run. Norms will be established based on age. You may be interested in these data.

I am interested in knowing if you have any data accumulated on the response of girls or women to the 12-minute test and if norms have been established? I am also interested in knowing if you can direct me to any research, current or completed, that might lend insight into the use of the 12-minute test with girls.

Thank you for your attention in this matter. I anxiously await your reply.

Sincerely,

Pat Hielscher

Dr. Rosemary McGee
Adviser

DEPARTMENT OF THE AIR FORCE

Wilford Hall USAF Medical Center (AFSC)
Lackland Air Force Base, Texas 78236

9 March 1970

TO: Miss Pat Hielscher
Department of Health, Physical
Education and Recreation
University of North Carolina at Greensboro
Greensboro, North Carolina 27412

Dear Miss Hielscher

I want to thank you for your letter of 12 February 1970 and I am delighted to learn that testing of young women is underway in Jacksonville, Florida. Several individuals have initiated studies evaluating the fitness of young women by either the 12-minute test or the 1¼ mile test. As you may have noticed from the current issue of Reader's Digest, I have established some physical fitness requirements for 12-minute testing for women. For women under 30 the following standards have been developed:

Fitness Category	12-Min Distance
1. Very Poor	less than 0.95 miles
2. Poor	0.95 - 1.14 miles
3. Fair	1.15 - 1.34 miles
4. Good	1.34 - 1.64 miles
5. Excellent	1.65+ miles

Mr. John Harralson, P.O. Box 230, University of Kentucky Medical Center, Lexington, Kentucky recently performed 12-minute studies on 125 young girls. The women were all under 30 years of age yet only 9 were able to reach the good or excellent categories according to the above criteria.

In a cohort study performed in this laboratory, 266 Airmen WAFs 18 to 22 years of age were evaluated on the 12-minute test before and after 6 weeks of training. The average distance increased from 1.16 miles to 1.24 miles (see enclosure). Using the standards for men, you can see that only 2.6% of the WAFs were able to reach the good category after six weeks of training. As a result, we feel that separate standards for women are justified.

Another investigator who has done extensive work in testing young women with both the 12-minute test and the 1¼ mile test is Miss Dorthey Arnold. She works with the Department of Physical Education at Grossmont Junior College, El Cajon, California. I would strongly encourage you to contact her.

I am most interested in the results that you obtain with this study and would be quite pleased to see the final report.

I hope that I have been of some help to you in this matter and if I can be of any further assistance, please feel free to contact me.

Sincerely,

KENNETH H. COOPER, Lt Col, USAF, MC
Aerospace Medical Laboratory (Clinical)

12-Minute Performance Data
(266 Airman WAFs)

Male Standards

	Before	After Training Six Weeks
<1.0 Miles	5.6	3.4
1.0-1.24 Miles	71.4	45.5
1.25-1.49 Miles	22.6	48.5
1.50-1.74 Miles	0.4	2.6
>1.75 Miles	0.0	0.0
Avg. Distance	1.16	1.24

Name _____ Age _____

Date of Birth _____

P.E. Class Period _____ Teacher _____

12 Minute Test	Mile & Quarter Run
Day _____	Day _____
Date _____	Date _____
Distance _____ _____	Time _____ _____
T-score _____	T-score _____
Category _____	

FIGURE I

SCORE CARD FOR THE 12-MINUTE TEST AND THE
1¼-MILE RUN TEST

TEST DIRECTIONS

Directions for the 1¼-Mile Run Test

The 1¼-Mile Run is a test designed to measure endurance. You must run 5 laps around the track. On the command "go", begin running. Pace yourself but run as fast as you can. If you must walk, do so, but begin running as soon as possible. Push yourself to give your best effort, but do not over pace yourself or exert past your ability. Keep count of each lap you run. At the end of your 5th lap your teacher will call out your time as you cross the finish line. Remember your time. This time will be recorded on your card.

Directions for the 12-Minute Test

The 12-Minute Test is designed to measure endurance. On the command "go", begin running. Pace yourself and run as far as you can. If you need to walk, do so, but begin running as soon as you can. Try to cover as much distance as you can during the 12 minutes. Push yourself to give your best effort but do not over pace yourself or exert past your ability. Keep count of each lap you run. At the end of the 12 minutes your teacher will blow her whistle. STOP immediately. Look for the letter marker you just passed. Your distance will be recorded according to the number of laps completed and the last marker passed.

TABLE XII

TABLE TO CONVERT LAPS AND DISTANCE MARKERS INTO MILES

Marker Letters	LAP							
	1st	2nd	3rd	4th	5th	6th	7th	8th
A	.025	.275	.525	.775	1.025	1.275	1.525	1.775
B	.05	.30	.55	.80	1.05	1.30	1.55	1.80
C	.075	.325	.575	.825	1.075	1.325	1.575	1.825
D	.10	.35	.60	.85	1.10	1.35	1.60	1.85
E	.125	.375	.625	.875	1.125	1.375	1.625	1.875
F	.15	.40	.65	.90	1.15	1.40	1.65	1.90
G	.175	.425	.675	.925	1.175	1.425	1.675	1.925
H	.20	.45	.70	.95	1.20	1.45	1.70	1.95
I	.225	.475	.725	.975	1.225	1.475	1.725	1.975
J	.25	.50	.75	1.00	1.25	1.50	1.75	2.00

(87:88)

TABLE XIII

T-SCORE NORMS FOR THE 12-MINUTE TEST AND THE 1¼-MILE RUN TEST

T-Score	12-Minute Test N = 502 Distance Laps	Miles	1¼-Mile Test N = 496 Time
84	6 G	1.425	
82	6 F	1.40	
81	6 E	1.375	
79	6 D	1.35	
78	6 C	1.325	
76	6 B	1.30	
74	6 A	1.275	
73	5 J	1.25	8:27-8:40
72			8:41-8:54
71	5 I	1.225	8:55-9:08
70	5 H	1.20	9:09-9:22
69			9:23-9:36
68	5 G	1.175	9:37-9:51
67			9:52-10:05
66	5 F	1.15	10:06-10:19
65	5 E	1.125	10:20-10:33
64			10:34-10:47
63	5 D	1.10	10:48-11:02
62	5 C	1.075	11:03-11:16
61			11:17-11:30
60	5 B	1.05	11:31-11:44
59			11:45-11:58
58	5 A	1.025	11:59-12:12
57	4 J	1.000	12:13-12:27
56			12:28-12:41
55	4 I	.975	12:42-12:55
54	4 H	.95	12:56-13:09
53			13:10-13:23
52	4 G	.925	13:24-13:38
51			13:39-13:52
50	4 F	.90	13:53-14:06
49	4 E	.875	14:07-14:20
48			14:21-14:34
47	4 D	.85	14:35-14:49
46	4 C	.825	14:50-15:03
45			15:04-15:17
44	4 B	.80	15:18-15:31
43			15:32-15:45
42	4 A	.775	15:46-16:00
41	3 J	.75	16:01-16:14
40			16:15-16:28
39	3 I	.725	16:29-16:42

TABLE XIII (continued)

T-Score	12-Minute Test N = 502 Distance Laps	Miles	1¼-Mile Test N = 496 Time
38	3 H	.70	16:43-16:56
37			16:57-17:11
36	3 G	.675	17:12-17:25
35			17:26-17:39
34	3 F	.65	17:40-17:53
33	3 E	.625	17:54-18:07
32			18:08-18:22
31	3 D	.60	18:23-18:36
30	3 C	.575	18:37-18:50
29			18:51-19:04
28	3 B	.55	19:05-19:18
27			19:19-19:33
26	3 A	.525	19:34-19:47
25	2 J	.50	19:48-20:01
24			20:02-20:15
23	2 I	.475	20:16-20:29
22	2 H	.45	20:30-20:44
21			20:45-20:58
20	2 G	.425	20:59-21:12
19			21:13-21:26
18	2 F	.40	
17	2 E	.375	
15	2 D	.35	