1965

A Three Year Study of the Physical Fitness Progress of the Athlete and Non-Athlete at the Junior High School Level

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A THREE YEAR STUDY OF THE PHYSICAL FITNESS PROGRESS OF THE ATHLETE AND NON-ATHLETE AT THE JUNIOR HIGH SCHOOL LEVEL

A Thesis

Presented to

the Graduate Faculty

Central Washington State College

In Partial Fulfillment

of the Requirements for the Degree

Master of Education

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by

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August 1965

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ACKNOWLEDGMENT

The writer wishes to express his sincere appreciation to Dr. Everett A. Irish for his supervision and guidance during the formulation of this study. Acknowledgment is also accorded to Dr. Gerald E. Gage and to Professor Adrian L. Beamer for serving on the graduate committee. A special thank you is accorded the writer's wife, Elaine, without whose help and encouragement this paper could not have been written.

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CHAPTER I

THE PROBLEM AND DEFINITION OF TERMS USED

This study was undertaken in an attempt to determine the difference in the physical progress of the athlete and the non-athlete in the junior high school. The purpose is not to justify the inclusion or exclusion of interscholastic sports in the junior high school, only to determine what effect these activities may have upon an individual's physical fitness and growth.

I. THE PROBLEM

Statement of the Problem

The study was undertaken to determine whether athletes in the junior high school increase to the same degree in physical fitness and growth as do non-athletes over a three year period. An attempt was made to answer the following questions:

1. Do athletes participating in sports increase in physical fitness more than non-athletes?
2. Does participation in more than one sport affect the physical progress of an athlete?
3. Is an increase in height and weight of the athlete different from that of the non-athlete?

Importance of the Study

By the use of a physical fitness testing program, an effort was made to determine if participation in athletics had a bearing on the increase in the general physical fitness, as measured by the Quick Card Physical Fitness Test, of boys between the ages of twelve and sixteen years. Over a three year comparison of growth records in height and weight of the athlete and non-athlete the testing attempted to determine if participation in sport activities had any bearing on these increases.

The study was limited to those boys who entered East Junior High School, Great Falls, Montana, during the 1962-1963 school year.

II. DEFINITION OF TERMS USED

Athlete

The athlete denotes a student who participated in at least one interscholastic sport for a complete season.

Non-Athlete

A student who did not participate in any organized school athletic program is referred to as the non-athlete.

Physical Progress

Physical progress is the increase or decrease in physical fitness as measured by the Quick Card Physical Fitness Scoring Test.

Quick Card Physical Fitness Test

This is the test used in gathering data, consisting of broad jump, pullups, pushups, situps, vertical jump, and burpees.

Junior High School

The junior high school is a school whose enrollment consists of seventh, eighth and ninth grades.

CHAPTER II

REVIEW OF THE LITERATURE

I. CONCEPTS OF PHYSICAL FITNESS

The term physical fitness has many connotations but no commonly accepted definition. Physical fitness has been consistently accepted throughout the field of physical education as one of its major objectives. Lack of a clear, concise, and acceptable definition of the term has caused many problems in the measurement of physical fitness (3:277-288).

P. H. Hunsicker, past director of our nation's youth fitness program, defined physical fitness to include:

> . . . those qualities which permit an individual to perform life activities involving speed, strength, agility, power and endurance, and to engage in the various kinds of physical activities required of modern living, including sports and athletics, and to be able to maintain his optimum amount of fitness (10:17).

With this definition of physical fitness, what is being done in this country at the present time to bring our national fitness to a level that it should be if we are going to compete on even terms with the powers of the world?

Hans Kraus, M. D., and Ruth P. Hirschland (now Bonnie Pruden) co-authored an article in which they presented their findings on the physical deficiencies of American children in contrast with European children. Because of this article,

President Eisenhower called a conference of 150 leaders in the field of sports, education, youth programs, recreation, health, and related areas. They were to discuss the total fitness of all America's youth, especially those within the age range of five to seventeen years (19:9).

Vice-President Nixon, in the keynote opening address at the President's Conference of Fitness of American Youth, held June 18-19, 1956, said:

1. Less than fifty percent of our boys and girls in high school have physical education.

2. Ninety-one percent of the Nation's 150,000 elementary schools have no gymnasium.

3. Only 1,200 of our 17,000 communities in the United States have full-time recreation leadership.

4. Forty percent of those persons entering the Armed Forces in World War II were unable to swim as far as fifty feet.

5. Drownings between the ages of five and forty-four are second only to motor vehicles in accidental deaths.

6. Most drownings occur within fifteen to twenty yards to some point of safety.

7. Less than five percent of our youth have had the opportunity to enjoy the experience of camping and outdoor living.

8. Ninety percent of the Nation's elementary schools have less than the recommended five acres of land necessary for essential play area (19:9).

Some of the high lights of the group's recommendations are outlined here to point out the general trend of discussion.

The President's Council facilitates more adequate services to the increasing youth population by using its resources and influence to strengthen existing programs serving youth.

Whenever federal, state, or local governments provide funds for educational purposes, an adequate proportion of these funds should be allocated to provide the necessary outdoor and indoor athletic, physical education, and recreation facilities.

Parents are encouraged to assume a full share of the responsibility for physical fitness in the family.

Communities should emphasize to their school boards the needs for planning community schools which will include facilities for community youth fitness programs during the school day and the usual after school hours.

There should be a program in every school which not only tests the fitness of school youth but which develops favorable attitudes toward sound body and healthy personality. This emphasis should be continued throughout the formal schooling period.

The strengthening of curricula in areas of health education, physical education, and recreation in high schools, colleges, and universities should result in the fitness of students and the preparation of professional leaders.

Establishment of an interdisciplinary research committee would facilitate development of a balanced and comprehensive program of research in the various fields required for a successful youth fitness program throughout this country.

The contribution of various sports, exercises, and activities to the development and maintenance of fitness of the whole individual as well as in the particular elements needs to be more thoroughly measured on a scientific basis for both sexes at different ages (25:40-43).

President Kennedy said, after being elected to office, that his administration would work on "developing a program which emphasizes that all children should participate in sports and recognize the need for physical fitness." The plan outlined by the President's Council on Youth Fitness features these basic recommendations:

1. Pupils who have a low level of muscular strength, agility, and flexibility should be identified by a screening test as part of the health appraisal. Pupils so identified should be required to participate in a program of developmental exercises and activities designed to raise their physical performance to desirable levels.

2. Objective valid tests of physical achievement should be used to determine pupil status, measure progress, and motivate pupils to achieve increasingly higher levels of physical fitness.

3. At least fifteen minutes of vigorous exercises and developmental activities should be included in the daily physical education period.

4. While giving priority to the three basic recommendations above, the school should strive to provide a comprehensive program of health education and physical education for all pupils (20:8-11).

A good physical fitness program is more than a series of stunts. It is based on the analysis of health and performance and consists of two parts, namely conditioning and testing (11:18-20).

II. CONDITIONING THROUGH SPORTS

J. B. Wolf, physical educator from Pennsylvania, told a group of educators in Rochester, New York, that:

> The youngster who does not participate in sports, or who evades physical education today, and who remains outside the pale of team play, is the potential neurotic, misfit, the social rejecter, and possibly the juvenile delinquent of tomorrow (26:67).

Experience in athletics has taught us that regular play develops enough fitness to sustain us in a friendly game. Where the objective is to win in competition, the chances are that the sport itself will not develop the level of strength and endurance that competition demands. Individuals cannot attain peak physical condition solely by practicing the sport. The practice session lacks something that is needed to build and maintain strength and endurance. What is missing is intensity and frequency of exercise (24:20-21).

Many complaints have been made that the gifted child receives special attention and for every boy who makes the team there are thirty or forty others relegated to the spectator stands.

Sports carry their own built-in incentives for the participant and because of this we should turn more and more to sports through intramural and community recreation programs.

Dr. Pauline Berry Mack, however, felt she had conclusively proved that Americans are overfed but seriously undernourished and that physical strength and stamina among public school students can be developed through diet alone (16:34-36).

III. TESTING OF PHYSICAL FITNESS

Paul Hunsicker, in an article on the myths about fitness, said one statement frequently made is that "No currently available instrument measures total fitness" (11:18-20).

The inference of this statement is that since we cannot measure total fitness we should not be concerned with measuring any component part. If we are willing to recognize certain physical traits as components of fitness there are tests which will measure these components. There are tests that measure traits such as muscular strength, muscular endurance, flexibility, weight, agility, and speed.

The validity of these tests compares favorably with those of tests measuring other human traits.

Norms are used constantly in medicine, such as in temperature, pulse rate, and blood pressure. The educator uses norms in arriving at pupil I.Q., reading age, and arithmetic age. Why then the hue and cry when someone suggests a norm for physical fitness?

People seem to fear that individual differences will be overlooked or ignored if national norms are widely used. How else can one recognize the average, the talented, or the retarded individual?

Physical education teachers should know what the average athletic performances are at all ages and how certain types of activities and fitness programs alter these performances (11:18-20).

In order to provide a national norm, the American Association of Health, Physical Education, and Recreation Youth Fitness Council (AAHPER) developed a physical fitness test battery for boys and girls dealing with situps, pushups, vertical jump, standing broad jump, running, fifty yard dash, chinups, and other activities.

With the completion of this test, the physical education instructors throughout the country had a guide with which to compare their students. The AAHPER test was used by other countries to find the comparison of fitness between

their youth and America's.

Campbell and Pohndorf found that English youth exceeded the American group in the AAHPER physical fitness test battery and other tests except on one item--the arm power test for boys (14:59-60).

Noguchi administered both the Kraus-Weber test of minimum muscular fitness and the AAHPER test battery to Japanese children. He found that Japanese children were more flexible than American children by the Kraus-Weber test (17:20-21). Noguchi, testing with Yoshiyuki, and using the AAHPER test, found that Japanese children surpassed American children except in situps (18:40-51).

Kraus and Weber, using their test of minimum muscular fitness, found that 56.6 percent of American children failed the test as compared to a significantly lower 8.2 percent failure by European youth (7:16-25).

Ikeda of Japan made a comparison of physical fitness between children in Iowa and Tokyo, Japan, and found that Japanese groups exceeded Iowa boys and girls except in situps (12:541-552).

On a report on the Kraus-Weber test in East Pakistan, M. S. Kelleher found that the over-all minimum muscular fitness of boys and girls there was below the standard of European children but higher than that of the Americans. Abdominal weakness was most pronounced among both boys and girls

in East Pakistan (13:34-42).

IV. EFFECT OF SPORTS ON PHYSICAL DEVELOPMENT

Dr. James B. Conant in an address to the American Association of School Administrators, February 15, 1960, denounced competition in the junior high schools and said that "The fact that the disease of athleticism has spread to the junior high schools was to me a new and shocking revelation" (1:171).

There has been a concerted effort by a few physicians to prohibit all contact football for children of junior high school age. However, in a survey of 220 pediatricians, cardiologists, orthopedists, psychologists, and general practitioners, less than half of the specialists believed that football should be prohibited (8:19-21).

The response of the medical profession as to the effect of interscholastic type athletics on young children has been limited, for the most part, to opinions and to review of research studies conducted by other professions (8:19-21).

For over half a century many studies have been conducted on the relationship of physiological maturity to structure strength and motor performance. As early as 1901, Crampton discussed the effects of physiological maturity on growth. He found that acceleration in weight, height, and

strength with pre-pubescence reached a rapid rate during late pubescense, and continued into post-pubescence. He concluded that growth rates are dependent upon pubescent periods and not upon age (4:13).

The results of controlled studies on the effect of participation in sports upon growth are inconclusive; they indicate that growth is stimulated by mild activity but that growth as expressed in height and weight is slightly retarded during a period of strenuous physical activity (9:20-22).

In a study by G. R. Shuch on the Effects of Athletic Competition on the Growth and Development of Junior High School Boys, the athletic boys were larger in body size and had faster speeds of growth than non-athletes, but their mean gain was about the same. In terms of these factors, there seems to be no retardant of growth due to participation in the athletic program (22:288-298).

Riley, of Fairmont Junior High School in Ohio, conducted a study on the weight, height, and lung capacity of the athlete and the non-athlete over a three year period. He found the average weight increase per boy for the athletic group for the three year period was 23.7 pounds while that of the non-athletic boy was 30.85 pounds. The average increase in height per boy in the athletic group was 1.85 inches while in the non-athletic group it was 3.79 (21:108-116).

A study on the comparison of physical growth and development of athletes and non-athletes at the junior high school level was done by L. W. McGraw while at the University of Texas. He compared the growth in height and weight of 104 boys who entered the junior high school during the years 1950 to 1953 and fifty-two boys who entered during the years 1952 to 1955. He had fifty-seven boys in the athlete classified group and ninety-nine in the non-athlete classified group. He found the average gain of the athlete was 6.12 inches and 27.20 pounds while the average gain of the non-athlete was 5.63 inches and 25.80 pounds. His findings indicated that the athletic participation stimulated growth. However, other studies have disagreed with his conclusions

A study by Marcel DeLotto, at the University of Oregon, on the effects of competitive athletics on the growth and development of pre-pubescent boys indicated that students participating in junior high athletics did not grow as much as those who did not participate (5:135).

Hollis Fait in his Doctoral Dissertation at the State University of Iowa in 1951 entitled "An Analytical Study of the Effects of Competitive Athletics on Junior High School Boys" agreed with this conclusion of DeLotto (9:20-22).

If it is true that competitive athletics do retard growth, why then are athletes generally larger than non-athletes?

Rowe suggested in his study that the reason for the greater growth reported in the group of young boys not engaged in interscholastic athletics might be that the non-athletic children had just entered their rapid growth period during the period of the investigation. Whereas the athletes could have completed their pubical spurt period (21:108-116).

It has been well established that the rate of maturation of athletes exceeds that of non-athletes. Rowe's explanations seem even more logical in view of the fact that studies on ten to twelve year old children have shown that athletes are taller and heavier than the average child of the same chronological age because many of the athletes were post-pubescent and non-athletes pre-pubescent (21:108-116).

Dr. T. Wingate Todd, of the Brush Foundation of the Western Reserve University, suggested a solution to the problem which is at least worthy of considerable thought. Dr. Todd's suggestion was that boys of athletic temperament mature earlier than do boys of non-athletic temperament, and that therefore, since the athletic group is composed of boys who have matured earlier, age considered, than the group of non-athletic boys, the athletic boy is not going to grow as much as the non-athletic boy over the same period of time (21:108-116).

CHAPTER III

PROCEDURES

All seventh grade boys, taking physical education, who entered East Junior High School, Great Falls, Montana, during the 1962-1963 school year were tested in this study. The approximate ages of these 238 boys were from twelve to sixteen years.

The subjects were given the Quick Card Physical Fitness Scoring Test four times each year, in September, December, March, and May. This particular test, which consists of burpees, situps, pushups, pullups, vertical jump, and standing broad jump, was chosen because it was the test that the school had been using to record the individual physical fitness progress of their physical education classes. This test was considered suitable for the particular area because it could be administered indoors during all months of the year and could be completed in one class period. The height and weight of each individual was also recorded at the time of each test.

All subjects were oriented as to the purpose of the test, told they would not be graded on the results, and asked to do their best at all times. Each individual was given a score card at the start of each year and all tests were explained. Each subject was also assigned a master

score card to which his individual score card was transposed at the end of each year. In order to facilitate administering the tests the most reliable boys in the class were picked to assist in taking height, weight, vertical jump, and pullup measurements. All classroom assistants were given private instruction on how to administer the tests properly and how to record these scores on the individual score cards. This was done each year and when possible the same boys administered the test each year.

Only the subjects who remained at the school for the full three years were used in the results of the testing. Of the 238 boys who started the test in the seventh grade, sixty were deleted before the start of the eighth grade because of moving from the area, doctor's excuses from physical education classes, and like reasons, thirty-seven from the eighth to ninth grade, and twelve during the ninth grade school year. At the duration of this time the final list of 129 boys was divided into two groups consisting of fifty-three athletes and seventy-six non-athletes. The athletes were then sub-classified into groups consisting of twenty-two one-sport athletes, sixteen two-sport athletes, and fifteen three-sport athletes.

The raw scores of the first and fourth times the subject took the test in each school year were used in the statistical treatment of this study to find the t-ratio,

which is the difference between the means. The athletes and non-athletes were compared each year and each of these times on each individual test item to find the mean and the t-ratio between them. This procedure was also followed in comparing the one sport against the two-sport athletes, the two-sport against the three-sport athletes, and the one-sport against the three-sport athletes.

I. ADMINISTRATION OF THE TEST

In administering the test the various test items were divided into two groups.

Group I includes those items which can be tested in mass. They consist of situps, pushups, and the Burpee test. The most efficient manner of testing was to place the class in two equal lines and assign pupils opposite each other to work as partners. While the pupils of one line are doing the test, their partners in the opposite line are counting and recording the results. The procedure is then reversed and the pupils of the second line take the test. Individual record cards were supplied pupils so that the proper entries could be made.

Group II consists of the broad jump, vertical jump, pullups, height, and weight. The establishment of four to eight testing stations in the gymnasium, depending on the size of the class, and the rotation of subjects from station

to station accomplished a complete testing on these items of a class from thirty-five to forty pupils in thirty to thirty-five minutes.

CHAPTER IV

ANALYSIS OF DATA AND CONCLUSIONS

I. ANALYSIS OF DATA

The purpose of the study was to determine if there was any difference in the increase of physical fitness and growth between the athlete and non-athlete over a period of three years. There are a number of different fields of thought on this subject.

There are those persons who feel that the athlete is far ahead at the start of the seventh grade because he has gone into his post-pubescent period and the non-athlete has not. They assume he is so much further along at this stage of the game that he will not increase as much as the non-athlete who is in his pre-pubescent or pubescent period.

There are those who believe that because the athlete is participating in sports he should naturally increase more than the non-athlete, failing to realize that after a certain level is reached in the physical growth of an individual the increase is very slow. Whereas, the non-athlete having not yet achieved his peak has more room for improvement.

Many questions on the validity of interscholastic athletics have been raised by doctors and administrators, among others, who feel that the athlete is retarded in his

physiological growth in early adolescence by undertaking too vigorous an athletic program. However, other doctors and persons in the field claim that athletics is a good stimulus for growth.

A review of the literature written on this subject reveals that the conclusions of previous researchers in this area are not in complete agreement as to the effects of athletics on individual physical fitness or physiological growth. It was hoped that by testing over a relatively long period of time some answers to this controversy might be revealed.

A test for t was used to determine the significance of the differences in the gains or changes registered by the test groups on each of the eight tests. In finding the values for t, the following formula was used:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{\Sigma x_1^2}{N_1(N_1-1)} + \frac{\Sigma x_2^2}{N_2(N_2-1)}}}$$

The computed t was compared with Fisher's table to determine whether or not the difference between the mean gains made by each group were significant (6:174).

Analysis of the Burpee Data

On the first test in the seventh grade, the athletes had a mean of 12.47 burpees and the non-athletes had a mean of 11.21. In the last test of this grade, the athletes had a mean of 16.62 while the non-athletes had a mean of 15.17. The athletes had a mean gain of 4.15 while the non-athletes had a mean gain of 3.92 burpees.

In the eighth grade, the athletes on the first test had a mean of 16.92 and the non-athletes had a mean of 15.93 burpees. On their last test at this grade level, the athletes had a mean of 17.86, a gain of .94, while the non-athletes had a mean of 16.61, a mean gain of .68 burpees.

The athletes, on the first test in the ninth grade, had a mean of 18.35 while the non-athletes had a mean of 16.44 burpees. At the end of the last test in the ninth grade, the athletes had a mean of 19.43 as compared to the non-athletes' mean of 17.56. The non-athletes in the ninth grade had the larger increase of 1.92 while the athletes had a net gain of 1.08 burpees.

When the gains registered by each of the two groups were compared to determine if either group of subjects had increased more than the other in burpees, little difference could be found. Table I, located on page 24, shows that the athlete gained 6.96 burpees while the non-athletes gained a mean of 6.35 burpees over the entire testing period. There

was no significant difference in the correlated t of the athletes' seventh grade pre-test and ninth grade post-test nor in the correlated t of the non-athletes in the same tests. The t between the athletes and non-athletes total mean for the three year period was not significant.

TABLE I

MEANS AND MEAN GAINS AND t-RATIOS OF DIFFERENCE BETWEEN MEANS OF ATHLETES AND NON-ATHLETES IN THE SEVENTH, EIGHTH AND NINTH GRADES BURPEE TEST

Grade Level	Mean	Mean Gain	t-Ratio	Significance
Pre-Test 7 Ath.	12.47		1.0280	no
Pre-Test 7 Non.	11.21			
Post-Test 7 Ath.	16.62	4.15	3.0193	.01
Post-Test 7 Non.	15.17	3.92		
Pre-Test 8 Ath.	16.92		2.1638	.05
Pre-Test 8 Non.	15.93			
Post-Test 8 Ath.	17.86	.94	3.3164	.01
Post-Test 8 Non.	16.61	.68		
Pre-Test 9 Ath.	18.35		3.5146	.01
Pre-Test 9 Non.	16.44			
Post-Test 9 Ath.	19.43	1.08	4.9826	.01
Post-Test 9 Non.	17.56	1.12		
Correlated t Ath.			.3218	no
Correlated t Non.			1.2871	no
Three year Ath. 7, 8, 9		6.96		
Totals Non. 7, 8, 9		6.35		
t between total Means			.9111	no

Analysis of the Situp Data

In the seventh grade, on the first test, the athletes had a mean of 40.58 situps and the non-athletes had a mean of 31.97. In the last test of the seventh grade, the athletes had a mean of 55.30 while the non-athletes had a mean of 45.44. The athletes had a mean gain of 14.72 while the non-athletes had a mean gain of 13.47 situps.

In the eighth grade, the athletes had a mean of 58.94 situps in the pre-test while the non-athletes had a mean of 49.64. In their last test, the athletes had a mean of 61.13 and the non-athletes had a mean of 52.18. This represented a mean gain of 2.54 for the non-athletes while the athletes had a mean gain of 2.19 situps.

The athletes, on the first test in the ninth grade, had a mean of 62.60 and the non-athletes had a mean of 53.71. On the post-testing in the ninth grade, the athletes had a mean of 70.83, a mean gain of 8.23, while the non-athletes had a mean of 62.73, a net gain for the ninth grade of 9.02 situps.

Table II reveals that the non-athletes gained 30.76 situps compared to an average of 30.25 by the athletes over the three year period. The correlated t of the seventh grade pre-test and ninth grade post-test was significant at the .05 level of confidence for the athletes and at the .01 level for the non-athletes. However, the t between the two groups was not significant.

TABLE II

MEANS AND MEAN GAINS AND t-RATIOS OF DIFFERENCES BETWEEN MEANS OF ATHLETES AND NON-ATHLETES IN THE SEVENTH, EIGHTH AND NINTH GRADES SITUPS TEST

Grade Level	Mean	Mean Gain	t-Ratio	Significance
Pre-Test 7 Ath.	40.58		3.9016	.01
Pre-Test 7 Non.	31.97			
Post-Test 7 Ath.	55.30	14.72	6.1836	.01
Post-Test 7 Non.	45.44	13.47		
Pre-Test 8 Ath.	58.94		6.7015	.01
Pre-Test 8 Non.	49.64			
Post-Test 8 Ath.	61.13	2.19	5.1845	.01
Post-Test 8 Non.	52.18	2.54		
Pre-Test 9 Ath.	62.60		5.8772	.01
Pre-Test 9 Non.	53.71			
Post-Test 9 Ath.	70.83	8.23	5.0089	.01
Post-Test 9 Non.	62.73	9.02		
Correlated t Ath.			2.4474	.05
Correlated t Non.			5.0938	.01
Three year Totals Ath. 7, 8, 9		30.25		
Non. 7, 8, 9		30.76		
t between total Means			.3043	no

Analysis of the Pushup Data

On the pre-test in the seventh grade, the athletes had a mean of 20.28 pushups while the non-athletes had a mean of 14.14. The results of the last test in the seventh grade show the athletes with a mean of 26.75 and the non-athletes with a mean of 16.36. This represented a mean increase of 2.22 for the non-athletes while the athletes had the larger mean increase of 6.47.

In the first test of the eighth grade, the athletes had a mean of 29.64 and the non-athletes had a mean of 18.09. The results of the last test in this grade showed the athletes with a mean of 30.94, a mean increase of 1.30, while the non-athletes had a mean of 21.38, a larger mean gain of 3.29 pushups.

The athletes, in the first test of the ninth grade, had a mean of 31.32 and the non-athletes a mean of 20.61. In the final results of the ninth grade, the athletes had a mean of 36.15 and the non-athletes a mean of 26.31. The larger increase was for the non-athletes with a mean gain of 5.70 while the athletes had a mean gain of 4.83 push-ups.

The gains registered by each of the two groups over the three year period were compared to determine if either group of subjects had increased significantly more than the other. Table III, located on page 29, shows that the

athletes gained 15.87 pushups on the average while the non-athletes gained a mean of 12.17 pushups. The correlated t of the non-athletes' seventh grade pre-test and ninth grade post-test was not significant. However, the athletes in these tests had a correlated t significant at the .01 level of confidence on the Fisher table. The t between the two groups was not significant.

TABLE III

MEANS AND MEAN GAINS AND t-RATIOS OF DIFFERENCES BETWEEN MEANS OF ATHLETES AND NON-ATHLETES IN THE SEVENTH, EIGHTH AND NINTH GRADES PUSHUPS TEST

Grade Level	Mean	Mean Gain	t-Ratio	Significance
Pre-Test 7 Ath.	20.28		3.7187	.01
Pre-Test 7 Non.	14.14			
Post-Test 7 Ath.	26.75	6.47	5.5639	.01
Post-Test 7 Non.	16.36	2.22		
Pre-Test 8 Ath.	29.64		5.0782	.01
Pre-Test 8 Non.	18.09			
Post-Test 8 Ath.	30.94	1.30	5.3689	.01
Post-Test 8 Non.	21.38	3.29		
Pre-Test 9 Ath.	31.32		5.7775	.01
Pre-Test 9 Non.	20.61			
Post-Test 9 Ath.	36.15	4.83	5.5179	.01
Post-Test 9 Non.	26.31	5.70		
Correlated t Ath.			3.1170	.01
Correlated t Non.			1.4051	no
Three year Ath. 7, 8, 9		15.87		
Totals Non. 7, 8, 9		12.17		
t between total Means			1.8275	no

Analysis of the Pullup Data

On the first test in the seventh grade, the athletes had a mean of 2.92 pullups and the non-athletes had a mean of 1.39. On the post-test in this grade, the athletes had a mean of 3.16 while the non-athletes had a mean of 1.55. The athletes had a mean gain of .24, the non-athletes a mean gain of .16 pullups.

In the eighth grade, the athletes, on the first test, had a mean of 3.62 pullups and the non-athletes had a mean of 1.71. On their last test at this grade level, the athletes had a mean of 4.28, a mean gain of .66, while the non-athletes had a mean of 2.13, a mean gain of .42 pullups.

The athletes, on the first test in the ninth grade, had a mean of 4.69 while the non-athletes had a mean of 2.56. At the conclusion of the last test the athletes had a mean of 6.07 and the non-athletes had a mean of 3.65. The athletes had a net gain of 1.38 pullups while the non-athletes had mean gain of 1.09 for the ninth grade.

The gains registered by each of the two groups were compared to determine if either group of subjects had increased more than the other in pullups over the three year period. Table IV, located on page 32, shows that the athletes gained 3.15 pullups while the non-athletes gained 2.26.

For both the athletes and the non-athletes in the seventh grade pre-test and ninth grade post-test, the correlated t was significant at the .01 level of confidence. The t between the two groups was significant at the .05 level of confidence.

TABLE IV

MEANS AND MEAN GAINS AND t-RATIOS OF DIFFERENCE BETWEEN MEANS OF ATHLETES AND NON-ATHLETES IN THE SEVENTH, EIGHTH AND NINTH GRADES PULLUPS TEST

Grade Level	Mean	Mean Gain	t-Ratio	Significance
Pre-Test 7 Ath.	2.92		3.9174	.01
Pre-Test 7 Non.	1.39			
Post-Test 7 Ath.	3.16	.24	3.9934	.01
Post-Test 7 Non.	1.55	.16		
Pre-Test 8 Ath.	3.62		4.6283	.01
Pre-Test 8 Non.	1.71			
Post-Test 8 Ath.	4.28	.66	4.8920	.01
Post-Test 8 Non.	2.13	.42		
Pre-Test 9 Ath.	4.69		4.1378	.01
Pre-Test 9 Non.	2.56			
Post-Test 9 Ath.	6.07	1.38	4.0838	.01
Post-Test 9 Non.	3.65	1.09		
Correlated t Ath.			3.5120	.01
Correlated t Non.			6.5625	.01
Three year Ath.	7, 8, 9	3.15		
Totals Non.	7, 8, 9	2.26		
t between total Means			2.3596	.05

Analysis of the Vertical Jump Data

In the seventh grade pre-test, the athletes had a mean of 13.79 inches and the non-athletes had a mean of 12.63 inches. On the post-test of this grade, the athletes had a mean of 15.98 inches while the non-athletes had a mean jump of 14.05 inches. The athletes had a mean gain of 2.19 inches while the non-athletes had a mean gain of 1.42 inches.

In the eighth grade, the athletes had a mean jump of 16.67 inches in the first test while the non-athletes had a mean of 14.36 inches. On their last test in this grade, the athletes had a mean of 19.16 inches and the non-athletes had a mean of 15.31. This was a mean gain of .95 inches for the non-athletes while the larger increase of 2.49 inches was recorded for the athletes.

The athletes, on the first test in the ninth grade, had a mean of 18.09 inches and the non-athletes had a mean of 15.84 inches. On the post-test the athletes had a mean of 19.56 inches, a mean gain of 1.47 inches, while the non-athletes had a mean of 17.09 inches, a net gain for the ninth grade of 1.25 inches.

The gains made by each of the two groups over the entire testing period were next compared to determine if either group had improved more than the other in the vertical jump. Table V, located on page 35, reveals that the non-

athletes gained an average of 4.46 inches compared to 5.77 inches by the athletes. When compared on the Fisher table, the athletes had a significant difference over the non-athletes on all tests at the .01 percent level of confidence. In the correlated t of the pre-test in the seventh grade and the post-test in the 9th grade, both the non-athletes and athletes had a gain significant at the .01 level of confidence.

TABLE V

MEANS AND MEAN GAINS AND t-RATIOS OF DIFFERENCE BETWEEN MEANS OF ATHLETES AND NON-ATHLETES IN THE SEVENTH, EIGHTH AND NINTH GRADES VERTICAL JUMP TEST

Grade Level	Mean	Mean Gain	t-Ratio	Significance
Pre-Test 7 Ath.	13.79		2.7279	.01
Pre-Test 7 Non.	12.63			
Post-Test 7 Ath.	15.98	2.19	4.1359	.01
Post-Test 7 Non.	14.05	1.42		
Pre-Test 8 Ath.	16.67		4.9954	.01
Pre-Test 8 Non.	14.36			
Post-Test 8 Ath.	19.16	2.49	5.3820	.01
Post-Test 8 Non.	15.31	.95		
Pre-Test 9 Ath.	18.09		4.5887	.01
Pre-Test 9 Non.	15.84			
Post-Test 9 Ath.	19.56	1.47	6.4937	.01
Post-Test 9 Non.	17.09	1.25		
Correlated t Ath.			3.9968	.01
Correlated t Non.			4.4815	.01
Three year Ath. 7, 8, 9		5.77		
Totals Non. 7, 8, 9		4.46		
t between total Means			3.6697	.01

Analysis of the Standing Broad Jump

On the pre-test in the seventh grade, the athletes had an average of 67.03 inches in the standing broad jump and the non-athletes had an average jump of 60.84 inches. In the last test of this grade, the athletes had a mean of 70.96 inches while the non-athletes had a mean of 63.75 inches. The non-athletes had a mean gain of 2.91 inches; the athletes had the larger gain of 3.93 inches.

In the eighth grade, the athletes, on the first test, had a mean jump of 71.52 inches while the non-athletes' mean was 63.57 inches. On their last test at this grade level, the athletes had a mean of 76.45 inches while the non-athletes had a mean of 69.21 inches. The total mean gain of the non-athletes in the eighth grade was 5.64 inches while the athletes had a mean gain of 4.93 inches.

The athletes, on the first test in the ninth grade, had a mean of 77.88 inches while the non-athletes had a mean jump of 69.36 inches. On the last test in the ninth grade, the athletes had a mean of 83.05 inches and the non-athletes had a mean of 73.97 inches. The athletes had a net gain of 5.17 inches for the ninth grade; the non-athletes had a smaller increase of 4.61 inches.

When the gains registered by each of the two groups were compared to determine if either group of subjects had increased more than the other in the standing broad jump,

a considerable difference was found. Table VI, located on page 38, shows that the athletes gained a mean of 16.02 inches for the three year testing period while the non-athletes gained 13.13 inches. The correlated t of the seventh grade pre-test and ninth grade post-test was significant at the .01 level of confidence for both the athletes and non-athletes. However, the t between the two groups was not significant.

TABLE VI

MEANS AND MEAN GAINS AND t-RATIOS OF DIFFERENCE BETWEEN MEANS OF ATHLETES AND NON-ATHLETES IN THE SEVENTH, EIGHTH AND NINTH GRADES BROAD JUMP TEST

Grade Level	Mean	Mean Gain	t-Ratio	Significance
Pre-Test 7 Ath.	67.03		4.6204	.01
Pre-Test 7 Non.	60.84			
Post-Test 7 Ath.	70.96	3.93	5.5895	.01
Post-Test 7 Non.	63.75	2.91		
Pre-Test 8 Ath.	71.52		5.7027	.01
Pre-Test 8 Non.	63.57			
Post-Test 8 Ath.	76.45	4.93	4.9372	.01
Post-Test 8 Non.	69.36	5.64		
Pre-Test 9 Ath.	77.88		5.7893	.01
Pre-Test 9 Non.	69.36			
Post-Test 9 Ath.	83.05	5.17	5.2048	.01
Post-Test 9 Non.	73.97	4.61		
Correlated t Ath.			5.5198	.01
Correlated t Non.			7.7029	.01
Three year Ath. 7, 8, 9		16.02		
Totals Non. 7, 8, 9		13.13		
t between total Means			1.4800	no

Analysis of the Height Data

At the end of the first measurement in the seventh grade, the athletes had a mean height of 61.22 inches while the non-athletes had a mean height of 60.57 inches. On the post-test, the athletes had a mean height of 63.67 inches, which was a mean gain of 2.45 inches. The non-athletes had a mean height of 62.63 inches, which was a mean gain of 2.06 inches.

In the eighth grade pre-test, the athletes had a mean height of 64.79 while that of the non-athletes was 63.73 inches. On the last test at the eighth grade level, the athletes had a mean height of 66.41 inches, which gave them the larger increase of net gain of 1.62 inches. The non-athletes had an average height of 65.13 inches giving them a mean gain of 1.40 inches.

On the first test in the ninth grade, the athletes had a mean height of 67.41 inches while the non-athletes had a mean height of 66.28 inches. In the post-test, the athletes had an average height of 68.66 inches, giving them a mean gain of 1.25 inches, while the non-athletes' average height was 67.92 inches, an increase of 1.64 inches.

The athletes' total mean gain was 7.44 inches compared to the non-athletes' of 7.35 inches as shown on Table VII. The correlated t of the seventh grade pre-test and ninth grade post-test was significant at the .01 level for both groups. The t between the two groups was not significant.

TABLE VII

MEANS AND MEAN GAINS AND t-RATIOS OF DIFFERENCE BETWEEN MEAN OF ATHLETES AND NON-ATHLETES IN THE SEVENTH, EIGHTH AND NINTH GRADES HEIGHT TEST

Grade Level	Mean	Mean Gain	t-Ratio	Significance
Pre-Test 7 Ath.	61.22		1.0084	no
Pre-Test 7 Non.	60.57			
Post-Test 7 Ath.	63.67	2.45	1.5791	no
Post-Test 7 Non.	62.63	2.06		
Pre-Test 8 Ath.	64.79		1.0093	no
Pre-Test 8 Non.	63.73			
Post-Test 8 Ath.	66.41	1.62	1.9348	no
Post-Test 8 Non.	65.13	1.40		
Pre-Test 9 Ath.	67.41		1.8143	no
Pre-Test 9 Non.	66.28			
Post-Test 9 Ath.	68.66	1.25	1.2976	no
Post-Test 9 Non.	67.92	1.64		
Correlated t Ath.			17.4789	.01
Correlated t Non.			13.7910	.01
Three year Ath. 7, 8, 9		7.44		
Totals Non. 7, 8, 9		7.35		
t between total Means			.3384	no

Analysis of the Weight Data

At the time of the first test in the seventh grade, the athletes had a mean weight of 101.30 pounds while the non-athletes had a mean weight of 97.32 pounds. On the last test the athletes had a mean weight of 112.30 pounds, a mean increase of 11.00 pounds; the non-athletes had a mean weight of 105.84 pounds, a smaller mean increase of 8.52 pounds.

In the eighth grade, the athletes, on the first test, had a mean weight of 117.54 pounds and the non-athletes had a mean weight of 109.78 pounds. On their last test at this grade level, the athletes had a mean of 125.20 pounds while the non-athletes had a mean of 118.64 pounds. This represented a mean gain of 7.66 pounds for the athletes, 8.86 pounds for the non-athletes.

The athletes, on the first test in the ninth grade, averaged 131.83 pounds while the non-athletes averaged 123.65 pounds. At the end of the last test the athletes averaged 140.66 pounds and the non-athletes averaged 131.80 pounds. The athletes had a mean increase of 8.83 pounds for the ninth grade; the non-athletes had a mean increase of 8.15 pounds.

When the gains of these two groups for the three year period were compared the athletes had a mean gain of 39.36 pounds while the non-athletes mean gain was 34.48

pounds as shown on Table VIII, located on page 43. The correlated t of the seventh grade pre-test and the ninth grade post-test was significant at the .01 level for both the athletes and the non-athletes. The t between the two groups was significant at the .01 level of confidence.

TABLE VIII

MEANS AND MEAN GAINS AND t-RATIOS OF DIFFERENCE BETWEEN MEAN OF ATHLETES AND NON-ATHLETES IN THE SEVENTH, EIGHTH AND NINTH GRADES WEIGHT TEST

Grade Level	Mean	Mean Gain	t-Ratio	Significance
Pre-Test 7 Ath.	101.30		1.0970	no
Pre-Test 7 Non.	97.32			
Post-Test 7 Ath.	112.30	11.00	1.5291	no
Post-Test 7 Non.	105.84	8.52		
Pre-Test 8 Ath.	117.54		1.9893	.05
Pre-Test 8 Non.	109.78			
Post-Test 8 Ath.	125.20	7.66	1.6746	no
Post-Test 8 Non.	118.64	8.86		
Pre-Test 9 Ath.	131.83		2.0780	.05
Pre-Test 9 Non.	123.65			
Post-Test 9 Ath.	140.66	8.83	3.4325	.01
Post-Test 9 Non.	131.80	8.15		
Correlated t Ath.			15.6331	.01
Correlated t Non.			18.2460	.01
Three year Ath. 7, 8, 9		39.36		
Totals Non. 7, 8, 9		34.48		
t between total Means			3.0158	.01

Analysis of the Burpee Data for Athletes

In the seventh grade pre-test, the mean of the two-sport athletes was 13.31, that of the three-sport athletes was 12.60 and of the one-sport athletes, 11.68 burpees. On the final test in the seventh grade, the mean of the three-sport athletes was 17.00, the one-sport athletes was 16.09 and the two-sport athletes was 15.81. The largest mean increase of 4.41 was by the one-sport athletes, the three-sport athletes had a mean gain of 4.40 and the two-sport group had a mean increase of 2.50 burpees.

On the pre-test in the eighth grade, the highest mean of the athletes was by the three-sport group with 17.00 burpees, the one-sport athletes had a mean of 16.54 and the two-sport athletes had a mean of 16.43. On the post-test, the three-sport athletes had a mean of 18.80 with the two-sport athletes having a mean of 17.81 and the one-sport having a mean of 17.27. The three-sport athletes had the largest mean gain of 2.80 while the two-sport athletes mean gain was 1.38 and the one-sport athletes had an increase of .73 burpees.

In the first test in the ninth grade, the two-sport athletes had a mean of 18.43, the three-sport group had a mean of 18.00 and the one-sport group had a 17.09 mean. In the final test the three-sport athletes had a mean of 19.46 while the two-sport athletes averaged 19.31 and the one-sport group had an average of 19.04 burpees. The increase was

largest in the one-sport group with a 1.95 mean gain, the three-sport group had 1.46 and the two-sport athletes had a .88 mean gain.

For the test period the three-sport athletes had the highest mean gain of 8.66 burpees, the one-sport athletes had a mean gain of 7.36 and the two-sport athletes had a mean gain of 6.00 burpees over three years.

When comparing the t scores there was no significance between any groups.

Analysis of the Situp Data for Athletes

The highest mean in the pre-test in the seventh grade was the two-sport athletes' of 45.62 situps, the three-sport athletes' mean was 40.13 and the one-sport athletes' mean 37.22. On the final test in this grade, the two-sport athletes' mean was 56.62, the three-sport athletes' mean was 55.13 and the one-sport athletes' was 54.45. The largest increase was made by the one-sport athletic group with a mean gain of 17.23 situps, the three-sport group had a mean gain of 15.00, the two-sport athletes an 11.00 mean gain.

On the first test in the eighth grade, the mean of the two-sport athletes was 61.43, that of the one-sport athletes was 58.40 and the three-sport athletes had a mean of 57.06. In the final test of this grade, the three-sport athletes had a mean of 61.86, while the two-sport athletes

had a mean of 61.18 and the one-sport athletes a mean of 60.59. The largest increase in the eighth grade was made by the three-sport athletes with a mean gain of 4.80; the one-sport athletes had a mean gain of 2.19. The two-sport athletes had a mean loss of .25 situps.

On the first test in the ninth grade, the two-sport athletes had a mean of 64.37 with the one-sport athletes having a mean of 63.09 and the three-sport group having a mean of 60.00. On the post-test in the ninth grade, the two-sport athletes had a mean of 72.56, the one-sport athletes a mean of 70.90 with the three-sport athletes having a mean of 68.86. The largest increase in the ninth grade was by the three-sport athletes with a mean gain of 8.86 with the two-sport athletes having a mean gain of 8.19 and the one-sport athletes having a mean gain of 7.81 situps.

The largest mean gain for the three year period was that of the one-sport athletes of 33.68, next was the three-sport athletic group with a mean gain of 28.73, with the two-sport group having a mean gain of 26.95.

Though the two-sport athletes had the smallest amount of gain for the three year period they still ended with the largest mean average in situps for the three year period.

There was no significant difference between any of the athletic groups when the t scores were compared on Fisher's table.

Analysis of the Pushup Data for the Athletes

On the first test in the seventh grade, the three-sport athletes had the highest mean of 22.26, the two-sport athletes had a mean of 21.06, and the one-sport athletes had a mean of 18.18 pushups. On the last test in the seventh grade the two-sport athletes had a mean of 27.12, the three-sport athletes had a mean of 26.13, and the one-sport athletes had a mean of 25.31. The mean gain of the one-sport athletes was 7.13, that of the two-sport athletes 6.06, and that of the three-sport athletes was 3.87 pushups.

In the eighth grade on the first test, the two-sport athletes had a mean of 28.31 followed by the one-sport group with 28.00 and the three-sport athletes with 26.40. On the last test in this grade, the three-sport athletes had a mean of 33.60, the one-sport athletes 30.09, the two-sport athletes 29.62. The highest mean gain for the eighth grade was by the three-sport athletes at 7.20 followed by the one-sport athletes at 2.09 and the two-sport athletes at 1.31 pushups.

The results of the pre-test in the ninth grade show the two-sport athletes with a mean of 31.75, the one-sport athletes with a 31.22 mean and the three-sport group with a 31.00 mean. In the post-test the highest mean went to the three-sport athletes with a 38.00 average followed by the two-sport athletes with 36.12 and the one-sport athletes

with an average of 43.90. The highest mean gain for the ninth grade was by the three-sport athletes with 7.00, followed by the two-sport athletes with 4.37 and the one-sport athletes with 3.68 pushups.

The highest increase over the three year period was by the one-sport athletes with a mean gain of 16.72. The three-sport athletes had the next largest gain of 15.74 and the two-sport athletes had the smallest mean gain of 15.06 pushups over the period.

Though the one-sport group had the highest mean gain they were still well behind the two and three sport athletes' average.

There was no significant difference between the groups on any of the testing.

Analysis of the Pullup Data for the Athletes

The pre-test results in the seventh grade show the two-sport athletes with a mean of 3.93 pullups, the three-sport athletes with 2.73, and the one-sport athletes with 2.32. On the post test in this grade, the two-sport athletes still had the highest mean of 4.00, the three-sport a mean of 3.80, and the one-sport athletes a mean of 2.36. The highest mean gain for the seventh grade was by the three-sport athletes with a mean gain of 1.07, the two-sport athletes were next with a mean gain of .07, and the one-sport had a mean gain of .04 pullups.

In the first test of the eight grade, the two-sport athletes again had the highest mean of 4.50, the three-sport athletes a mean of 3.93, and the one-sport athletes had a mean of 2.77 pullups. On the final test in the eighth grade, the three-sport athletes had an average of 4.86 pullups, the two-sport athletes an average of 4.75, and the one-sport athletes a 3.79 average. The highest increase for this grade was by the three-sport athletes with a mean gain of .93 while the one-sport athletes had a mean gain of .82 and the two-sport group had a mean gain of .25 pullups.

The three-sport athletes had the highest mean of 5.53 pullups on the first test in the ninth grade, while the two-sport athletes had a mean of 4.75 and the one-sport athletes had a mean of 4.09. Results of the last test show the three-sport athletes with a mean of 6.93, the two-sport athletes with a mean of 6.50, and the one-sport athletic group with a mean of 5.18. In the mean gain the two-sport athletes increased the most with 1.75, the three-sport athletes gained 1.40, and the one-sport athletes gained an average of 1.09 pullups.

In comparing the results of the three groups over the entire testing period, the three-sport athletes had the highest mean gain of 4.20 with the one-sport athletes having a mean gain of 2.86 and the two-sport athletes having a mean gain of 2.57 pullups.

There was no significant difference between any of the groups on any of the tests.

Analysis of the Vertical Jump for the Athletes

In the pre-testing of the seventh grade, the three-sport athletes had the highest mean vertical jump of 14.60 inches, while the two-sport athletes had a 14.06 inch average jump and the one-sport athletes had an average of 12.90 inches. On the post-test in the seventh grade, the three-sport athletes had a mean of 16.43 and the one-sport athletes had a mean of 14.45 inches. The highest mean gain for the seventh grade was in the three-sport athletic group with a mean of 3.13, followed by the two-sport group with 2.37 and the one-sport athletes with a mean gain of 1.55 inches.

In the eighth grade pre-testing, the three-sport athletes had the highest average jump of 18.00 inches, the two-sport athletes had a 17.06 inch average, and the one-sport athletes a 15.50 average. In the post-test of the eighth grade, the three-sport athletes again had the highest mean of 20.20 inches, the two-sport athletes had a mean of 17.62 and the one-sport athletes had a 17.09 mean. The highest mean gain for this grade was by the three-sport athletes with 2.20 inches, followed by the one-sport athletes with 1.59 and the two-sport athletes with a .56 mean gain.

On the pre-test in the ninth grade, the three-sport

athletes had a mean vertical jump of 20.06 inches, the two-sport athletes had a mean of 18.12 inches and the one-sport athletes had a 16.72 inch mean. In the post-test of the ninth grade, the three-sport athletes had a 21.33 inch vertical jump, the two sport athletes had a 19.56 inch mean and the one-sport group had a 18.59 inch mean jump. The highest increase in the ninth grade was by the one-sport athletes who had a 1.78 inch mean gain followed by the two-sport athletes with 1.44 inches and the three-sport athletes with a mean gain of 1.27 inches.

For the three year total, the three-sport athletes had the highest mean gain of 6.73 inches while the one-sport athletes had a mean of 5.69 inches and the two-sport athletes had a 5.50 inch mean gain.

The three-sport athletes' t-ratio over the one-sport athletes was significant at the .05 percent level of confidence on the first test in the seventh grade and they increased this to the .01 percent level of confidence in all other tests. The three-sport athletes t-ratio over the two-sport athletes was not significant for the first three tests, but on the post-test in the eighth grade and a significance at the .05 percent level during the entire ninth grade.

The only significant difference in the t-scores between the two-sport and one-sport athletes is in the post-test in the seventh grade and the pre-test in the eighth grade where

the two-sport athletes had a .05 level of confidence.

Analysis of the Standing Broad Jump Data for Athletes

The results of the seventh grade pre-test in the standing broad jump show the two-sport athletes with a mean of 69.68 inches, the three-sport athletes with a mean of 69.06 inches while the one-sport athletes had a mean of 63.72 inches. On the seventh grade post-test, three-sport athletes had a mean of 75.20 inches, with the two-sport athletes having a mean of 73.18 inches and the one-sport athletes having a mean of 66.63 inches. The three-sport athletes had the highest mean gain of 6.14 inches, the two-sport athletes an increase of 3.50 inches while the one-sport group had a 2.91 inch mean gain.

In the eighth grade pre-test, the three-sport athletes had a mean of 75.13 inches with the two-sport athletes having a mean of 75.12 inches and the one-sport athletes a mean of 66.74 inches. The results of the last test in this grade show the three-sport athletes with a mean jump of 81.80 inches, while the two-sport athletes had a mean of 77.81 inches and the one-sport athletes had a mean of 72.27 inches. The highest increase for this grade was by the three-sport athletes with a mean gain of 6.67 inches while the one-sport athletes had a mean increase of 5.55 inches and the two-sport athletes had a mean gain of 2.69 inches.

In the ninth grade pre-test, the three-sport athletes had an average jump of 82.06 inches with the two-sport athletes having an average of 78.68 inches, and the one-sport athletes averaging 74.45 inches. On the last test the two-sport athletes had a mean of 84.87 inches while the three-sport athletic group had a mean of 83.26 inches and the one-sport athletes had a mean of 78.09 inches. The largest increase was made by the two-sport athletes with a mean gain of 5.69 inches, followed by the one-sport group with a mean increase of 3.64 inches, and the three-sport athletes having a mean gain of 1.20 inches.

For the entire testing period of three years, the two-sport athletes had the largest mean gain of 14.69 inches followed by the one-sport athletes with a mean gain of 14.37 inches and the three-sport group of athletes with a mean gain of 14.20 inches.

Both the two and three-sport athletes showed a significant difference over the one-sport athletes at the .01 percent level of confidence while the two and three-sport groups showed no significant difference between them.

Analysis of the Height Data for Athletes

The pre-testing results in the seventh grade find the three-sport athletes with a mean height of 63.73 inches while the two-sport athletes had a mean of 61.43 inches and the one-sport athletes had a mean of 59.36 inches. On the last test

at this grade level, the three-sport athletes had a mean height of 66.53 inches, the two-sport group's mean height was 63.87 inches and the one-sport group's was 61.63 inches. The highest increase in this year was by the three-sport athletic group with a mean gain of 2.80 inches, while the two-sport athletes made a gain of 2.44 inches and the one-sport athletes gained 2.27 inches in height.

In the eighth grade, on the first test, the three-sport athletes had a mean height of 67.53 inches, the two-sport group a mean of 65.00 inches and the one-sport athletes averaged 62.77 inches. In the post-testing at this grade, the three-sport athletes had a mean height of 69.00 inches, the two-sport athletes averaged 66.62 inches and the one-sport group had an average of 64.54 inches. The largest increase was by the one-sport athletes with a mean gain of 1.77 inches, while the two-sport athletes gained 1.12 inches and the two-sport athletes gained 1.48 inches.

In the first test of the ninth grade, the three-sport athletes again had the highest mean height of 69.66 inches, the two-sport athletes had a mean of 67.62 inches and the one-sport athletes a mean of 65.72 inches. In the post-testing, the three-sport athletes had a mean height of 70.60 inches, the two-sport athletes had a 69.00 mean and the one-sport athletes an average height of 67.22 inches. The high mean gain of 1.50 was by the group of one-sport

athletes while the two-sport group had a mean gain of 1.38 inches and the three-sport athletes gained .94 inches.

The highest group gain for the three year period was by the one-sport athletic group with a mean gain of 7.86 inches while the two-sport group had a mean gain of 7.57 inches and the three-sport had a gain of 6.87 inches.

When comparing the three-sport athletes to the one-sport athletes, there was a significant difference in all tests at the .01 percent level of confidence on the Fisher table. When comparing the three-sport to the two-sport groups and the one-sport to the two-sport groups there was no significant difference in any of the tests.

Analysis of the Weight Data for Athletes

The three-sport athletes, in the pre-testing in the seventh grade, came out far ahead on the mean weight with a mean of 116.44 pounds while the two-sport group had a mean weight of 98.00 pounds and the one-sport group had a mean weight of 92.95 pounds. The results of the seventh grade post-testing show the three-sport athletes still out in front in the weight department with a mean of 128.46 pounds, the two-sport athletes at 110.81 pounds and the one-sport athletes weighing an average of 102.36 pounds. The highest increase for this period was by the two-sport athletes with a mean gain of 12.31 pounds, and the three-sport athletes gained an average of 12.00 pounds while the one-sport athletic

group gained 9.41 mean pounds.

In the eighth grade pre-test, the three-sport athletes had a mean of 134.66 pounds, the two-sport athletes weighed an average of 116.31 pounds and the one-sport athletes averaged 106.95 pounds. The three-sport athletes had a mean weight of 142.06 pounds on the last test in the eighth grade, the two-sport athletes had 124.12 pounds while the one-sport athletes weighed an average of 114.50 pounds. The highest mean gain was that of the two-sport athletes who averaged a gain of 7.81 pounds while the one-sport athletes gained an average of 7.55 pounds and the three-sport athletes gained 7.45 mean pounds.

The ninth grade pre-testing shows the three-sport athletes weighing an average of 148.80 pounds, the two-sport athletes weighing 130.81 on the average and the one-sport athletic group averaging 121.00 pounds. On their final test the three-sport athletes weighed an average of 155.26 pounds, the two-sport group weighed an average of 140.93 pounds and the one-sport group averaged 130.50 pounds. The highest gain for the ninth grade was by the one-sport athletes who had a mean gain of 9.50 pounds while the two and three-sport athletes each gained 6.46 mean pounds.

Over the three year period the highest total mean gain was by the two-sport athletic group averaging a total of 42.43 pounds gained followed by the three-sport group

with a mean gain of 38.86 pounds and the one-sport athletes who gained an average of 37.55 pounds.

Even though the two-sport athletes gained more pounds than the three-sport athletes, they fall far behind in the mean weights.

When comparing the t-scores of the three-sport group over the one-sport group, there was a significant difference at the .01 percent level of confidence on all tests. When the three-sport athletes were compared to the two-sport athletes there was a significant difference on all tests at the .05 percent level except on the ninth grade post-test where there was no significance. There was no significance between the one and two-sport athletes.

Table IX indicates the post-test means of the one, two, and three sport athletes in the seventh, eighth, and ninth grades.

TABLE IX

POST TEST MEANS OF ONE, TWO, AND THREE-SPORT ATHLETES IN THE SEVENTH, EIGHTH AND NINTH GRADES

Grade Level	Burpee	Situps	Pushups	Pullups
SEVENTH				
one-sport	16.09	54.45	25.31	2.36
two-sport	15.81	56.62	27.12	4.00
three-sport	17.00	55.13	26.13	3.80
EIGHTH				
one-sport	17.27	60.59	30.09	3.59
two-sport	17.81	61.18	29.62	4.75
three-sport	18.80	61.86	33.60	4.86
NINTH				
one-sport	19.04	70.90	34.90	5.18
two-sport	19.31	72.56	36.12	6.50
three-sport	19.46	68.86	38.00	6.93

TABLE IX (continued)

Grade Level	Vertical Jump	Broad Jump	Height	Weight
SEVENTH				
one-sport	14.45	66.63	61.63	102.36
two-sport	16.43	73.18	63.87	110.81
three-sport	14.45	75.20	66.53	128.46
EIGHTH				
one-sport	17.09	72.27	64.54	114.50
two-sport	17.62	77.81	66.62	124.12
three-sport	20.20	81.80	69.00	142.06
NINTH				
one-sport	18.59	78.09	67.22	130.50
two-sport	19.56	84.37	69.00	140.93
three-sport	21.33	83.26	70.60	155.26

II. SUMMARY AND CONCLUSIONS

Summary

From the study as written in the preceding chapters, the following observations were made:

1. The boys who participated in athletics were heavier, taller, and able to perform better than the non-athlete at the beginning of the seventh grade.
2. The boys who participated in athletics were still heavier, taller, and able to perform better than the non-athlete at the end of the ninth grade.
3. The athlete had a mean gain larger than the non-athlete in all categories except situps. In situps, the non-athlete had a slightly larger (.51) mean gain than the athlete.
4. When correlated t's were computed, significance at the .01 level of confidence was achieved by the athlete in height, weight, pullups, broad jump, vertical jump, and pushups. In situps a significance at the .05 level was achieved. In the burpees, no significant change was made.

5. When correlated t's of the non-athlete were computed, those items reaching the .01 level of confidence were height, weight, pullups, broad jump, vertical jump, and situps. In pushups and burpees, no significant change was made.

6. In computing the t's of the total mean gains, the .01 level of confidence was obtained favoring the athlete in weight and vertical jump. In pullups, the athletes had a significant difference at the .05 level of confidence. In the broad jump, pushups, height, situps and burpees, there was no significant differences.

7. When comparing the ninth grade post-test means of the one, two, and three sport athletes, the three sport group had the highest mean in the burpee, pushup, pullup, broad jump, height, and weight categories. They ranked third in the situps and second in the vertical jump. Two-sport athletes ranked higher in all test items than one-sport men, ranking ahead of the three-sport group in situps and vertical jump. Even though the one-sport athletes had higher gains on most of the tests than the three and

two-sport athletes, when comparing mean scores the one-sport group still fell below the others.

8. The one-sport athletes had the largest mean gain in burpees, situps, pushups, and height, while the three-sport athletes had the largest mean gain in pullups and vertical jump. The two-sport athletes had the highest mean gain in the broad jump and weight.

Conclusions

From the above it can be concluded that athletics are not detrimental to a junior high school boy's growth in height and weight or in the items included in the test battery.

All boys in junior high school increase in height and weight whether they are participating in athletics or not.

Boys who do participate in athletics generally scored higher on the test battery to begin with and continued to score higher. In addition they showed the most increase. This increase was significant, however, only in weight, vertical jump and pullups.

The athletes showed a significant gain in all categories except the burpees, while the non-athletes showed a significant gain in all categories except burpees and pushups.

The question has been raised many times on whether the junior high student should be allowed to take part in more than one interscholastic activity. The results of this study would seem to indicate that participation in more than one sport helps the individual to obtain a higher degree of physical fitness.

In summation, it would seem the results of the study do not support the beliefs of those who feel that participation in a vigorous athletic program is harmful to the adolescent. Instead, the data suggests that this participation helps influence physical fitness and possibly even stimulates physical growth.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Brickman, William W. "American Association of School Administrators," School and Society, 88:171, April, 1960.

2. Clark, H. H., James C. Harrison. "Differences in Physical and Motor Traits Between Boys of Advanced, Normal, and Retarded Maturity," Research Quarterly, 33:13-25, March, 1962.

3. Cousins, G. F. "A Factor Analysis of Selected Wartime Fitness Test," Research Quarterly, 26:277-88, October, 1955.

4. Crampton, C. W. "Physiological Age--A Fundamental Principle," American Physical Education Review, 1908.

5. DeLotto, Marcel J. "The Effects of Competitive Athletics on the Growth and Development of Pre-Pubescent Boys," Doctor's Dissertation, Eugene, University of Oregon, 1954.

6. Fisher, R. A. Statistical Methods for Research Worker. 13th Ed. Edinburgh: Oliver and Boyd, 1958.

7. Glines, Don, Glenn Kirchner. "Comparative Analysis of Eugene, Oregon, Elementary School Children Using the Kraus-Weber Test of Minimum Muscular Fitness," Research Quarterly, 28:16-25, March, 1957.

8. Hale, Creighton J. "Athletics for Pre-High School Age Children," Journal of Health, Physical Education and Recreation, 30:19-21, 1959.

9. Fait, Hollis, F. "Editorial," Journal of Health, Physical Education and Recreation, 32:20-2, February, 1961.

10. Hunsicker, P. H. "AAHPER'S Youth Fitness Project," Journal of Health, Physical Education and Recreation.

11. Hunsicker, P. H. "Myth About Fitness," Journal of Health, Physical Education and Recreation. 31:18-20, November, 1960.

12. Ikede, N. "Comparison of Physical Fitness of Children in Iowa, U.S.A., and Tokyo, Japan," Research Quarterly, 33:541-52, December, 1962.

13. Kelleher, M. S. "Report on the Kraus-Weber Test in East Pakistan," Research Quarterly, 31:34-42, March, 1960.

14. Larson, Leonard A. "Health and Fitness in the Modern World," Journal of Health, Physical Education and Recreation, 31:59-60, December, 1960.

15. McGraw, L. W. "Comparison of Physical Growth and Development of Athletes and Non-Athletes at the Junior High School Level," Report to Research Section AAHPER Convention, Chicago, Ill., April, 1956.

16. Morris, M. H. "Does Sports Equal Fitness?" Education Digest, 23:34-6, September, 1957.

17. Noguchi. "Fitness Testing of Japanese Children," Journal of Health, Physical Education and Recreation, 27:20-1, October, 1956.

18. Noguchi, Yoshiyuki, Yoshida. "Comparative Study of Motor Fitness Between Japanese and American Youth," Journal of Health, Physical Education and Recreation, 27:40-51, October, 1956.

19. "President's Conference on Fitness of American Youth," Journal of Health, Physical Education and Recreation, 27:9, August, 1956.

20. "President's Council on Youth Fitness," Journal of Health, Physical Education and Recreation, 32:8-11, October, 1961.

21. Rowe, Floyd A. "Growth Comparison of Athletes and Non-Athletes," Research Quarterly, 4:108-16, October, 1933.

22. Shuch, G. H. "Effects of Athletic Competition on the Growth and Development of Junior High School Boys," Research Quarterly, 33:288-98, May, 1962.

23. "Sports Yield Youth Fitness," Journal of Health, Physical Education and Recreation, 31:66, January, 1960.

24. Weiss, R. A. "Do Sports Produce Fitness?" Journal of Health, Physical Education and Recreation, 32:20-1, March, 1961.

25. "The Westpoint Fitness Conference," Journal of Health, Physical Education and Recreation, 27:40-3, November, 1957.

26. Wolf, J. B. "Keeping up With Fitness," Journal of Health, Physical Education and Recreation, 31:67, January, 1960.

APPENDIX

APPENDIX

QUICK CARD PHYSICAL FITNESS SCORING TEST

DIRECTIONS FOR THE INDIVIDUAL TESTS

1. BROAD JUMP: Measure the jump from the take-off mark to the mark made by the heels nearest to the take-off line. The take-off mark must be placed so that the person being tested jumps from a gym floor. A line should be drawn on the floor at the take-off mark. The various required distances for successful completion of the test may be painted or marked with chalk on the floor and thus facilitate the measurement of jumps. In jumping, the pupil stands with toes even with the edge of the take-off mark and then jumps forward (use a two-foot take-off) as far as possible. The pupil should swing arms and hands to help in jumping. The better of two jumps is recorded.
2. PULLUPS: The pupil hangs on a horizontal bar, arms and legs fully extended. Be sure that at the beginning of the pullup or chinup the arms are straight. This is the starting position. The pupil should pull the body up so that the chin is above the bar. This counts as one pullup. No swinging or kicking in order to help lift the body is permissible. Then he should lower the body to the starting position. Hands should be placed so

that knuckles are over the bar, thumbs under the bar, and the palms of the hands facing away from the body. This is known as the overhand grasp. The exercise should be repeated as many times as the pupil can pull up so that the chin is over the bar. Knees must be kept straight during the exercise. In counting the pullups, the tester may indicate successful completion of the pullup when the pupil lowers the body to the starting position and arms become straight. Thus, there is no question about starting from the correct position for the next pullup.

3. PUSHUPS: Pushups are to be done on the floor. They are completed from a front-leaning rest position in which the body is supported on the hands and feet with the arms and body straight. From a squat position, the pupil places hands on floor and extends legs backwards so that the feet are close together, the back straight, the legs straight, and the arms straight with weight on hands and toes only. This position is the starting position. The first part of the exercise calls for a bending (flexing) of the arms, allowing the body to come down so that the chest barely touches the floor. The second phase of the exercise calls for the arms to be extended so that the body may be brought to the starting position. This complete procedure counts as one

pushup. The body cannot rest on the floor at the conclusion of the first part of the exercise. The chest must barely touch the floor and the trunk and legs are to remain in a straight line. The pushups are to be done without rest between parts of the exercise or during the complete exercise. If any part of the body, except hands, toes, or chest, touches the floor, the trial is not counted. The number of successful completions of the complete exercise indicates the number of pushups. Do not count a pushup as complete until the arms are fully extended. Also require that the body be lowered to the floor and the back kept straight throughout the test.

4. SITUPS: The situp exercise is done from a lying position, back on the floor, fingers of both hands interlaced behind the neck, and feet held together and down by another member of the class who serves as tester. (Hold ankles with just enough pressure to keep the feet on the floor, but allow calf and thigh of leg or knees to rise slightly if they are inclined to do so.) The first part of the test calls for the trunk to be raised forward and moved downward, rotating so that the right elbow touches the left knee. The second part of the test calls for a return of the body to the starting position. On the next situp the left elbow touches the right knee. Thus,

alternate elbows touch alternate knees each time the trunk is raised. The complete exercise is to touch the right knee with the left elbow or vica versa. Each time the pupil sits up and touches a knee, it counts as one situp. The tester who holds the pupil's feet counts aloud as the exercise progresses. No rest period is allowed between parts of the exercise or between two complete exercises. The score will be the number of situps completed in two minutes.

5. VERTICAL JUMP: (jump and reach) The pupil takes a position facing the wall, feet together, toes touching the wall, and heels touching the floor. With one hand he reaches as high as possible keeping the heels on the floor and the hand and forearm against the wall, and makes his mark on the wall or vertical jump board with a short piece of chalk or with his fingers which have been dipped in chalk dust. A blackboard may be used to mark upon by moistening the fingers with water. After marking the wall, the pupil then turns so that the arm used to mark the wall is next to the wall. He then swings both arms vigorously and makes a jump vertically into the air, reaching up and touching the wall with a second mark. The distance between the two marks is the individual's record. Record the distance to the nearest inch. The better of two trials is recorded. No

preliminary springs or jumps off the floor are allowed.

6. BURPEE TEST: (30 seconds) The burpee test consists of four distinct counts. On the first count, the pupil bends to the squatting position placing his hands on the floor with the arms between the legs. On the count of two, the pupil extends his legs straight backward, feet together, and assumes the same position as though he was ready to start dipping for the pushup exercise. The feet cannot be extended backward until the position for count one has been definitely taken. On the count of three, he resumes the same position as he was in at the count of one and on the count of four, he resumes the starting position, coming to a definite upright position with knees straight. Each position must be taken definitely and deliberately. The test is to determine the number of times a pupil can go through the complete cycle in thirty seconds. Failure to execute any of the positions properly results in loss of count for the complete cycle in which the failure occurred. Count each cycle, completed according to directions, as one successful completion.
7. HEIGHT: The pupil is measured on a regular balanced scale in gym shoes and gym clothes.
8. WEIGHT: The pupil is weighed on a regular balanced scale in tennis shoes and gym clothes.