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AN EVALUATIVE STUDY ON THE EFFECTS OF THE 1972 FOOTBALL OFF-SEASON WEIGHT TRAINING PROGRAM ON THE STRENGTH DEVELOPMENT OF THE PARTICIPANTS

by

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B. A., Kansas State University, 1969

A MASTER'S REPORT

9984

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Physical Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1972

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Major Professor

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1972
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INTRODUCTION

With the ever increasing emphasis being placed on college athletics it is important to determine the best types of programs to be used for improving and conditioning the athletes. It is felt that strength development in the athlete plays a very important role in the overall physical and mental improvement of the athlete. In a program such as weight training, where the primary goal is development of the muscular system, it is common knowledge of the physiological changes that are constantly taking place.[1] Therefore, Kansas State University has made an attempt to improve the type of weight program used during the off-season. This study attempts to examine the effectiveness of the weight training program by administering a series of tests and measurements at the beginning of the off-season, the end of the off-season, and at the end of spring practice. The records in the Appendix show the results of the weight training and how the subjects regress without the training.

Statement of Problem

This study attempted to determine whether the new weight program involved with Kansas State's off-season showed improvement of strength in the athletes over a nine-week period. The physical aspects included in the study were back strength, leg strength, and grip strength.

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[1]John Patrick O'Shea, Scientific Principles and Methods of Strength Fitness (Reading, Massachusetts: Addison-Wesley Publishing Co., 1969), p. 1.

Purpose of Study

The basic intentions of the study was to isolate the investigation to the improvement of strength in the individual athletes. It was not the intent of this study to determine whether the improvement of strength made the athlete a better football player. However, it was interesting to note that throughout spring practice those who had made the most improvement in strength also improved in performance as a football player.

REVIEW OF LITERATURE

In the study it was necessary to review material relating to Kansas State University's off-season programs along with material on strength development. The following literature is presented to show the effectiveness and importance of the weight training as tested with a dynamometer and manuometer.

According to the historical account by Hunsicker and Donnelly, the first person to use an instrument known as a dynamometer was an Englishman named Graham.

The forerunner of the spring dynamometer in use today was produced in 1807 by Regnier. This instrument was utilized to measure grip strength, pulling power of the arm muscles, and lifting power of the legs and back muscles. Sargent initiated strength testing at Harvard University in 1880. He used an instrument similar to Regnier's dynamometer for measuring back and leg strength; for testing grip strength, a compact manuometer, small enough to fit inside a person's hand was utilized. With an adapter, this grip dynamometer was also used to test arm-pulling and arm pushing strengths. The spring-type back and leg dynamometer was improved over the years; and, several types of grip dynamometers were devised, including the Collin eliptical spring steel instrument, the Smedley adjustable grip device, and the Narragensett manuometer which is the type used for our testing.[2]

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[2]Harrison H. Clarke, Muscular Strength and Endurance in Man (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962), p. 3.

According to the principles of the Percentage Power Program introduced by Russ Knipps, the intent was to increase the athlete's ability to defy the law of gravity while jumping, running, hitting, lifting, pushing, and throwing. This is important in the performance of all sports. Athletes need to train scientifically in order to achieve maximum results. A good athlete knows that one should never work out heavily all the time--the continual tearing down of the muscles causes a build-up of lactic acid (waste products) in the muscles which restricts their stretching ability and causes a feeling of tiredness. And, further, if a muscle becomes too congested, it is highly vulnerable to pulling and tearing.[3]

Some of the overall body symptoms of being overtrained are loss of appetite, restless sleep, tension and irritability. This is why proper nutrition, methodical training and adequate rest are vital to maintain steady progress.

In his book, Application of Weight Training to Athletics, Gene Hooks states that the easiest and surest way to attain general physical fitness is with weights. He lists five benefits which can be derived from weight training. These benefits are as follows:

1. Improved strength.
2. Enlargement of the exercised muscles.
3. Improved power, endurance, flexibility and speed.

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[3]Russ Knipps, "Percentage Power Program," Unpublished Weight Training Program Paper, U.S. Olympic Weight Team, New York, N.Y. 1968, p. 4.

4. Improved body measurement.

5. Improved confidence and feeling of well being.[4]

Strength is one of the important components of physical fitness and is needed in varying degrees in all types of work and play. The importance of strength is not realized by most athletes until an example of an athlete who has made it by his or her dedication to weight training; or by the introduction of a superb weight training program being put to use, by a knowledgeable individual, in the sport they are performing or participating in and it improves their abilities.

Since strength is needed to perform daily functions, the development and maintenance of a sound level of strength is essential for a healthy life.[5] Therefore, it is safe to assume that a certain amount of strength is necessary for a person to be a successful participant in any sport. Once this level is reached, further gains in strength do not appear to be accompanied by the same amount of increase in performance. Various strength levels for different activities is not known, however, it is safe to assume that most athletes will profit by developing more than they ever have.

Strength (capacity to do work) is increased by training. This is accounted for in several ways:

1. Increase in size of the muscle fibers (muscle hypertrophy), which results in more powerful contractions (strength),

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[4]Gene Hooks, Application of Weight Training to Athletics (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962), p. 27.

[5]Corbin/Dowell/Lindsey/Tolson, Concepts in Physical Education (With Laboratories and Experiments) (Dubuque, Iowa: William C. Brown Co., Publishers, 1971), p. 17.

2. Improved coordination, in which the antagonistic muscles are completely relaxed at the proper time and thus do not impede the functioning of the active muscles, and

3. Ability of the muscle to repeat contractions more rapidly (muscular power speed).[6]

In the past decade, there has been a vast amount of experimental work by researchers seeking to find answers to the phenomenon of strength and muscle hypertrophy. Some of their findings have made it possible for teachers and coaches to utilize weight training on a scientific basis. Research studies by DeLorme indicate that for the development of strength, 1-3 repetitions for 3-4 sets with maximum load are best; and for muscular endurance, 10-12 repetitions for 3-4 sets with maximum load are best. Recent studies by Berger and Clarke indicate that for developing a combination of strength and muscular endurance, the most effective (90 percent) progressive weight training program is 5-6 repetitions, 3-4 sets, with maximum or near maximum loads.[7]

The off-season program was mainly concerned with the improvement of strength in the ball players. Therefore, the Percentage Program incorporated the use of 1-5 repetitions for 5-6 sets. The program was designed to cover a four week work period. The breakdown of percentages of maximum lifts during the four week period run from 70 percent of their maximum lift to 100 percent of their maximum lift.

Weight training is not a "dynamic wonder course." Depending on the athlete's body type characteristics, it takes an average of two or

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[6]John Patrick O'Shea, op. cit., p. 7.

[7]Harrison H. Clarke, op. cit., p. 58.

three months before specific results are realized. However, when weight training is properly applied, performances will improve and the time required to develop into a good varsity athlete or a potential record-breaking champion will be greatly reduced.

METHODS AND PROCEDURES

Description of the Training Program

In the 1972 Kansas State University off-season weight training program four basic lifts were used. These were incorporated in Russ Knipps' percentage weight training program and are explained below:

BENCH PRESS

Starting Position. Supine position on bench with head on bench. Using pronated grip slightly wider than shoulder width, hold bar at arm's length above chest.

Movement. Inhale, then lower the bar to the chest, touching lightly; with a vigorous arm, shoulder, and chest drive (no bounce or heave permitted), press to the starting position and exhale. When bench pressing maximum or near maximum loads, lower the bar slowly so as to permit complete control of the weight at all times. When lifting any weight, at least one spotter, if not two, should be used at all times in case of emergency. Throughout the complete lift the buttocks must remain in contact with the bench, with the elbows at the sides or pointed outward, depending on which is more comfortable for the individual on this particular lift.[8]

MAJOR MUSCLES EXERCISED

1. Deltoids--Primary Muscle
2. Upper pectoralis--Assistant
3. Latissimus dorsi--Assistant (stabilizer)

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[8]Russ Knipps, "Percentage Power Program," Ibid.

SQUATS

Starting Position. Bar on shoulders in balanced position, head up, feet 12-14 inches apart, back straight, with small of back arched to reduce pain. It is important to use a weight belt on this particular lift to reduce the chance of injury to the small of the back.

Movement. Inhale deeply and proceed to squat slowly to a position drive upward remembering to keep the small of the back arched through the completion of the lift. Allowing the buttocks to rise too fast causes rounding of the back, which puts tremendous strain on the vertebraes. If there is trouble in maintaining balance try to position the feet with toes facing outward, which allows feet to remain flat on the floor, or place a board under your heels.

MAJOR MUSCLES EXERCISED

1. Quadriceps--Primary Muscle
2. Gletaeus maximus, hamstring--Primary Muscle
3. Erector spine--Primary Muscle

MILITARY PRESS (standing)

Starting Position. Hands a little wider than shoulder width with feet position 12-14 inches apart, and knees locked.

Movement. Take a deep breath and press the weight overhead using arms and shoulders for power. Keep the knees in a locked position, feet flat, and wear a weight belt in case of any excessive bending of the back.

MAJOR MUSCLES EXERCISED

1. Deltoids--Primary Muscle
2. Upper pectoralis major--Assistant
3. Latissimus dorsi--Assistant (stabilizer)

POWER CLEAN

Starting Position. Body in squatting position, that is, thighs are approximately parallel to the floor, and feet are 8-12 inches apart. Hands are shoulder width apart, grip alternating or pronated; arms are straight. Head is up, and back is at a 25-30 degree angle, flat, and arched at the base. Here again it is important to have the use of a weight belt to cut down on the possibility of back injury.

Movement. Supply the pull from the legs and back in a strong but slow move. As the bar moves up the body accelerates the pull by driving the knees and hips upward and forward. Keep elbows high and out to the sides while keeping the bar close to the body. At the top of the pull, approximately chest high, duck under the bar by bending the knees and whipping the elbows under to catch the weight. Always keep the back flat and arched at the base.

MAJOR MUSCLES EXERCISED

1. Quadriceps--Primary Muscle
2. Glutaeus maximus, hamstrings--Primary Muscle
3. Erector spinae--Assistant
4. Abdominal and hip flexors--Assistant
5. Deltoids--Primary Muscle
6. Trapezius, upper--Assistant
7. Biceps--Assistant
8. Radial flexors--Assistant

For reference as to which muscles are being exercised in each one of the lifts check the superficial muscles charts of the human body; both anterior view and posterior view.

In order to accomplish our goals some changes were necessary, but basically the program followed Russ Knipps' principles.[9]

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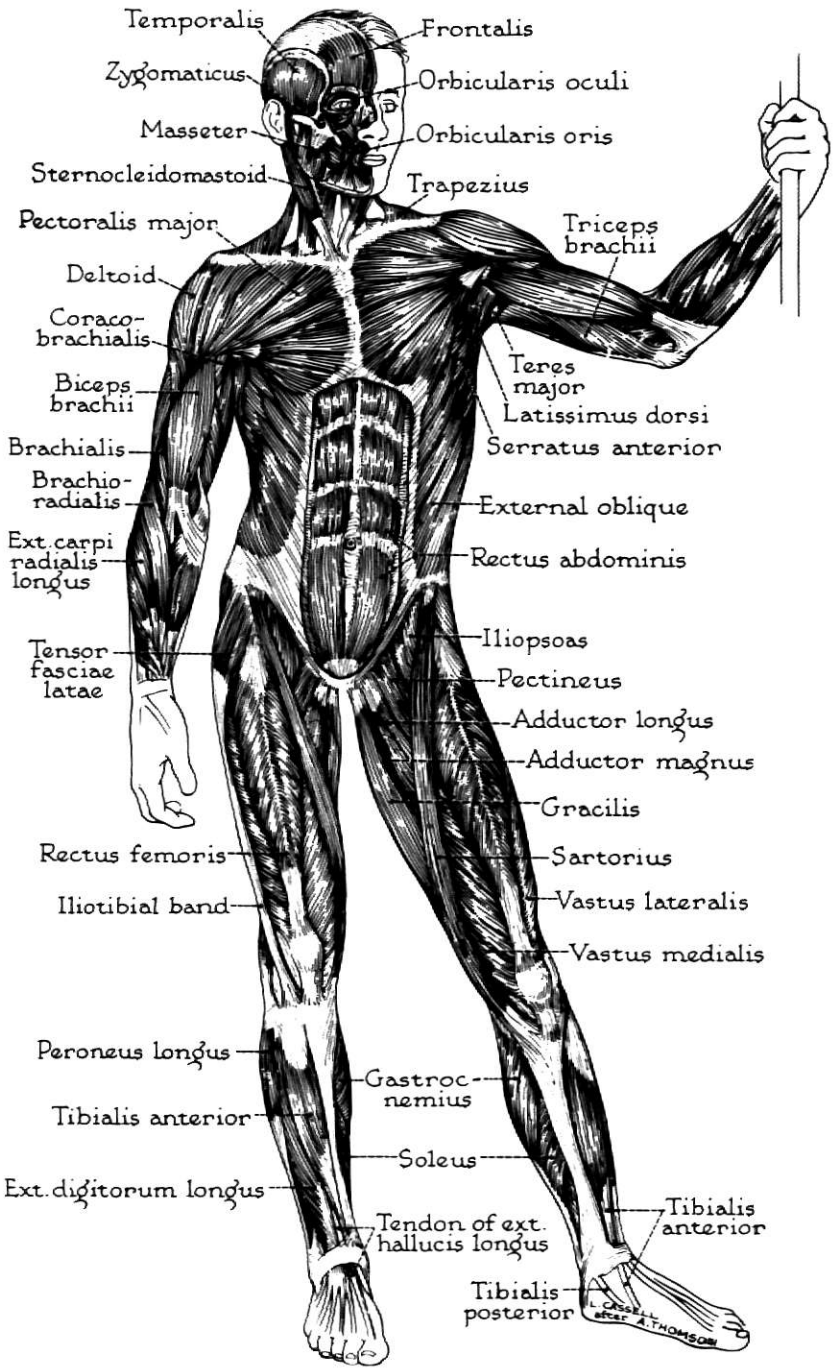
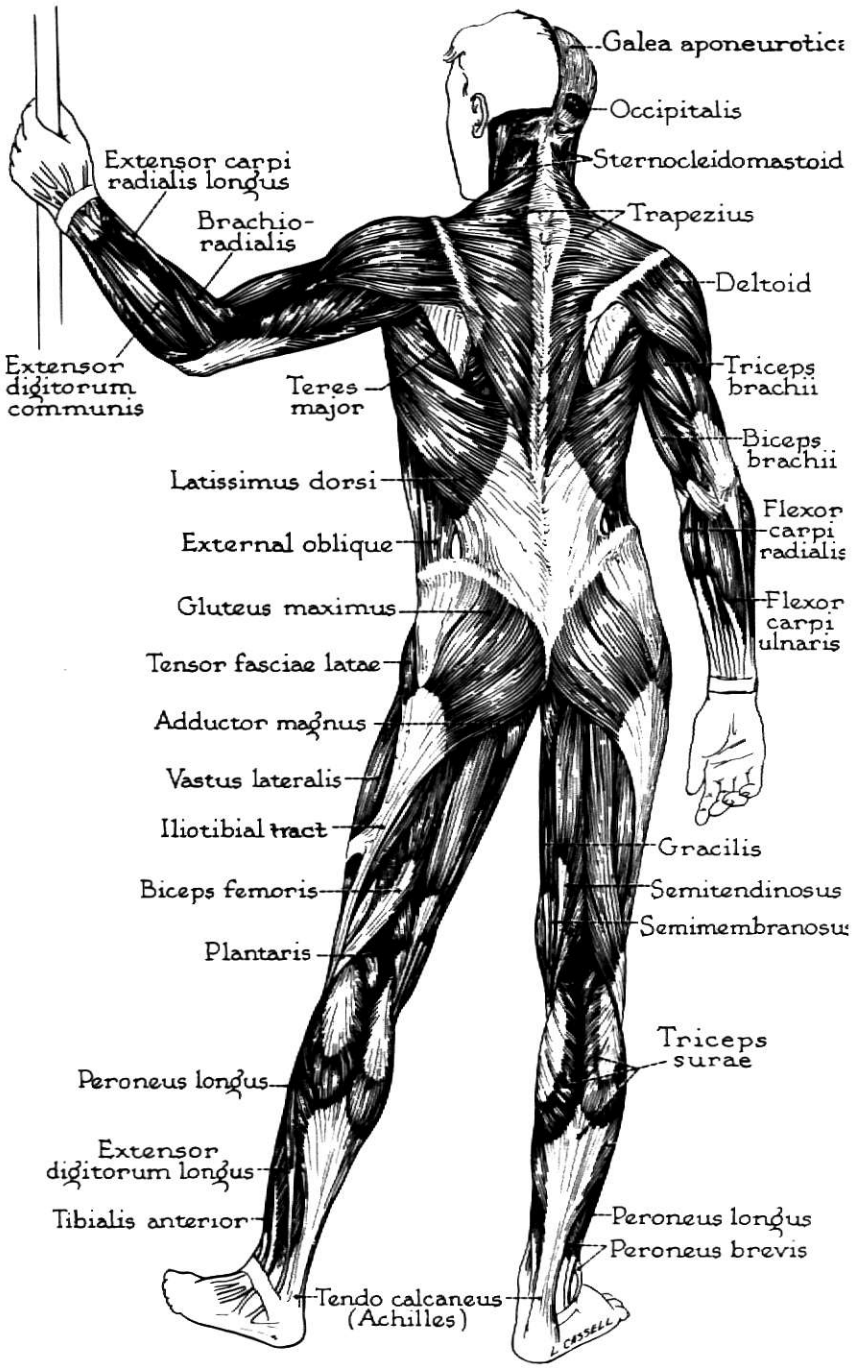
[9]Russ Knipps, Ibid.



Anterior View



Posterior View

The first three or four weeks of the program were spent on very basic procedures consisting of all the exercises used in the advanced program. The athletes in this study were directed to perform six sets of each exercise. The first set was performed with a weight which could be easily handled for six repetitions, then the weight was increased gradually for all six sets until the athlete was performing a maximum lift for only one repetition. After completing that particular exercise for six sets, the athlete progressed to the next exercise and repeated the cycle. After each lift the athletes were directed to carefully record the amount of weight handled and the number of repetitions performed. It was most important that the records be kept so that this program could be set up.

Prior to this year the weight program was based on light weights with high repetitions and moving quickly from station to station. However, this year it was possible to incorporate the Percentage Power Program, which allowed only forty minutes for the first group each day and twenty minutes for the second group each day.

Eight stations were set up in the weight room from which the players executed four lifts. The players were divided so that the strength of the group at each station would be as equal as possible. Ten minutes were spent at each station before rotating to the next. The forty minute group would always complete the work outs at each station but those in the twenty minute group would have to return and finish up after the techniques of football class.

After establishing maximum poundage in each of the lifts to be used in the off-season program and working for three or four weeks to

become familiar with the lifts, they were ready to go on the Percentage Power Program.[10]

The program was based on a five day work week with Monday, Wednesday, and Friday devoted to two groups for lifting and Tuesday, Thursday, and Saturday scheduled for the other two groups. The program was designed to cover a four week work period with the fourth week used for re-establishment of the maximum lifts. A simple breakdown of the five day a week program, based on a percentage of maximum efforts, would appear as the following:

	Monday	Tuesday	Wednesday	Thursday	Friday
First Week	70%	70%	75%	75%	70%
Second Week	85%	85%	70%	70%	80%
Third Week	92%	92%	75%	75%	80%
Fourth Week	Max.	Max.	70%	70%	100%

During the first two weeks, the exercises were done using six sets of five repetitions; for the third week they were done using six sets of three repetitions; and the fourth week they were done in singles. The above percentages were used for the final three sets of the six sets; the first three sets were performed by gradually increasing weights which could be performed with moderate effort. The athlete was very careful in warming up adequately in the first three sets by using light to moderate weights for three to five repetitions.

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[10]Bill Favrow, "Kansas State University Percentage Program," Unpublished Weight Program Paper, Kansas State University, Manhattan, Kansas, 1969, p. 1.

The first week had to be light in preparation in order to go heavier during the fourth week. The athlete must work light again to recuperate from the previous heavy work outs. Once exceeding the previous best in the fourth week the player begins again the first week with a new percentage of the new best poundages. This percentage routine applied to all exercises. No more than the six sets prescribed were to be done.

The purpose of weight training was to increase the athlete's ability to improve his strength which is important for all sports. A good athlete knows that one should never work out heavy all the time--the continual tearing down of the muscles causes poor results in contraction efficiency.

Testing Procedures

The generally accepted standard of test reliability is .85 for individual use, and .75 when the test results are used to evaluate group achievement. In the case of this study ten sample subjects were selected and tested on all four testing procedures to determine if the test had a good reliability coefficient for each testing procedure.

For the right hand the rank order coefficient was 1 -.15 which is equal to .85; for the left hand the rank order coefficient was 1 -.17 which is equal to .83; for the back the rank order coefficient was 1 -.15 which is equal to .85; and for the legs the rank order coefficient was 1 -.18 which is equal to .82.

Hand Manuometer. The manuometer which was used for this test was manufactured by Narragansett Machine Co., Providence, Rhode Island.

It was calibrated in twenty pound intervals with the scale ranging from 0-200. The subjects were instructed to place the manuometer in the palm of their hand with the dial facing inward. The arm could use any range of motion but could not touch any object or make contact with the body. As soon as the subject completed the contraction of the hand, he handed the manuometer over, and the score was recorded. This was done with both the right and left hand.

Back and Leg Dynamometer. The dynamometer used was manufactured by T. A. Upham, Boston, U.S.A. The measurement was in Kilo-grams and was computed to pounds by multiplying 2.2 times the kilo-gram reading on the dynamometer. The range was from 0-500 Kilo-grams.

The subjects on the back test were required to keep their legs straight, grasping the bar with the most comfortable grip for himself. His shoulders were slightly forward to allow for slack which would be needed for the upward exertion on the dynamometer. When the subject finished he stepped off the dynamometer to allow for the score to be calibrated and recorded.

On the leg test the subject squatted so that his thighs and calves formed a 45 degree angle, keeping the back straight and grasping the bar in the same manner as for the back test. The subject once again exerted force upward until completing the contraction. Upon completion he once again stepped off the dynamometer and his score calibrated and recorded.

Four tests were used in testing the athletes in the 1972 off-season program. They were administered on three different dates. The first administering of the test was on February 6, 1972; the second

on March 5, 1972; and the third and final test was administered on May 6, 1972.

The four tests were personally administered all three times by the investigator with the use of manuometer and dynamometer. It was hoped that no heavy exercising was done by the athletes before the tests were given.

A recording sheet was used for each test. The sheets contained each subject's name and a place for recording his right hand grip strength, left hand grip strength, back strength, and leg strength. The data obtained from the administering of these tests can be found in the Appendix. The number of subjects tested was always thirty, although due to injuries, some of the subjects had to be tested at different times.

RESULTS AND DISCUSSION

The findings of the study show that the effects of the nine week off-season weight training program, upon strength development of the football players at Kansas State University, to be progressive. It should also be realized that without the proper supervision and administering of the weight program the results would not show as much of a substantial gain.

The definition of muscular strength proposed is the tension the muscles can apply in a single maximum contraction. Strength by this definition provides the basis for all strength studies reported. However, various applications of this "maximum-tension principle" have been made. Thus, in this study, the strength a given muscle group can apply when the body is positioned in one or more specified ways was studied. In other studies, strength tests given before and after fatiguing activity indicated the amount of resultant muscular fatigue. In each instance, a strength test constitutes an essential testing element.

In the conduct of this study, only the muscular strength efforts of the subjects were measured. Efforts were made to obtain "all out" responses of the various subjects in a given testing situation. The method of motivating the subjects was consistently maintained; this method involved proper instruction before testing and verbal encouragement during testing.

All subjects tested showed either definite improvement in strength or retained their original score or close to it.

Of the four tests given, the one for the back showed the greatest improvement with an increase of 30 pounds. This could be attributed to the fact that three of the four lifts that the subjects performed put stress on the back muscles.

The mean score before off-season, after off-season, and after spring ball was over were tabulated in all of the tests, along with the mean increases for after off-season and after spring ball.

Table 1 shows the analysis of the mean gains in pounds of the right hand grip test with the manuometer.

Table 1

Analysis of the Mean Gains (lbs.) of the Right Hand Grip Test with the Manuometer

Test	Before Off-Season	After Off-Season	After Spring Ball	After Off-Season	After Spring Ball
Manuometer (Right Hand)	Mean	Mean	Mean	Mean Gain	Mean Gain
	139	144	141	5	2

In analyzing the results of this test one may wonder why the increase was so small. The increase was small because none of the lifts done really worked on the individual's grip strength. Instead the subjects worked extra time on a tricep program, which consisted of curls, behind the neck presses, and tricep presses.

Table 2 gives an analysis of the mean gains in pounds of the left hand grip test with the manuometer.

Table 2

Analysis of the Mean Gains (lbs.) of the Left Hand Grip Test with the Manuometer

Test	Before Off-Season	After Off-Season	After Spring Ball	After Off-Season	After Spring Ball
Manuometer (Left Hand)	Mean	Mean	Mean	Mean Gain	Mean Gain
	130	137	133	7	3

In analyzing the results of this test one would have to conclude that the findings were the same as for the right hand.

Table 3 gives an analysis of the mean gains in pounds of the back test with the dynamometer.

Table 3

Analysis of the Mean Gains (lbs.) of the Back Test with the Dynamometer

Test	Before Off-Season	After Off-Season	After Spring Ball	After Off-Season	After Spring Ball
Dynamometer (Back)	Mean	Mean	Mean	Mean Gain	Mean Gain
	467	497	481	30	14

In analyzing the results of this test one can't help but notice the large increase. This would have to be due to the fact that three of the four lifts performed involved the back muscles either as primary muscles or as assistants.

Table 4 shows an analysis of the mean gains in pounds of the leg test with the dynamometer.

Table 4

Analysis of the Mean Gains (lbs.) of the
Leg Test with the Dynamometer

Test	Before Off-Season	After Off-Season	After Spring Ball	After Off-Season	After Spring Ball
Dynamometer (Leg)	Mean	Mean	Mean	Mean Gain	Mean Gain
	531	553	544	22	13

In analyzing the results of this test a fairly substantial gain was shown for the leg strength. It was felt that the squats and power clean lifts indicated improvement in the areas for which they were intended.

Table 5 shows an analysis of the mean gains in pounds of the total body strength tests.

Table 5

Analysis of the Mean Gains (lbs.) of the
Total Body Strength Tests

Test	Before Off-Season	After Off-Season	After Spring Ball
Total Body Strength	Mean	Mean	Mean
	1267	1331	1299

SUMMARY

In analyzing the effectiveness of Kansas State's football off-season weight training program, thirty members of the squad were tested to determine the amount of body condition improvement. This was done by administering four types of tests, one before off-season, one after off-season, and one after spring ball. The tests were: right hand grip with a manuometer having a mean gain after off-season of 5 pounds and after spring ball a mean gain of 2 pounds; left hand grip with a manuometer having mean gain after off-season of 7 pounds and after spring ball a mean gain of 3 pounds; back test with a dynamometer having a mean gain after off-season of 30 pounds and after spring ball a mean gain of 14 pounds; leg test with a dynamometer having a mean gain after off-season of 22 pounds and after spring ball a mean gain of 13 pounds.

The data collected consisted of records of performance on individual test items. The data was computed to calculate means for the total score of each item and to find the total body strength of the subjects both after off-season, which showed a mean gain of 1331 pounds, and after spring ball which showed a mean gain of 1299 pounds.

CONCLUSION

From the data obtained and presented in this study, one could conclude that this years' football off-season weight training program at Kansas State University showed marked improvement in strength development. However, it is felt that the amount of time, attention, and emphasis on weight training by the football department should be increased. The program this year did indicate a step in the right direction, as most of the subjects realized from this experience in weight training the increased effects on their own individual performances.

ACKNOWLEDGMENTS

Appreciation is expressed to Dr. Charles B. Corbin for his assistance and inspirational teaching, Professor T. M. Evans for the use of materials and literature along with his assistance, Associate Professor R. A. Wauthier, and all other professors who made this year in graduate school so educational and this study possible.

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APPENDIX

APPENDIX I

RIGHT HAND
(Manuometer)

Name	First Test (Score in lbs.)	Second Test	Third Test
Hopkins	120	130	130
Glatz	150	160	150
Ottiemeir	165	165	160
Jones, Greg	135	135	135
Jones, Kevin	140	145	140
Eaton	140	140	140
Brittan	120	150	140
Rothwell	165	170	160
Freeman	120	130	120
Brandt, Bob	115	120	120
Wells	140	145	145
Hilton	130	130	130
Scott	140	150	145
O'Neil	140	140	140
Hernandez	140	140	140
Acker	160	180	170
Georger	120	130	125
Brown, Dave	125	125	125
Brown, Terry	140	150	145
Calhoun	125	140	130

Name	First Test (Score in lbs.)	Second Test	Third Test
Coppenberger	140	145	140
Jackson	180	180	180
Thomas	130	135	135
Holman	130	130	130
McCarthy	160	160	160
Brumley	165	160	165
Melcher	140	150	145
Agoston	130	135	135
Chapin	140	140	140
Morrison	125	100	110

APPENDIX II

LEFT HAND
(Manuometer)

Name	First Test (Score in lbs.)	Second Test	Third Test
Hopkins	100	110	105
Glatz	130	130	130
Ottiemeir	160	160	160
Jones, Greg	130	135	135
Jones, Kevin	130	135	130
Eaton	145	150	145
Brittan	110	130	120
Rothwell	135	180	150
Freeman	105	110	110
Brandt, Bob	100	110	110
Wells	145	150	145
Hilton	130	130	130
Scott	135	140	135
O'Neil	140	140	140
Hernandez	125	130	130
Acker	145	160	150
Georger	110	120	115
Brown, Dave	130	140	135
Brown, Terry	140	140	140
Calhoun	105	120	110

Name	First Test (Score in lbs.)	Second Test	Third Test
Coppenberger	130	140	135
Jackson	130	150	140
Thomas	130	135	135
Holman	110	125	120
McCarthy	155	160	160
Brumley	150	155	150
Melcher	130	140	140
Agoston	130	125	125
Chapin	130	135	130
Morrison	130	130	130

APPENDIX III

BACK
(Dynamometer)

Name	First Test (Score in lbs.)	Second Test	Third Test
Hopkins	396	440	410
Glatz	550	594	560
Ottiemeir	539	550	540
Jones, Greg	506	506	506
Jones, Kevin	418	484	462
Eaton	462	528	473
Brittan	484	528	528
Rothwell	462	572	494
Freeman	462	550	462
Brandt, Bob	462	494	462
Wells	484	484	484
Hilton	440	484	484
Scott	462	462	462
O'Neil	550	539	550
Hernandez	506	484	484
Acker	539	572	572
Georger	407	418	407
Brown, Dave	550	550	550
Brown, Terry	481	440	440
Calhoun	473	506	473

Name	First Test (Score in lbs.)	Second Test	Third Test
Coppenberger	418	462	440
Jackson	495	528	528
Thomas	462	484	462
Holman	396	418	418
McCarthy	396	418	396
Brumley	462	462	462
Melcher	506	506	506
Agoston	374	440	407
Chapin	528	550	528
Morrison	462	473	473

APPENDIX IV

LEGS
(Dynamometer)

Name	First Test (Score in lbs.)	Second Test	Third Test
Hopkins	561	528	550
Glatz	616	660	638
Ottiemeir	550	550	550
Jones, Greg	550	572	561
Jones, Kevin	550	572	550
Eaton	528	528	528
Brittan	506	594	550
Rothwell	594	616	616
Freeman	550	770	638
Brandt, Bob	550	572	572
Wells	638	638	638
Hilton	462	506	473
Scott	550	572	550
O'Neil	792	704	704
Hernandez	528	550	550
Acker	638	704	670
Georger	462	462	462
Brown, Dave	550	528	528
Brown, Terry	418	462	429
Calhoun	506	550	528

Name	First Test (Score in lbs.)	Second Test	Third Test
Coppenberger	429	440	440
Jackson	440	484	440
Thomas	473	484	473
Holman	418	528	528
McCarthy	418	462	506
Brumley	506	528	506
Melcher	594	550	594
Agoston	484	462	462
Chapin	550	550	550
Morrison	528	550	550

APPENDIX V

TOTAL BODY STRENGTH
(Manuometer-Dynamometer)

Name	First Test (Score in lbs.)	Second Test	Third Test
Hopkins	1159	1208	1195
Glatz	1446	1544	1478
Ottiemeir	1414	1425	1410
Jones, Greg	1331	1348	1337
Jones, Kevin	1238	1336	1282
Eaton	1275	1346	1286
Brittan	1220	1402	1338
Rothwell	1356	1538	1420
Freeman	1237	1560	1330
Brandt, Bob	1227	1296	1264
Wells	1407	1417	1412
Hilton	1162	1250	1217
Scott	1287	1324	1292
O'Neil	1622	1523	1534
Hernandez	1299	1304	1304
Acker	1482	1616	1562
Georger	1099	1130	1109
Brown, Dave	1355	1343	1338
Brown, Terry	1116	1192	1154
Calhoun	1204	1316	1241

Name	First Test (Score in lbs.)	Second Test	Third Test
Coppenberger	1117	1187	1155
Jackson	1245	1342	1288
Thomas	1195	1238	1205
Holman	1054	1201	1196
McCarthy	1129	1200	1222
Brumley	1283	1305	1283
Melcher	1370	1346	1385
Agoston	1118	1162	1129
Chapin	1348	1375	1348
Morrison	1245	1253	1263

APPENDIX VI

HEIGHT AND WEIGHT

Name	Beginning Height	Beginning Weight	End Height	End Weight	Weight + -
Hopkins	6' 3"	250	6' 3"	230	-20
Glatz	6' 3"	250	6' 3"	240	-10
Ottiemeir	6' 6"	220	6' 6"	230	+10
Jones, Greg	6' 1"	213	6' 1"	224	+9
Jones, Kevin	6' 3"	225	6' 3"	230	+5
Eaton	6' 0"	240	6' 0"	230	-10
Brittan	6' 5"	230	6' 5"	245	+15
Rothwell	6' 4"	220	6' 4"	230	+10
Freeman	6' 3 1/2"	250	6' 4"	250	0
Brandt, Bob	6' 3"	241	6' 4"	235	-6
Wells	6' 4"	225	6' 4"	237	+12
Hilton	6' 3"	220	6' 3"	220	0
Scott	6' 2"	225	6' 2 1/2"	230	+5
O'Neil	6' 3"	226	6' 3"	230	+4
Hernandez	6' 2"	243	6' 2"	250	+7
Acker	6' 4"	230	6' 4"	243	+13
Georger	6' 0"	170	6' 0"	180	+10
Brown, Dave	6' 4"	198	6' 4"	205	+7
Brown, Terry	6' 2"	200	6' 2 1/2"	210	+10
Calhoun	6' 0"	195	6' 0"	210	+15

Name	Beginning Height	Beginning Weight	End Height	End Weight	Weight + -
Coppenberger	6' 1"	195	6' 1"	200	+5
Jackson	5' 10"	185	5' 11"	195	+10
Thomas	6' 0"	200	6' 0"	205	+5
Holman	5' 11"	200	5' 11"	210	+10
McCarthy	6' 2"	185	6' 2"	195	+10
Brumley	6' 3"	199	6' 3"	195	-4
Melcher	6' 0"	200	6' 0"	210	+10
Agoston	6' 0"	190	6' 0"	180	-10
Chapin	5' 10"	190	5' 11"	195	+5
Morrison	6' 3"	205	6' 3"	210	+5

APPENDIX VII

RIGHT HAND CHART

Players	X	Y	R_x	R_y	$R_x - R_y$	$(R_x - R_y)^2$
A	125	115	7	10	-3	9
B	115	125	9	8	1	1
C	135	145	5	4	1	1
D	180	175	1	1	0	0
E	165	170	2	2	0	0
F	110	130	10	7	3	9
G	130	135	6	6	0	0
H	120	120	8	9	-1	1
I	150	150	4	3	1	1
J	160	140	3	5	-2	4
						24

$$R = 1 - \frac{6\ (R_x - R_y)^2}{N(N^2 - 1)}$$

$$R = 1 - \frac{6(24)}{10(100 - 1)}$$

$$R = 1 - \frac{144}{990}$$

$$R = 1 - .15$$

$$R = .85$$

APPENDIX VIII

LEFT HAND CHART

Players	X	Y	R_x	R_y	$R_x - R_y$	$(R_x - R_y)^2$
A	140	115	6	9	-3	9
B	160	140	3	5	-2	4
C	170	170	2	1	1	1
D	135	130	7	6	1	1
E	120	120	8	8	0	0
F	155	125	4	7	3	9
G	110	115	10	9	1	1
H	150	145	5	4	1	1
I	115	110	9	10	-1	1
J	180	160	1	2	-1	1
						28

$$R = 1 - \frac{6\ (R_x - R_y)^2}{N(N^2 - 1)}$$

$$R = 1 - \frac{6(28)}{10(100 - 1)}$$

$$R = 1 - \frac{168}{990}$$

$$R = 1 - .17$$

$$R = .83$$

APPENDIX IX

BACK CHART

Players	X	Y	R_x	R_y	$R_x - R_y$	$(R_x - R_y)^2$
A	506	506	4	4	0	0
B	550	539	1	2	-1	1
C	462	484	7	6	1	1
D	440	462	8	7.5	.5	.25
E	539	572	2	1	1	1
F	407	418	10	10	1	0
G	495	528	5	3	2	4
H	418	462	9	8.5	.5	.25
I	484	495	6	5	1	1
J	528	473	3	7	-4	16
						24.50

$$R = 1 - \frac{6\ (R_x - R_y)^2}{N(N^2 - 1)}$$

$$R = 1 - \frac{6(24.50)}{10(100 - 1)}$$

$$R = 1 - \frac{147}{990}$$

$$R = 1 - .15$$

$$R = .85$$

APPENDIX X

LEG CHART

Players	X	Y	R_x	R_y	$R_x - R_y$	$(R_x - R_y)^2$
A	561	484	4	8	-4	16
B	616	660	3	2	1	1
C	550	550	5	5	0	0
D	528	594	6	4	2	4
E	792	704	1	1	0	0
F	418	462	10	9	1	1
G	429	440	9	10	-1	1
H	440	524	8	6	2	4
I	462	506	7	7	0	0
J	638	638	2	3	-1	1
						28

$$R = 1 - \frac{6\ (R_x - R_y)^2}{N(N^2 - 1)}$$

$$R = 1 - \frac{6(28)}{10(100 - 1)}$$

$$R = 1 - \frac{168}{990}$$

$$R = 1 - .17$$

$$R = .83$$

AN EVALUATIVE STUDY ON THE EFFECTS OF THE 1972 FOOTBALL OFF-SEASON WEIGHT TRAINING PROGRAM ON THE STRENGTH DEVELOPMENT OF THE PARTICIPANTS

by

RICHARD KENT WILKINSON

B. A., Kansas State University, 1969

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Physical Education

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1972

The purpose of this study was to evaluate the effects of the off-season football weight program in relation to strength improvement of the participants involved in the test.

In order to evaluate the success of the weight training program, thirty members of the football team participated in the study. They were tested at three different times. Once before off-season, again after off-season, and once again after spring ball was over with. They were each tested for right hand grip strength with the manuometer, left hand grip strength with the manuometer, back strength with the dynamometer, and leg strength with the dynamometer.

The data consisted of records of performance on individual test items. The data was computed to calculate means for the total score of each item of the three different tests.

The results of the test showed that there was a marked improvement in the four areas of strength. The back strength showed the greatest improvement with an increase of 30 pounds, and the right hand grip test showed the smallest improvement of only 5 pounds.

From the data obtained and calculated one would have to conclude that this years' off-season football program for weight training at Kansas State University gave convincing proof of it's effectiveness on the participants in the development of body strength.