A STUDY TO FIND THE RELATIONSHIP BETWEEN A FIVE-MINUTE AND A FIFTEEN-MINUTE CALISTHENIC PROGRAM ON PHYSICAL FITNESS

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ABSTRACT

A STUDY TO FIND THE RELATIONSHIP
BETWEEN A FIVE-MINUTE AND A FIFTEEN-MINUTE
CALISTHENIC PROGRAM ON PHYSICAL FITNESS

By

Marvin Keith Fulver

This study was undertaken to determine whether or not a five-minute daily calisthenic program would achieve the same level of physical fitness as that achieved by a fifteen-minute daily calisthenic program.

The data were collected on 207 white seventh and eighth grade boys at Mason Junior High School during the fall of 1968. The ages of the boys ranged from 11 years and 9 months to 14 years and 10 months. The classes were grouped by grade with two seventh and two eighth grade physical education sections used as the experimental group in this study. Boys scheduled in study hall acted as the control groups. Each class met either two times a week or three times a week on alternate weeks, for fourteen weeks. The five-minute calisthenic program was randomly assigned to one seventh and one eighth grade class as was the fifteen-minute calisthenic program.

The test battery consisting of pull-ups, sit-ups, standing broad jump, shuttle run, and vertical jump was administered to both the experimental and the control groups preceeding and following a fourteen-week period.

One-way analysis of variance was applied to the data. Duncan's Multiple Range Test was employed to find which dependent variable means were significantly different when significant F-ratios were detected. Both tests were run at the .05 level of significance.

Under the conditions of this study:

1. Five minutes of calisthenics is significantly more effective than fifteen minutes of calisthenics in producing an improvement in pull-ups.
2. Five minutes of calisthenics is just as effective as fifteen minutes of calisthenics in producing an improvement in vertical jump.
3. Five minutes of calisthenics is just as effective as fifteen minutes of calisthenics in producing an improvement in the shuttle run.
4. Five minutes of calisthenics is just as effective as fifteen minutes of calisthenics in producing an improvement in sit-ups.
5. Five minutes of calisthenics is just as effective as fifteen minutes of calisthenics in producing an improvement in standing broad jump.
6. A fifteen-minute calisthenic program may be too strenuous and may bring about loss of enthusiasm and desire for complete exertion.

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Marvin Keith Pulver

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To Shari

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Appreciation is extended to those students of Mason Junior High School who cooperated so willingly in this study.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

CHAPTER I

Great concern has been expressed regarding the physical fitness of American youth since World War II. Physical educators have been concerned with the physical fitness of youth for many years, but only in the last three decades has it been of national concern.

Hunsicker notes that: "Few educators need to be convinced of the importance of fitness in our youth. For the past ten years, a deluge of newspaper and magazine articles have been decrying the lack of fitness in our youth. . . However, the present emphasis on fitness in peacetime is unusual" (17).

In view of the great concern for the improvement of physical fitness, any research which might aid the general public to attain physical fitness is desirable. This study was directed toward providing a physical fitness program which could be incorporated into a physical education curriculum or the home.

Statement of the Problem

To attain the desired level of physical fitness, says Weiss, will cause the physical education curriculum to sacrifice a few necessities. "First, we would sacrifice time." As we raise the standards of physical fitness, more time must be invested. Unfortunately, physical education time is at a premium.

Second, "we would sacrifice instruction in activity skills." The only method we have to develop fitness is to overload the body with intensive exercise. However, during skills instruction the students exert themselves relatively little. If we expect them to form the habit of being physically active, we must give them the skills with which to enjoy activity.

A third sacrifice is incentive. The intensive physical conditioning programs tend to be administered with strict discipline in a formal atmosphere. Through such a program some of the other goals of physical education, such as development of the personality and furthering of the democratic way of life, cannot be attained (35, p. 18).

In addition, Weiss states that, "it is quite possible that overemphasis on physical fitness in the school can lead to less interest in physical activity later in life" (35, p. 62).

There exists in many school systems today an urgent need for efficient programs which will increase the level of physical fitness of American youth. Too many school systems lack the time for developing physical fitness of youth. The President's Council on Physical Fitness has recommended highly the adoption of a minimum of fifteen minutes of vigorous activity daily (25). When a school has only forty-five minutes for the entire class period, a fifteen-minute time period spent on exercises for developing physical fitness leaves very

little time to be spent on other objectives of the curriculum. This is especially true when one considers that the time needed for dressing and showering is taken from that forty-five minute period. Thus, the physical education period may include as little as twelve to fifteen minutes of sport and/or game activities.

Purpose of the Study

This study was undertaken to determine whether or not a five-minute daily calisthenic program would achieve the same level of physical fitness as that achieved by a fifteen-minute daily calisthenic program. If five minutes of calisthenics are as effective as fifteen minutes of calisthenics, the physical educator could have an additional ten minutes to involve the students in sport and game activities. With the public showing great concern for physical fitness, five minutes of vigorous activity would be easier to implement and follow than a fifteen-minute program.

Limitations of the Study

1. This study was limited to 207 junior high school male students.
2. This study was limited to an experimental period of 14 weeks.
3. This study was limited in that there was no control over the activities of the subjects outside of the normal class period.

4. This study was limited to a program in which the classes met either twice a week or three times a week, on alternate weeks.
5. This study was limited to a physical fitness test consisting of: pull-ups, sit-ups, standing broad jump, shuttle run, and vertical jump.

Definition of Terms

1. Calisthenics shall refer to an exercise program executed by one individual in a stationary position, without the use of equipment or apparatus.
2. Physical fitness refers to the ability of a person's body to meet the demands placed upon it by his work, by his way of life and by the necessity to meet emergency situations.

CHAPTER II

Related Literature

Calisthenics have been used as a method of developing physical fitness since the fourth or fifth century B.C. However, the modern use of calisthenic exercises dates from about the year 1785. Christian Carl Andre, a gymnastics instructor teaching in Salzman's school at Schnepfenthal, is credited with introducing the work (28, p. 2).

Calisthenics as a method of developing the body spread around the world, but did not gain adequate recognition until July 16, 1956, when the President's Council on Youth Fitness was established by executive order. The purpose of this council is to promote existing programs and launch additional programs which will improve the fitness of American youth (41).

President-elect John F. Kennedy recognized the urgent need for improving the physical fitness of American youth. In an article, "The Soft American," that appeared in the December 26, 1960 issue of Sports Illustrated, Kennedy wrote, "But the harsh fact of the matter is that there is also an increasingly large number of young Americans who are neglecting their bodies -- whose physical fitness is not what it should be -- who are getting soft. And such softness on the part of individual citizens can help to strip and destroy the vitality of a nation" (20, p. 16).

Upon assuming office, President Kennedy continued to focus national attention upon this serious problem. On July 19, 1961, the President's Council on Youth Fitness released to the schools these basic recommendations under the President's Fitness Program:

1. Identify the physically underdeveloped pupil and work with him to improve his physical capacity.
2. Provide a minimum of fifteen minutes of vigorous exercise and developmental activities every day for all pupils.
3. Use valid fitness tests to determine pupils' physical abilities and evaluate their progress (41).

Physical fitness has always been one of the objectives of physical education. Basic to it are proper nutrition, adequate rest and relaxation, good health practices, and good medical and dental care. But these are not enough. An essential element is physical activity -- exercise for a body that needs it.

The human body contains more than 600 muscles; overall it is more than half muscle. Muscles make possible every motion. "They also push food along the digestive tract, suck air into the lungs, tighten blood vessels to raise blood pressure when you need more pressure to meet an emergency" (42, p. 6). The heart itself is a muscular pump.

Technological advances have changed our way of living, but the needs of the human body have not changed. Muscles are meant to be used. If we become inactive, we must pay the price in decreased efficiency. "Through lack of exercise the various organs decay" (28, pp. 9-10). Continual inactivity produces muscular atrophy and the individual soon becomes undermuscled for his weight. As a result, he lacks the strength and endurance to do his daily work easily and efficiently.

Physical fitness is but one phase of total fitness. Other aspects of total fitness are: emotional, mental, and social (33, p. 16; 7, p. 11). Steinhaus says that total fitness means:

1. A body free from disease.
2. Muscles, heart, and lungs developed to give strength, speed, agility, and endurance to do easily the tasks of each day.
3. An alert mind -- free from undue worry, fear, or tension -- that can relax completely with the moment of opportunity and as quickly be engrossed in the next challenging task.
4. A spirit that feels itself unselfishly part of an important venture and important to that venture (31).

Physical fitness is not only important to itself, but to these other phases of total fitness. As President Kennedy

wrote: "The relationship between the soundness of the body and the activities of the 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 strong bodies" (20, p. 16).

Cromwell and Hayman define physical fitness as the ability of an individual to execute any given daily task without unnecessary fatigue (5). Karpovich defines physical fitness as "Fitness to perform some specified task requiring muscular effort" (19). Cureton says "physical fitness means ability to handle the body well and the capacity to work hard over a long period of time without diminished efficiency" (7, p. 111). Willgoose described physical fitness in terms of strength, stamina, cardiorespiratory endurance, agility, speed and coordination (36). The components of physical fitness are many. They have been studied separately and in groups many times.

Wilson conducted a study to evaluate experimentally the results of a weight-training program on the physical fitness of young men. He concluded that weight training affected the quality of fitness, with power, agility, balance, flexibility and strength increased but endurance decreased in his experimental group (37).

Hilsendager conducted a study to determine whether ten minutes of calisthenics was of more or less value to motor

fitness than ten minutes spent in skill activity. Two classes of 37 male high-school boys, 17 in one class and 20 in the other, met two times a week and three times a week on alternate weeks. A fitness test, which consisted of a standing broad jump, pull-ups, sit-ups, a shuttle-run and squat thrusts, was administered previous to the training. For an interval of ten class periods, one class engaged in ten minutes of calisthenics before beginning the daily skill activity, while the other class immediately began the skill activity. At the end of this interval, the fitness test was again administered. For the next ten class periods, the two classes reversed their procedure from the initial interval. This alternation of treatments continued through four such intervals, with a fitness test concluding each interval. The results indicated that calisthenics improved performances on the standing broad jump and squat thrusts more than did touch football, and improved sit-ups more than did volleyball or basketball. No significant differences were found between calisthenics and handball (14).

Tumin, Brockway, and Whitcher conducted a study to determine the effects on physical fitness of varying degrees of exercise. The experiment had a duration of ten days. The subjects, 44 untrained men ranging in age from 18 to 22, were randomly divided into four groups. One group was the control group, while the three experimental groups walked 10 km., 20 km., or 30 km. daily. Physical fitness was determined by measurements of pulmonary ventilation, oxygen extraction,

oxygen consumption, and heart rate, measured on a treadmill. The results indicated that the group of men walking 20 km. daily had the most marked improvement in physical fitness (8).

Four methods of developing physical fitness were compared by Banister. Four matched groups of 14 to 16 year-old boys participated in different training programs in one of their four weekly physical education classes for a period of two months. The training programs were: 1) interval circuit training, emphasizing endurance and strength training, 2) circuit training with endurance running, 3) circuit training with games activity, and 4) games only. A composite index was scored by combining the Larson Strength score and two-thirds of the Harvard Step test score. Gains were obtained by all groups, but the largest gains were obtained by the interval circuit training group, particularly in the strength index (3).

Alexander, Martin, and Metz conducted a study of the effects of a four-week training program with previously conditioned young university men ranging in age from 17 to 23 years. Measurements were obtained on changes in body girth, subcutaneous tissue, muscular strength and endurance, and cardiovascular fitness. The experimental group of eleven men performed isotonic exercises for 20 minutes three times per week in addition to participation in a karate class. The control group of six men participated only in the karate class. It was concluded that the experimental group improved significantly in all measurements while the control group

demonstrated significant improvement only in cardiovascular fitness (1).

Kershner conducted twelve case studies on adult men who participated in a physical education class. The class included tests for their physical evaluation, games, and exercise. It was observed that the men interested in strength improvement demonstrated gains in strength only; the men interested in games demonstrated improvement of their skills but other measures remained constant; and the men involved in all-around exercise program demonstrated the best overall improvement (12). Kelbers concurred with Kershner's conclusion that subjects demonstrate improvement in the fitness for which they train (3).

Barrfoto conducted a study which concerned muscular endurance. In his study, he investigated changes in all-around motor endurance produced by four different physical education courses: (a) boxing, (b) weight-lifting, (c) wrestling, and (d) volleyball. It was concluded that the greatest gains in muscular endurance were produced by boxing and weight-lifting while wrestling yielded only moderate improvements; and volleyball produced negligible gains (4).

Wardlaw conducted a study on college men enrolled in the service program at the University of Illinois. The effects of four physical education classes on muscular endurance were compared. It was concluded that Basic Conditioning contributed more than Apparatus Stunts, Individual Tumbling, or Combination (10).

Taddonio conducted a study comparing the physical fitness levels of two fifth-grade self-contained classes. The control group, 27 boys and girls, received no physical education, while the experimental group, also 27 boys and girls, received a progressively-graded calisthenics program for fifteen minutes daily for four months. Fitness was measured pre- and post-experimentally by the use of the AAHPER Youth Fitness Test. Analysis of the data showed no significant differences between groups, with the exception of in the 50-yard dash where the experimental group demonstrated a significant improvement (32).

The effects of a two-minute isometric exercise program on force and fatigue in skeletal muscle was investigated by McGlynn. The subjects ranged in age from 17 to 20 years with matched groups of 30 subjects. The control group received no training, while the experimental group was instructed to hold maximal isometric tension of the index finger for two minutes in the morning and two minutes in the afternoon, for a period of 20 days. The groups were measured for index finger abduction pressure by a strain gauge. The control group was tested after 20 days while the experimental group was tested on the 5th, 10th, 15th, and 20th days. It was concluded that isometric training, continued after five days, produces no further significant gains in strength, whereas, a significant increase in isometric endurance may continue. It was further concluded that isometric exercise continued after 15 days

produces significant decreases in strength and isometric endurance (22).

Baker concluded that a ten-minute daily program of rope skipping was as efficient as a thirty-minute daily program of jogging for improving cardiovascular efficiency, as measured by the Harvard Step Test. Ninety-two male college students were randomly placed into two groups: the rope-skipping group and the jogging group. The rope-skipping group skipped rope ten minutes per day, five days a week, for six weeks. The jogging group jogged 30 minutes per day, five days a week, for six weeks (2).

McCloy computed factor analysis on 12 athletic events administered to 400 well-conditioned soldiers. Results indicated a high correlation between running at a constant speed or for distance and circulo-respiratory endurance; velocity of muscular contraction speed correlated with the shot put, standing broad jump, shuttle run, six-second sprint, and the 300-yard run; and muscular endurance correlated with the six-second sprint, squat thrust, pull-ups, push-ups, and sit-ups (21).

Montbleux and Barker studied the AAHPER Youth Fitness Test by applying correlation analysis and factor analysis to its seven test items, utilizing the test results of 1,335 male college freshman subjects. The intercorrelations showed that the abilities as measured by the seven test items are all positively related. The correlations between "circulo-respiratory endurance" and pull-ups, sit-ups, and 600-yard

run-walk, respectively were .54, .53, and .51. A correlation of .49 was obtained between the softball throw and "gross body coordination." The factor of "muscular explosiveness" was correlated with the standing broad jump, 50-yard dash, and shuttle-run, respectively at .60, .73, and .71 (24).

Fabricius investigated the effects of added calisthenics on the physical fitness of fourth grade boys and girls. The subjects, 162 boys and girls (99 boys and 63 girls), met four times a week, for 20 weeks. The control group participated in their class as usual, while the experimental group had an average of three minutes and nine seconds of added calisthenics. Physical fitness was measured by the Oregon Motor Fitness Test. The results showed that the experimental group improved significantly more than the control group (9).

CHAPTER III

Research Methods

The data were collected on 207 white seventh and eighth grade boys at Mason Junior High School during the fall of 1968. The ages of the boys ranged from 11 years and 9 months to 14 years and 10 months.

The classes were grouped by grade with two seventh and two eighth grade sections used for this study. The seventh and eighth grade boys took physical education for one semester and study hall the other semester. The four first-semester physical education classes were used as the experimental group, while those students who had study hall the first semester acted as the control group. One seventh grade class and one eighth grade class had 32 boys each, while the other two classes had 35 boys each.

Each class met either two times a week or three times a week, on alternate weeks, for 14 weeks. Time was taken from this study for a teacher's workshop and Thanksgiving vacation, a total of three days.

The test battery was administered to both the experimental and the control groups preceeding and following a 14-week period. This required a total of six days.

Calisthenic Program

Two programs of daily calisthenics were used for this study -- Program A and Program B. Program A was used on the

odd numbered days during the 14-week period, while Program B was used on the even numbered days. Both programs, consisting of eleven exercises, are shown in Appendix A. These two programs were chosen so the boys would not perform the same exercises throughout the 14-week training period. This was an attempt to relieve any boredom which may be encountered in a training program.

The same calisthenic program was administered to each of the four physical education classes each day they met. The amount of time during class spent exercising varied between the groups. The fifteen-minute plan was applied to one seventh and one eighth grade class as was the five-minute plan. The random assignments for the classes were as follows:

Class No.	Section	Time
I	1st 8th grade class	5 Min.
II	1st 7th grade class	15 Min.
III	2nd 7th grade class	5 Min.
IV	2nd 8th grade class	15 Min.

The calisthenic exercises were selected from those recommended by Steinhaus (31) and Hillcourt (13). Exercises were selected so as to develop overall physical fitness and not fitness of one particular muscle group.

The data on any boy who failed to participate in this calisthenic program seven or more times, due to illness or not being dressed, was dropped from this study.

A bell, operated by the physical education teacher with a stop watch, notified the students when one exercise in the

plan was completed. This was to insure that the same amount of time was spent on each section of the calisthenic plan by all classes. Upon command by the teacher, the students immediately started the next exercise.

Description of the Calisthenic Exercises

1. Jumping Jack:

   Starting Position -- The subject stood in an erect position with his arms at his sides and his feet together.
   Movement -- The subject abducted both arms in a continuous circle until they met over his head. At the same time, the subject jumped a couple of inches into the air and abducted his feet to slightly wider than shoulder width. On the second motion, he again jumped a couple of inches vertically and simultaneously adducted his arms and feet to their original position. This movement pattern was referred to as a single jumping jack.

2. Toe Touch:

   Starting Position -- The subject stood in an erect position with his arms abducted to shoulder level and his feet abducted to slightly wider than shoulder width.
   Movement -- The subject bent forward, keeping his knees straight, and touched his left foot with his right hand. Upon completing this movement, the subject returned to his starting position. The same movement was then performed only touching the right foot with the left hand followed immediately by returning to the starting

position. This movement pattern was referred to as a single toe touch.

3. Vertical Jump to ½ Squat:

Starting Position -- The subject stood erect with his hands at his side and his feet abducted to shoulder width.

Movement -- The subject bent his knees and extended his arms down past his sides. The jump was accomplished by simultaneously extending the knees and thrusting the arms upward. The subjects were instructed to land in a half-squat, immediately starting another vertical jump.

4. Raised-Leg Push-Up:

Starting Position -- The subject laid flat on his stomach with his knees extended, his legs abducted and his ankles flexed dorsally. His hands were placed palms down next to his shoulders, with the elbows adducted.

Movement -- The subject extended his right leg maximally, while simultaneously extending his elbow joints thus raising the rest of his body. Keeping the right leg extended, the subject lowered his body until his chest just barely touched the floor. This was referred to as a raised-leg push-up. After one-half the time segment had elapsed, the right leg was lowered and the left leg was extended and the arm action repeated.

5. Arm Pull:

Starting Position -- The subject stood erect with his feet together and his arms abducted to shoulder level.

Movement -- The subject used a ballistic movement to horizontally extend his arms with the hands supinated maximally until the range of motion was completed and the arms returned to the starting position.

6. Alternate Leg-Raise (on stomach):

Starting Position -- The subject laid flat on his stomach with his knees extended and legs abducted. His arms were abducted slightly and his hands supinated so that the palms were flat on the floor.

Movement -- The subject extended his left leg maximally, while extending his knee. The leg was pliometrically lowered to the starting position. Next, the right leg was extended and lowered in the same manner. This movement pattern was referred to as a single alternate leg raise.

7. Single Leg Raise (on side):

Starting Position -- The subject laid on his right side with his head resting on his right arm which was extended over the head with the palm down. His left arm was placed palm down beside the chest for balance. His legs were extended to form a straight line from head to foot.

Movement -- The subject abducted his left leg maximally. With his left knee extended, he then pliometrically returned the leg to the starting position. The position was reversed for the raising of the right leg after one-half the time segment had elapsed.

8. Forward Curl (on back):

Starting Position -- The subject laid on his back with his legs abducted. His hands were placed on his thighs with the palms down.

Movement -- The subject curled his head, shoulders, and upper part of his back through trunk flexion as his hands slid down his thighs to his patellas. Once the patellas were touched, the subject pliometrically returned to the starting position.

9. Grass Exercise:

Starting Position -- The subject stood erect with his legs abducted to shoulder width and his arms abducted overhead with palms pressed together.

Movement -- The subject lowered the upper part of his body as he moved his hands to the ground between the heels of his feet. He then straightened his body and performed the movement again, each time trying to touch the ground farther behind his body.

10. Push-up:

Starting Position -- The subject laid flat on his stomach with his legs abducted and ankles flexed dorsally. His hands were placed palms down next to his shoulders, with his elbows abducted.

Movement -- The subject, extended his elbow joint maximally while his body was kept in a straight line from head to toe. The subject returned to the starting position by pliometrically contracting the elbow extensors.

11. Chest-and-Leg Raises (on stomach):

Starting Position -- The subject laid flat on his stomach with his legs abducted and his arms adducted to his thighs with hands supinated until the palms were flat on the floor.

Movement -- The subject raised his shoulders and chest as high as possible. At the same time, he extended both legs maximally, with the knees extended. Then he returned his body to the starting position.

12. Simultaneous Leg Raise (on side):

Starting Position -- Same as for single-leg raise.

Movement -- The subject abducted his left leg and simultaneously adducted his right leg maximally beyond the mid-line of the body attempting to keep the legs together. Then he returned his legs to the starting position. The movement was repeated from the left side after one-half the time segment had elapsed.

13. Sit-up:

Starting Position -- The subject laid on his back with his legs extended and abducted about one foot. His hands were clasped behind the neck with fingers interlaced.

Movement -- The subject curled his head and shoulders forward and sat up, then twisted his body to touch the right elbow to the left knee. Next, the subject returned to the starting position. The exercise was repeated alternating sides.

14. Chopping Wood:

Starting Position -- The subject assumed an erect position, with the feet abducted one foot and the hands abducted overhead with palms together.

Movement -- The subject arched his back, thrust his arms forward and downward, keeping his knees extended, attempted to touch the floor, with his finger tips. He then returned to the starting position.

Description of Test

Pull-ups -- A chinning bar was used. The pronated hand position (back of the hand toward the face) was used. After assuming the hanging position, the subject elevated his body until his chin was raised above the bar. He then lowered his body to a full hang and again elevated his body as many times as he was able, always returning to the full hang. One point was scored for every properly completed pull-up.

Sit-ups -- The subject assumed a position on his back with his legs extended and his feet abducted to shoulder width. His hands were placed on the back of his neck with the fingers interlaced. A partner held the ankles down, the heels being in contact with the mat or floor at all times. The subject sat up, turned to the left and touched the right elbow to the left knee, returned to the starting position, then sat up, turned the trunk to the right and touched the left elbow to the right

knee. The exercise was repeated, alternating sides. There was no time limit, but the subject was not allowed to rest between attempts. One point was scored for every properly executed movement.

Standing broad jump -- The subject stood with his toes behind a starting tape. His feet were shoulder width apart. Preparatory to jumping, the subject extended his arms and flexed his knees. The jump was accomplished by simultaneously extending the knees and flexing the shoulder joint. Practice jumps were allowed. The score was recorded in feet and inches and later converted to inches.

Shuttle run -- Two parallel lines (A and B) were placed on the floor 30 feet apart. Two 2"x2"x4" blocks of wood were placed behind line B. The subject stood behind line A. On the signals "Ready? Go!" the subject ran to line B, picked up one block, ran back to line A and placed the block behind the line; he then ran back to line B and picked up the second block which he carried across line A. Practice runs were allowed without timing. The time to the nearest tenth of a second was recorded.

Vertical jump -- The initial measurement consisted of having the subject extend one arm upward with the tips of the fingers touching the measuring tape marked in one-half inches. The subject's feet were flat on the

floor and adjacent to the wall. The number nearest the extended finger tips was recorded. The subject then lowered his arm and moistened his finger tips in preparation to jump. He bent his knees and swung his arms backward. The jump was accomplished by simultaneously extending the knees and thrusting the arms upward. The finger tips of the hands used to obtain the initial measurement touched as high as possible on the tape. The number at the moistened spot was recorded. The score was the difference between the initial and final values.

Age -- At the beginning of the training period, age was recorded in years and months and later converted to months for computational purposes. If a boy was 12 years and 4 months plus 12 days old, his age was recorded as 148 months. If it had been 14 days or more from the last monthly anniversary date, his age would have been recorded to the next month.

Method of Data Analysis

One-way analysis of variance was applied to the data. F-statistics were obtained from between and within subcategory mean squares of dependent variables, classified according to pull-ups, sit-ups, standing broad jump, shuttle run and vertical jump. Duncan's Multiple Range Test was employed to find which dependent variable means were significantly different when significant F-ratios were detected. Both tests were run at the .05 level of significance.

CHAPTER IV

Analysis of Data

This study was undertaken to determine whether or not a vigorous five-minute daily calisthenic program would achieve the same level of physical fitness as that achieved by a vigorous fifteen-minute daily calisthenic program. The subjects for the experimental group were those boys scheduled for physical education the first semester, while the subjects for the control group were those boys scheduled in study hall. The five-minute calisthenic plan was randomly assigned to one seventh and one eighth grade class as was the fifteen-minute plan. Each class met either two times a week or three times a week on alternate weeks. The test battery consisted of: pull-ups, sit-ups, vertical jump, standing broad jump, and shuttle run. The physical fitness test was administered before and after the fourteen-week training period.

Presentation of Data

One seventh and one eighth grade class made up the five-minute group and one seventh and one eighth grade class made up the fifteen-minute group. A comparison of the mean values for these two groups and the control group is shown for each of the five dependent variables.

Sit-ups

Table I shows the mean differences of the three treatment groups in the sit-up. All three groups showed improvement, with the fifteen-minute group showing the largest

TABLE I

MEAN SCORE DIFFERENCES BY TREATMENT IN THE SIT-UP

Group	N	Pre-Test Mean Scores	Post-Test Mean Scores	Difference Between Means	"F" Value	P
1. 5-Minute	73	40.60	82.09	41.49	19.531	<0.0005
2. 15-Minute	64	44.98	86.91	41.93		
3. Control	73	43.46	62.56	19.10		

Duncan's significant difference between means: 1>3; 2>3

improvement, a gain of 41.93 sit-ups. The five-minute group showed a gain almost as large, 41.19. Both the five-minute and the fifteen-minute groups improved significantly over the control group, but there was no significant difference between the improvements of the two experimental groups.

Table II shows the mean score differences of the three treatment groups by grade in the sit-ups. It can be seen that the eighth grade boys did not score better on the post-test than did the seventh grade boys as might be expected. Class II had a final sit-up mean score of 94.97 and an improvement of 55.69 sit-ups. This improvement was significantly greater than was found for both control groups and Classes I and IV.

TABLE II

MEAN SCORES AND DIFFERENCES BY GROUPS
AND TREATMENT IN THE SIT-UP

Group	N	Pre-Test Mean Scores	Post-Test Mean Scores	Difference Between Means	"T" Value	P
1. 7-5 Min (III)	39	31.23	79.86	48.63	15.369	<0.0005
2. 7-15 Min (II)	39	39.28	94.97	55.69		
3. 7th Control	39	37.03	61.59	24.56		
4. 8-5 Min (I)	39	40.07	74.21	34.34		
5. 8-15 Min (IV)	39	50.69	77.84	27.15		
6. 8th Control	41	49.49	63.32	14.83		

Duncan's significant difference between means: 2>6, 3, 5, 4; 1>6, 3, 5, 4; 4>6; 5>6

but not significantly greater than that of Class III. The improvement for Class III was also significantly greater than that of both controls and Classes I and IV. Classes I and IV improved significantly more than did the eighth grade control group, but not significantly more than the seventh grade control group.

Table III shows the mean differences of the three treatment groups in the sit-up for six age levels. The post-test scores for the fifteen-minute group were very high at all age levels except for the ages 156-160 months and above 166 months. The post-test scores for the five-minute group showed only one high score, above 166 months, but showed no low scores. All of the control scores were low to very low. Large gains from the pre-test scores were achieved by both

TABLE III

[illegible] SCORE DIFFERENCES BY AGE AT [illegible] IN [illegible] SIT-UP

Age	Group	N	Pre-Test Mean Scores	Post-Test Mean Scores	Difference Between Means	"F" Value	P
1. ≤ 145 M	5-Min.	5	38.60	83.80	45.20	3.90*	<0.0005
2. ≤ 145 M	15-Min.	9	45.33	95.78	50.45		
3. ≤ 145 M	Control	8	31.75	70.88	39.13		
4. 146-150 M	5-Min.	15	39.87	79.73	40.86		
5. 146-150 M	15-Min.	8	44.13	99.00	54.87		
6. 146-150 M	Control	8	37.00	54.38	17.38		
7. 151-155 M	5-Min.	14	29.71	79.71	50.00		
8. 151-155 M	15-Min.	14	41.79	92.29	50.50		
9. 151-155 M	Control	16	42.69	61.63	18.94		
10. 156-160 M	5-Min.	17	46.12	82.59	36.47		
11. 156-160 M	15-Min.	10	36.00	69.90	33.90		
12. 156-160 M	Control	14	43.72	55.36	11.64		
13. 161-165 M	5-Min.	12	49.50	82.00	32.50		
14. 161-165 M	15-Min.	13	52.92	89.38	36.46		
15. 161-165 M	Control	10	50.10	65.65	15.55		
16. ≥ 166 M	5-Min.	7	60.29	91.71	31.42		
17. ≥ 166 M	15-Min.	10	48.50	75.50	27.00		
18. ≥ 166 M	Control	7	46.57	70.14	23.57		

Duncan's significant difference between means: 5>12, 15, 6, 9, 18, 17; 8>12, 15, 6, 9, 18; 3>12, 15, 6, 9; 7>12, 15, 6, 9, 18; 4>12, 15, 6, 9, 18, 17; 1>12, 15; 3>12; 10>12, 15; 14>12, 15

the five-minute and fifteen-minute groups at all three age levels below 155 months while they improved only moderately above 155 months. The control group improved only slightly with the exception of the below-145-months group. All five-minute groups below 160 months showed a significant increase over all control groups, except the control group below 145 months. They did not improve significantly over the

fifteen-minute groups except the fifteen-minute group over 166 months. All the fifteen-minute groups, except 156-160 months group and the group above 166 months, improved significantly more than all the control groups except the control group below 145 months, but did not improve significantly over any of the five-minute groups.

Pull-ups

Table IV gives the overall results of the three treatment groups in the pull-ups. The fifteen-minute group scored

TABLE IV

MEAN SCORE DIFFERENCES BY TREATMENT IN THE PULL-UP

Group	N	Pre-Test Mean Scores	Post-Test Mean Scores	Difference Between Means	"F" Value	P
1. 5-Minute	70	3.07	3.61	0.54	4.651	0.011
2. 15-Minute	64	3.31	3.01	-0.30		
3. Control	73	2.73	2.95	0.22		

Duncan's significant difference between means: 1>2

lower on the post-test than the pre-test, with a difference between means of -0.30. The five-minute group recorded a gain of 0.54 and the control group has a gain of 0.22. The difference between the five-minute group and the fifteen-minute group was significant. There was no significant difference between the five-minute group or the fifteen-minute group and the control group.

Table V shows that Class IV was primarily responsible for the low post-test score by the fifteen-minute group.

TABLE V

MEAN SCORE DIFFERENCES BY GRADE AND TREATMENT IN THE PULL-UP

Group	N	Pre-Test Mean Scores	Post-Test Mean Scores	Difference Between Means	"F" Value	P
1. 7-5 Min (III)	35	2.86	3.37	0.51	2.417	0.037
2. 7-15 Min (II)	32	2.84	2.87	0.03		
3. 7th Control	32	2.28	2.44	0.16		
4. 8-5 Min (I)	35	3.29	3.86	0.57		
5. 8-15 Min (IV)	32	3.78	3.16	-0.62		
6. 8th Control	41	3.07	3.34	0.27		

Duncan's significant difference between means: 4>5; 2>5; 6>5

However, the other fifteen-minute class, Class II, had only a very meager gain of 0.03. Classes I and III both scored well on the post-test, with gains of 0.57 and 0.51 respectively. Classes I, II, and the eighth grade control improved significantly over Class IV.

Table VI compares the mean score differences in the pull-ups of the three treatments at six age levels. It can be seen that the fifteen-minute group's post-test scores for all age levels was lower than the pre-test scores, with the exception of the age level 151-155 months. The fifteen-minute group had losses ranging from -0.08 to -0.80. The five-minute group and control group each had only one pull-up

TABLE VI

MEAN SCORE DIFFERENCES BY AGE AND TREATMENT IN THE PULL-UP

Age	Group	N	Pre-Test Mean Scores	Post-Test Mean Scores	Difference Between Means	"F" Value	P
1. ≤ 145 M	5-Min.	5	1.40	1.20	-0.20	1.302	0.195
2. ≤ 145 M	15-Min.	9	3.89	3.22	-0.67		
3. ≤ 145 M	Control	8	2.75	2.25	-0.50		
4. 146-150 M	5-Min.	15	2.33	2.73	0.40		
5. 146-150 M	15-Min.	8	2.50	1.87	-0.63		
6. 146-150 M	Control	8	1.75	2.75	1.00		
7. 151-155 M	5-Min.	14	3.21	3.86	0.65		
8. 151-155 M	15-Min.	14	3.14	3.64	0.50		
9. 151-155 M	Control	16	2.19	2.31	0.12		
10. 156-160 M	5-Min.	17	3.29	4.06	0.77		
11. 156-160 M	15-Min.	10	4.40	3.60	-0.80		
12. 156-160 M	Control	14	2.07	2.07	0.00		
13. 161-165 M	5-Min.	12	4.08	4.33	0.25		
14. 161-165 M	15-Min.	13	2.46	2.38	-0.08		
15. 161-165 M	Control	20	3.65	3.95	0.30		
16. ≥ 166 M	5-Min.	7	3.29	4.43	1.14		
17. ≥ 166 M	15-Min.	10	3.70	3.10	-0.60		
18. ≥ 166 M	Control	7	3.71	4.28	0.57		

No significant differences between treatment means

post-test score lower than the pre-test score, both were at the youngest age level, below 145 months. The five-minute group showed a continuous pull-up post-test score improvement from below 145 months to above 166 months, while the fifteen-minute group and control group did not. There were no significant differences between the treatment means.

Table VII shows the mean score differences of the three treatment groups for each hour in the pull-ups. It can be

TABLE VII

MEAN SCORE DIFFERENCES BY HOUR AND TREATMENT IN THE PULL-UP

Group	N	Pre-Test Mean Scores	Post-Test Mean Scores	Difference Between Means	"F" Value	P
1. 1st 5-Min.	35	3.29	3.86	0.57	1.819	0.085
2. 1st Control	23	3.82	4.27	0.45		
3. 2nd 15-Min.	32	2.84	2.87	0.03		
4. 2nd Control	17	2.23	2.47	0.24		
5. 3rd 5-Min.	35	2.86	3.37	0.51		
6. 3rd Control	15	2.33	2.40	0.07		
7. 4th 15-Min.	32	3.78	3.16	-0.62		
8. 4th Control	19	2.21	2.26	0.05		

Duncan's significant difference between means: 1>7; 5>7; 2>7

seen that not only did the fourth-hour fifteen-minute treatment group have a negative difference between means, but the fourth-hour control group had a low difference between means as well. It should also be noted that the second-hour fifteen-minute group scored a very low difference between means while the second-hour control group did not. The first and third hour five-minute groups improved significantly over the fourth-hour fifteen-minute group, but there were no other significant differences.

Standing Broad Jump

Table VIII shows the mean score differences of the three treatment groups in the standing broad jump. The fifteen-minute group recorded the largest gain, 2.58 inches, while

TABLE VIII

MEAN SCORE DIFFERENCES BY TREATMENT IN THE STANDING BROAD JUMP

Group	N	Pre-Test Mean Scores (In.)	Post-Test Mean Scores (In.)	Difference Between Means (In.)	"F" Value	P
1. 5-Minute	70	59.01	61.16	2.15	1.523	0.221
2. 15-Minute	64	60.64	63.22	2.58		
3. Control	73	58.75	59.71	0.96		

No significant differences between treatment means

the five-minute group was close behind with a gain of 2.15 inches. The control group scored a gain of only 0.96 inches. There was no significant difference between the three treatment groups.

Table IX shows the mean score differences of the three treatment groups by grade in the standing broad jump. It can be seen, as expected, the eighth grade boys scored higher on the standing broad jump than did the seventh grade boys. Class I recorded the largest improvement with a gain of 3.06 inches, while Class IV was close behind with a gain of 3.04 inches. Class III recorded the smallest improvement with a gain of 1.23 inches while Class II scored a slightly higher score, with a gain of 2.12 inches. There were no significant differences between the mean differences.

TABLE IX

MEAN SCORE DIFFERENCES BY GRADE AND TREATMENT IN THE STANDING BROAD JUMP

Group	N	Pre-Test Mean Scores (In.)	Post-Test Mean Scores (In.)	Difference Between Means (In.)	"F" Value	P
1. 7-5 Min (III)	35	56.43	57.66	1.23	1.174	0.323
2. 7-15 Min (II)	32	57.16	59.28	2.12		
3. 7th Control	32	56.81	57.19	0.38		
4. 8-5 Min (I)	35	61.60	64.66	3.06		
5. 8-15 Min (IV)	32	64.12	67.16	3.04		
6. 8th Control	41	60.27	61.68	1.41		

No significant differences between treatment means

Table X shows the mean score differences of the three treatment groups at six age levels in the standing broad jump. The five-minute treatment group below 145 months scored no improvement in the standing broad jump, while the five-minute group above 166 months scored the largest improvement with a gain of 6.71 inches. The fifteen-minute treatment group showed improvement at all age levels, with the smallest gain below 145 months of 0.78 inches and the largest gain at 161-165 months of 4.07 inches. There were no significant differences between the treatment means at the various age levels.

TABLE X

MEAN SCORE DIFFERENCES BY AGE AND TREATMENT IN THE STANDING BROAD JUMP

Age	Group	N	Pre-Test Mean Scores (In.)	Post-Test Mean Scores (In.)	Difference Between Means (In.)	"F" Value	P
1. ≤ 145 M	5-Min.	5	56.60	56.60	0.00	0.911	0.562
2. ≤ 145 M	15-Min.	9	58.78	59.56	0.78		
3. ≤ 145 M	Control	8	54.25	54.00	-0.25		
4. 146-150 M	5-Min.	15	54.47	55.13	0.66		
5. 146-150 M	15-Min.	8	56.75	60.63	3.88		
6. 146-150 M	Control	8	55.63	55.25	-0.38		
7. 151-155 M	5-Min.	14	58.00	61.14	3.14		
8. 151-155 M	15-Min.	14	60.64	62.78	2.14		
9. 151-155 M	Control	16	59.25	60.00	0.75		
10. 156-160 M	5-Min.	17	58.94	61.23	2.29		
11. 156-160 M	15-Min.	10	62.10	63.60	1.50		
12. 156-160 M	Control	14	56.07	58.93	2.86		
13. 161-165 M	5-Min.	12	65.25	66.08	0.83		
14. 161-165 M	15-Min.	13	60.08	64.15	4.07		
15. 161-165 M	Control	20	61.95	62.55	0.60		
16. ≥ 166 M	5-Min.	7	62.00	68.71	6.71		
17. ≥ 166 M	15-Min.	10	64.70	67.60	2.90		
18. ≥ 166 M	Control	7	62.57	64.14	1.57		

No significant differences between treatment means

Vertical Jump

Table XI shows the mean score differences of the three treatment groups in the vertical jump. The five-minute group recorded the largest improvement with a gain of 1.14 inches, while the fifteen-minute group recorded a gain of 0.81 inches. The control group scored a loss of -0.09 inches. Both the five-minute group and the fifteen-minute group improved significantly over the control group. The

TABLE XI

MEAN SCORE DIFFERENCES BY TREATMENT IN THE VERTICAL JUMP

Group	N	Pre-Test Mean Scores (In.)	Post-Test Mean Scores (In.)	Difference Between Means (In.)	"F" Value	P
1. 5-Minute	70	11.59	12.73	1.14	13.622	<0.0005
2. 15-Minute	64	12.31	13.12	0.81		
3. Control	73	12.89	12.80	-0.09		

Duncan's significant difference between means: 1>3; 2>3

difference between the five-minute group and the fifteen-minute group was not significant.

Table XII shows the mean score differences of the three

TABLE XII

MEAN SCORE DIFFERENCES BY GRADE AND TREATMENT IN THE VERTICAL JUMP

Group	N	Pre-Test Mean Scores (In.)	Post-Test Mean Scores (In.)	Difference Between Means (In.)	"F" Value	P
1. 7-5 Min (III)	35	10.64	11.78	1.14	6.771	<0.0005
2. 7-15 Min (II)	32	11.45	12.31	0.86		
3. 7th Control	32	12.36	11.80	-0.56		
4. 8-5 Min (I)	35	12.53	13.67	1.14		
5. 8-15 Min (IV)	32	13.17	13.92	0.75		
6. 8th Control	41	13.30	13.58	0.28		

Duncan's significant difference between means: 4>3, 6; 1>3, 6; 2>3; 5>3; 6>3

treatment groups by grade in the vertical jump. It can be seen as expected, the eighth grade boys scored higher on the vertical jump than did the seventh grade boys. Classes I and II recorded the largest improvement in the vertical jump with identical gains of 1.14 inches. Class II recorded the second largest improvement with a gain of 0.86 inches while Class IV had a gain of 0.75 inches. The differences in all the groups were significantly greater than that of the seventh grade control group, while the improvements in Classes I and III were also significantly greater than that of the eighth grade control group. There was no significance between the five-minute group or the fifteen-minute group at the several grade levels.

TABLE XIII

MEAN SCORE DIFFERENCES BY HOUR AND TREATMENT IN THE VERTICAL JUMP

Group	N	Pre-Test Mean Scores (In.)	Post-Test Mean Scores (In.)	Difference Between Means (In.)	"F" Value	P
1. 1st 5-Min.	35	12.53	13.67	1.14	8.009	<0.0005
2. 1st Control	22	13.30	14.39	1.09		
3. 2nd 15-Min.	32	11.45	12.31	0.86		
4. 2nd Control	17	12.50	11.53	-0.97		
5. 3rd 5-Min.	35	10.64	11.78	1.14		
6. 3rd Control	15	12.20	12.10	-0.10		
7. 4th 15-Min.	32	13.17	13.92	0.75		
8. 4th Control	19	13.32	12.66	-0.66		

Duncan's significant difference between means: 1>4, 8, 6; 5>4, 8, 6; 2>4, 8, 6; 3>4, 8, 6; 7>4, 8

Table XIII shows the mean score differences of the three treatment groups for each hour in the vertical jump. It can be seen that both of the seventh grade control groups scored a loss, which indicates that the loss shown in Table XII was not due to one class as it was in the pull-ups. Both the five-minute classes and the fifteen-minute classes improved significantly over all of the control groups, but there was no significant difference between the five-minute classes and the fifteen-minute classes.

Table XIV shows the mean score differences of the three treatment groups at six age levels in the vertical jump. It can be seen that at all age levels, except above 166 months, the control group scored lower on the post-test than on the pre-test. The five-minute groups scored gains of one inch or more at all age levels, except below 145 months, while the fifteen-minute group, only scored a gain of one inch or more at the age level 156-160 months. All the five-minute groups, except below 145 months, gained significantly over all the control groups, except the control group above 166 months, while only the fifteen-minute group at 156-160 months gained significantly over the control groups. There was no significant difference between the five-minute groups and the fifteen-minute groups at any age level.

TABLE XIV

MEAN SCORE DIFFERENCES IN AGE AND TREATMENT IN THE VERTICAL JUMP

Age	Group	N	Pre-Test Mean Score (In.)	Post-Test Mean Scores (In.)	Difference Between Means (In.)	"T" Value	P
1. ≤ 145 M	5-Min.	5	10.90	11.70	0.80	2.350	0.003
2. ≤ 145 M	15-Min.	9	11.72	12.61	0.89		
3. ≤ 145 M	Control	6	11.50	10.93	-0.57		
4. 146-150	5-Min.	15	10.67	11.83	1.16		
5. 146-150	15-Min.	9	12.06	12.75	0.69		
6. 146-150	Control	9	12.31	11.69	-0.62		
7. 151-155	5-Min.	13	11.04	12.32	1.28		
8. 151-155	15-Min.	14	11.93	12.71	0.78		
9. 151-155	Control	14	12.91	12.63	-0.28		
10. 156-160	5-Min.	13	11.26	12.47	1.21		
11. 156-160	15-Min.	10	12.55	13.90	1.35		
12. 156-160	Control	14	12.36	12.25	-0.11		
13. 161-165	5-Min.	13	13.00	14.00	1.00		
14. 161-165	15-Min.	13	12.65	13.19	0.54		
15. 161-165	Control	23	13.70	13.63	-0.07		
16. ≥ 166 M	5-Min.	7	13.50	14.64	1.14		
17. ≥ 166 M	15-Min.	10	12.90	13.55	0.65		
18. ≥ 166 M	Control	7	13.86	15.36	1.50		

Duncan's significant difference between means: 1>6, 3, 9, 15; 11>6, 3, 9, 12, 15; 7>6, 3, 9, 12, 15; 10>6, 3, 9, 12, 15; 4>6, 3, 9, 15; 13>6

Shuttle Run

Table XV shows the mean score differences of the three treatment means in the shuttle run. The five-minute group recorded the largest improvement with a gain of -0.98 seconds, while the fifteen-minute group recorded a gain of -0.88 seconds. The control group recorded a gain of -0.67 seconds. The five-minute group improved significantly over the control

TABLE XV

MEAN SCORE DIFFERENCES BY
TREATMENT IN THE SHUTTLE RUN

Group	N	Pre-Test Mean Scores (Sec.)	Post-Test Mean Scores (Sec.)	Difference Between Means (Sec.)	"F" Value	P
1. 5-Minute	70	11.92	10.94	-0.98	2.433	0.090
2. 15-Minute	64	11.91	11.03	-0.88		
3. Control	73	11.74	11.07	-0.67		

Duncan's significant difference between means: 1>3

group, but the fifteen-minute group did not. The difference between the five-minute group and the fifteen-minute group was not significant.

TABLE XVI

MEAN SCORE DIFFERENCES BY GRADE
AND TREATMENT IN THE SHUTTLE RUN

Group	N	Pre-Test Mean Scores (Sec.)	Post-Test Mean Scores (Sec.)	Difference Between Means (Sec.)	"F" Value	P
1. 7-5 Min (III)	35	12.10	11.01	-1.09	1.879	0.099
2. 7-15 Min (II)	32	12.23	11.38	-0.85		
3. 7th Control	32	12.01	11.14	-0.87		
4. 8-5 Min (I)	35	11.73	10.87	-0.86		
5. 8-15 Min (IV)	32	11.60	10.68	-0.92		
6. 8th Control	41	11.54	11.02	-0.52		

Duncan's significant difference between means: 1>6

Table XVI shows the mean score differences of the three treatment groups by grade in the shuttle run. With the exception of Class III, it can be seen, as expected, the eighth grade boys scored lower on the pre-test and post-test than the seventh grade boys. Class III recorded the largest improvement in the shuttle run with a gain of -1.09 seconds. Class III gained significantly over the eighth grade control.

TABLE XVII

MEAN SCORE DIFFERENCES BY AGE AND TREATMENT IN THE SHUTTLE RUN

Age	Group	N	Pre-Test Mean Scores (Sec.)	Post-Test Mean Scores (Sec.)	Difference Between Means (Sec.)	"F" Value	P
1. ≤ 145 M	5-Min.	5	12.12	11.20	-0.92	1.737	0.039
2. ≤ 145 M	15-Min.	2	12.01	11.09	-0.92		
3. ≤ 145 M	Control	8	12.14	11.14	-1.00		
4. 146-150 M	5-Min.	15	12.22	11.23	-0.99		
5. 146-150 M	15-Min.	8	12.40	11.40	-1.00		
6. 146-150 M	Control	8	12.23	11.33	-0.90		
7. 151-155 M	5-Min.	14	12.34	10.74	-1.60		
8. 151-155 M	15-Min.	13	11.75	11.01	-0.74		
9. 151-155 M	Control	10	11.80	11.01	-0.79		
10. 156-160 M	5-Min.	12	12.01	10.99	-1.02		
11. 156-160 M	15-Min.	10	12.05	10.87	-1.18		
12. 156-160 M	Control	14	11.84	11.31	-0.53		
13. 161-165 M	5-Min.	10	11.31	10.78	-0.53		
14. 161-165 M	15-Min.	11	11.96	11.11	-0.85		
15. 161-165 M	Control	20	11.51	10.82	-0.69		
16. ≥ 166 M	5-Min.	7	11.10	10.69	-0.41		
17. ≥ 166 M	15-Min.	10	11.46	10.76	-0.70		
18. ≥ 166 M	Control	7	11.10	11.07	-0.03		

Duncan's significant difference between means: 7>14, 9, 6, 17, 15, 12, 13, 16, 18; 11>18; 10>18; 4>18

Table XVII shows the mean score differences of the three treatment groups at six age levels in the shuttle run. As might be expected, those at the younger end of the table improved more than those at the older end of the table. It can also be seen that those at the older end of the table scored lower on the pre-test and post-test than those at the younger end of the table. The five-minute group at 151-155 months recorded the largest improvement with a gain of -1.60 seconds. This was significantly different from that of all treatment groups above 150 months with the exception of the five-minute and fifteen-minute groups at 156-160 months. The five-minute groups at 156-160 months and 146-150 months and the fifteen-minute group at 156-160 months all improved significantly over the control group above 166 months.

Discussion of Data

Table XVIII shows a comparison of the mean differences of the three treatment groups on the five variables.

On three of the five variables -- pull-ups, vertical jump, and shuttle run -- the five-minute group improved more than the fifteen-minute group, but only in the pull-ups was the difference significant. The fifteen-minute group improved more than the five-minute group in two of the five

TABLE XVIII

COMPARISON OF THE DIFFERENCE BETWEEN MEANS OF THE [illegible] GAINS ON THE FIVE VARIABLES

Group	N	Sit-Ups	Pull-Ups	Standing Broad Jump	Vertical Jump	Shuttle Run
5-Minute	70	41.49(a)	0.54(b)	2.15	1.14(a)	-0.9[illegible](a)
15-Minute	64	41.93(a)	-0.39	2.5[illegible]	0.81(a)	-0.[illegible]
Control	73	19.10	0.[illegible]	0.96	-0.09	-0.07

(a) Significantly greater than the Control Group
(b) Significantly greater than the 15-Minute Group

variables -- sit-ups and standing broad jump -- though the differences between the two groups were not significant.

Pull-ups -- It appears as though the fifteen-minute program may have been detrimental to Pull-up ability. Both the five-minute group and the control group improved more than did the fifteen-minute group, although the difference between the fifteen-minute group and the control group was not significant. Tables V and VI show that this negative difference for the fifteen-minute group was not exclusively the result of either the seventh or eighth grade subjects or of any one age level. This may indicate that the fifteen-minute calisthenic program was too vigorous in relation to shoulder and arm strength. Another possibility is the boys in the fifteen-minute group may have grown tired of exercising and lost

their desire and enthusiasm for completely exerting themselves as they were instructed.

Vertical Jump -- Both the five-minute group and the fifteen-minute group improved significantly more than the control group. Table XII shows that, with the exception of the seventh grade control group, both grades had approximately the same amount of improvement. Table XIV shows that the gains scored by the five-minute groups were consistent throughout all age levels while the fifteen-minute groups made gains inconsistently.

Shuttle Run -- The five-minute group improved significantly more in the shuttle run than did the control group. Even though the five-minute group improved more than did the fifteen-minute group, the difference was not significant. Table XVI shows that, with the exception of the eighth grade control group, both grades had mean differences which were very similar. Table XVII shows that age did not affect the scores for the treatment groups.

Sit-ups -- Both the five-minute group and the fifteen-minute group improved significantly more than the control group in sit-ups. Though the fifteen-minute group improved more than the five-minute group, the difference was small and not significant. The closeness of the post-test scores indicates that five minutes of calisthenics is nearly as effective as fifteen minutes of calisthenics in bringing about an improvement in sit-ups. Table II shows the seventh grade

boys gained more than did the eighth grade boys, for all three treatment groups; while Table III shows that the younger boys tended to have a greater difference between means for all treatment groups.

Standing Broad Jump -- Even though the five-minute group and the fifteen-minute group both improved more than the control group, the differences were not large enough to be significant. The fifteen-minute group improved slightly more than the five-minute group. Table IX shows the eighth grade boys scored better gains than the seventh grade boys, in addition to scoring higher on the post-test. Table X shows that the boys tended to jump farther at an older age for all three treatment groups.

CHAPTER V

Summary, Conclusions and Recommendations

Summary

This study was undertaken to determine whether or not a vigorous five-minute daily calisthenic program would achieve the same level of physical fitness as that achieved by a vigorous fifteen-minute daily calisthenic program. The sample consisted of 207 white seventh and eighth grade boys ranging in age from 141 months to 178 months in Mason Junior High School, Mason, Michigan. The subjects for the experimental group were those boys scheduled for physical education the first semester, while the subjects for the control group were those boys scheduled in study hall. The five-minute calisthenic plan was randomly assigned to one seventh and one eighth grade class as was the fifteen-minute plan. Two different daily calisthenic programs were used for this study, so that the exercises would not be the same for each day throughout the fourteen-week training period. Each class met either two times a week or three times on alternate weeks, with a total of three days taken out of the study for a teacher's workshop and Thanksgiving. The test battery consisted of: pull-ups, sit-ups, vertical jump, standing broad jump and shuttle run. The test, requiring a total of six days, was administered to both the experimental and

control groups preceeding and following the fourteen-week training period. The data were tabulated and treated statistically using the "F" test and Duncan's Multiple-Range Test, both at the .05 level of significance. The five-minute group improved more than the fifteen-minute group on three of the five test items -- pull-ups, vertical jump and shuttle run -- with a significant difference only in the pull-ups. The fifteen-minute group improved more than the five-minute group in two of the five test items -- sit-ups and standing broad jump -- with no significant differences. The five-minute group improved significantly more than the control group in the sit-ups, vertical jump and shuttle run, while the fifteen-minute group improved significantly more than the control group in the sit-ups and vertical jump. There were no significant improvements in the standing broad jump by any of the treatment groups.

Conclusions

1. Five minutes of calisthenics is significantly more effective than fifteen minutes of calisthenics in producing an improvement in pull-ups when carried out under the conditions of this study.
2. Five minutes of calisthenics is just as effective as fifteen minutes of calisthenics in producing an improvement in the vertical jump

when carried out under the conditions of this study.

3. Five minutes of calisthenics is just as effective as fifteen minutes of calisthenics in producing an improvement in the shuttle run when carried out under the conditions of this study.
4. Five minutes of calisthenics is just as effective as fifteen minutes of calisthenics in producing an improvement in the sit-ups when carried out under the conditions of this study.
5. Five minutes of calisthenics is just as effective as fifteen minutes of calisthenics in producing an improvement in the standing broad jump when carried out under the conditions of this study.
6. A fifteen-minute calisthenic program as used in this study may be too strenuous and may bring about loss of enthusiasm and desire for complete exertion.

Recommendations

1. A similar study should be conducted, starting at some time other than at the beginning of the school year when the students' excitement and enthusiasm runs very high and concluding

at some time other than before a holiday when the students' anticipation of a vacation runs higher than their enthusiasm for physical testing.

2. A similar study should be conducted with ten minutes of calisthenics administered as well as the five-minute calisthenic program.
3. A similar study should be conducted with a maturational factor being considered.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Alexander, John F.; Stephen L. Martin; and Kenneth Metz. "Effects of a Four-Week Training Program on Certain Physical Fitness Components of Conditioned Male University Students." Research Quarterly 39:16-24, March, 1968.

2. Baker, John A. "Comparison of Rope Skipping and Jogging as Methods of Improving Cardiovascular Efficiency of College Men." Research Quarterly 39:240-243, May, 1968.

3. Banister, E. W. "A Comparison of Fitness Training Methods in a School Program." Research Quarterly 36:387-392, December, 1965.

4. Berrafato, Peter R. "The Effect of Various Physical Education Activities on All-Around Muscular Endurance." Unpublished Master's Thesis, University of Illinois, Urbana, Illinois, 1949.

5. Brownell, Clifford L., and Hagman, Patrica. Physical Education Foundations and Principles. New York: McGraw-Hill Book Company, 1951. (p. 353).

6. Campney, Harry L., and Wehr, Richard W. "Effects of Calisthenics on Selected Components of Physical Fitness." Research Quarterly 36:393-402, December, 1965.

7. Cureton, Thomas K. "What is Physical Fitness." Journal of the American Association for Health, Physical Education and Recreation 16:111-ff, March, 1945.

8. Durnin, J. V. G. A.; J. M. Brockway; and H. W. Whitcher, "Effects of a short period of training of varying severity on some measurements of physical fitness." Journal of Applied Physiology 15:161-165, 1960.

9. Fabricius, Helen. "Effect of Added Calisthenics on the Physical Fitness of Fourth Grade Boys and Girls." Research Quarterly 35:135-140, May, 1964.

10. Fordham, Sheldon LeRoy. "The Effect of Four Selected Physical Education Activities on Muscular Endurance Test Scores." Unpublished Master's Thesis, University of Illinois, Urbana, Illinois, 1949.

11. Hart, Marcis E. and Shay, Clayton T. "Relationship Between Physical Fitness and Academic Success." Research Quarterly 35:443-445, October, 1964.

12. Herkimer, L. R. "The Effects of Physical Exercise on Adult Men." Unpublished Master's Thesis, University of Illinois, 1949.

13. Hillcourt, William. Physical Fitness for Boys. New York: Golden Press, 1967.

14. Hilsendager, Donald. "Comparison of a Calisthenic and a Non-Calisthenic Physical Education Program." Research Quarterly 37:148-150, March, 1966.

15. Hlavac, Frank John. "Frequency of Physical Education Instruction as a Factor Influencing Changes in Strength and Motor Proficiency of Secondary School Boys." Unpublished Master of Science Thesis, University of Wisconsin, Madison, Wisconsin, 1954.

16. Hopkins, Richard E. "The Effects of Volleyball and Calisthenics on the Physical Fitness of Adult Men." Unpublished Master of Science Thesis, University of Illinois, Urbana, Illinois, 1951.

17. Hunsicker, Paul A. American Association for Health, Physical Education, and Recreation Youth Fitness Test Manual. p. 1, American Association for Health, Physical Education, and Recreation: Washington 6, D. C., 1958.

18. Ikeda, Namiko. "A Comparison of Physical Fitness of Children in Iowa, U.S.A., and Tokyo, Japan." Research Quarterly 33:541-552, December, 1962.

19. Karpovich, Peter V. Physiology of Muscular Activity. Philadelphia: W. B. Saunders and Company, 1953. (p. 81).

20. Kennedy, John F. "The Soft American." Sports Illustrated 13:15-17, December 26, 1960.

21. McCloy, C. H. "A Factor Analysis of Endurance." Research Quarterly 27:213-216, May, 1956.

22. McGlynn, George H. "Effect of an Isometric Exercise on Force and Fatigue in a Skeletal Muscle." Research Quarterly 39:131-137, March, 1968.

23. Nagle, Francis J. "How Much Fitness." Journal of Health, Physical Education, and Recreation 31:28, September, 1960.

24. Ponthieux, N. A., and Barker, D. G. "An Analysis of the AAHPER Youth Fitness Test." Research Quarterly 34:225-226, December, 1963.

25. President's Council on Physical Fitness. "Adult Physical Fitness, A Program for Men and Women." Washington: U. S. Government Printing Office, 1963.

26. Reynolds, Charles F. "Comparative Effects of Two Different Physical Education Programs Upon the Physical Fitness and Motor Educability of Ninth and Tenth Grade Boys." Unpublished Master of Science Thesis, South Dakota State College of Agriculture and Mechanic Arts, Brookings, South Dakota, 1957.

27. Sloan, A. W. "Effect of Training on Physical Fitness of Women Students." Journal of Applied Physiology 15:167-169, 1961.

28. Staley, S. C. Calisthenics. New York: A. S. Barnes and Company, 1934.

29. Staley, Seward C. Physical Exercise Programs. St. Louis, Mo.: C. V. Mosby, 1953.

30. Steel, Robert G. and James H. Torrie. Principle and Procedures of Statistics. New York: McGraw-Hill Book Company, Inc., 1960.

31. Steinhaus, Arthur H. How to Keep Fit and Like It. Chicago, Illinois: The Hartnell Corporation, 1963.

32. Taddonio, Dominick A. "Effect of Daily Fifteen-Minute Periods of Calisthenics upon the Physical Fitness of Fifth-Grade Boys and Girls." Research Quarterly 37:376-381, May, 1966.

33. Vincitore, Michael Anthony. "Effects of a Physical Conditioning Program on the Progressive Pulse Ratio Test of Adult Men." Unpublished Master's Thesis, University of Illinois, Urbana, Illinois, 1951.

34. Wallis, Carl L., and Gene A. Logan. Figure Improvement and Body Conditioning Through Exercise. Englewood Cliffs, New Jersey, Prentice Hall, Inc., 1964.

35. Weiss, Raymond A. "Is Physical Fitness Our Most Important Objective?" Journal of Health, Physical Education, and Recreation 35:17-18ff, February, 1964.

36. Willgoose, Carl E. Evaluation in Health Education and Physical Education. New York: McGraw-Hill Book Company, 1961. (pp. 16-17).

37. Wilson, Arthur L., Jr. "The Effect of Weight Training on the Physical Fitness of Young Men." Unpublished Master's Thesis, University of Illinois, Urbana, Illinois, 1947.

38. Wolbers, C. P. "The Effects of Volleyball on the Physical Education of Adult Men." Unpublished Master's Thesis, University of Illinois, 1950.

39. _____. "Fitness for Secondary School Youth." American Association for Health, Physical Education and Recreation, 1958.

40. _____. "The President's Conference on Fitness of American Youth." Journal of Health, Physical Education and Recreation 27:8-10, 58, September, 1956.

41. _____. "The President's Fitness Program." Journal of Health, Physical Education and Recreation 32:58-61, September, 1961.

42. _____. The United States Book of Family Physical Fitness. New York: Pocket Books, Inc., 1965.

APPENDIX

APPENDIX A

Calisthenic Programs

Program A (11 exercises)	Classes II & IV	Classes I & III
Jumping Jacks	2 min. 30 sec.	50 sec.
Toe Touch	1 min. 15 sec.	25 sec.
Vertical Jump to ½ Squat	1 min.	20 sec.
Raised-leg Push-up	1 min.	20 sec.
Alternate Leg Raise (on stomach)	1 min. 30 sec.	30 sec.
Single Leg Raise (on side)	1 min. 30 sec.	30 sec.
Forward Curl (on back)	1 min. 30 sec.	30 sec.
Arm Pull	30 sec.	10 sec.
Grass Exercise	45 sec.	15 sec.
Jumping Jacks	1 min.	20 sec.
Run	2 min. 30 sec.	50 sec.
	15 min.	5 min.

Program B (11 exercises)	Classes II & IV	Classes I & III
Jumping Jacks	2 min.	40 sec.
Toe Touch	1 min. 30 sec.	30 sec.
Vertical Jump to ½ Squat	1 min.	20 sec.
Push-up	1 min. 30 sec.	30 sec.
Chest & Legs Raising (on stomach)	1 min. 30 sec.	30 sec.
Simultaneous Leg Raising (on side)	1 min. 30 sec.	30 sec.
Sit-up (on back)	1 min. 30 sec.	30 sec.
Chopping Wood	1 min.	20 sec.
Arm Pull	30 sec.	10 sec.
Jumping Jacks	1 min.	20 sec.
Run	2 min.	40 sec.
	15 min.	5 min.