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Comparison of Two Methods of Training For Improving Jumping Ability

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To the Graduate Council:

I am submitting herewith a thesis written by Bobby Carter entitled "Comparison of Two Methods of Training For Improving Jumping Ability." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Exercise Science.

E. K. Capen, Major Professor

We have read this thesis and recommend its acceptance:

Ben O. Ptohieds, Sam A. Venable

Accepted for the Council:

Carolyn R. Hodges

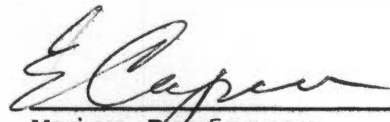
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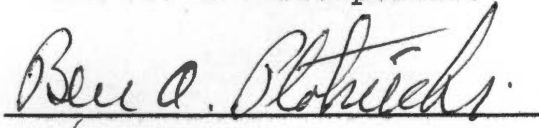
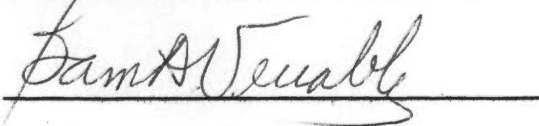
August 27, 1963

To the Graduate Council:

I am submitting herewith a thesis written by Bobby Carter entitled "Comparison of Two Methods of Training for Improving Jumping Ability." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Physical Education.


Major Professor

We have read this thesis and
recommend its acceptance:

Accepted for the Council:


Dean of the Graduate School

COMPARISON OF TWO METHODS OF TRAINING FOR
IMPROVING JUMPING ABILITY

A Thesis

Presented to

The Graduate Council of
The University of Tennessee

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by

Bobby Carter

August 1963

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ACKNOWLEDGMENT

I wish to express my appreciation to Dr. E. K. Capen, Professor of Physical Education at the University of Tennessee, for his helpful guidance and supervision in this study.

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CHAPTER I

INTRODUCTION

Until the last decade, weight training was excluded from nearly all training programs for athletes engaged in sports requiring a high degree of coordination because it was thought that the use of weights resulted in muscle-boundness and a decrease in speed of movement. However, in 1951 Zorbas and Karpovich¹ conducted, at Springfield College, an experiment which indicated that the foregoing notion was erroneous. The purpose of their experiment, which involved six hundred men, was to test the speed of muscular contraction. They found that the three hundred men who participated in weight training were .174 seconds faster in turning a crank twenty-four turns than were the three hundred men who had not participated in weight training. This and subsequent experiments of a similar nature have disproved the old theory to such an extent that weight training is now generally included in training programs for most sports.¹

¹William S. Zorbas and Peter Karpovich, "The Effect of Weight Lifting Upon the Speed of Muscular Contraction," Research Quarterly, 22:145-48, May, 1951.

It is commonly accepted that jumping ability is vitally important to the basketball player. Perhaps no one has expressed its importance more succinctly and forcefully than Bunn:

Jumping is of great importance in basketball and merits the special attention of players and coaches alike. The ability to out-jump an opponent is the difference between ball control and the lack of it on many occasions. A fraction of an inch increase in the jump can be the difference.²

In view of the foregoing statement, one would expect that coaches would place strong emphasis on the development of jumping ability, but the history of basketball shows that surprisingly little systematic effort has been made to improve jumping ability. "Jumping ability," declares Dean, "is a much neglected fundamental."³ However, as basketball coaches are becoming better trained, they are showing more interest in finding ways to improve jumping ability.

Various methods have been used by basketball coaches to increase jumping ability. Rupp, the highly successful coach at the University of Kentucky, has long used rope

² John W. Bunn, Scientific Principles of Coaching, Englewood Cliffs: Prentice-Hall, Inc., 1955, p. 218.

³ Everett S. Dean, Progressive Basketball, Englewood Cliffs: Prentice-Hall, Inc., 1950, p. 159.

jumping to develop jumping height.⁴ Bunn has used such exercises as the heel lift and the knee bend using barbells.⁵ Weighted vests and weighted insteps have been used by coaches known by the writer. Also, as Dean points out, "It is a common practice of basketball coaches to suspend a ball on a string from a balcony, which provides good jumping practice and gives the player a chance to practice the 'feel' of the ball."⁶

Studies have been made of various methods used to improve jumping ability, but the writer has found no record of any studies comparing the effectiveness of one of these methods with another. It was the purpose of this study to compare two methods of training for improving vertical jumping ability: (1) rope jumping with ankle weight strapped around each ankle and (2) squat jumping with a fifteen-pound dumbbell in each hand.

⁴Adolph F. Rupp, Rupp's Championship Basketball, New York: Prentice-Hall, Inc., 1948, p. 9.

⁵Frank D. Sills, Laurence E. Morehouse, and Thomas F. Delorme, Weight Training in Sports and Physical Education, The American Association on Health, Physical Education, and Recreation, 1962, p. 64.

⁶Dean, op. cit., p. 160.

CHAPTER II

REVIEW OF THE LITERATURE

During the past decade a number of studies have been made concerning the relationship between weight training and jumping ability. Most of these studies have concluded that jumping ability is increased with a well-organized program. The writer did not find any studies which compared different methods of training for jumping in weight training programs.

So far as this writer can ascertain, the first experimental studies of the relationship between weight training and jumping ability were conducted at the State University of Iowa in the late 1940's. A study of this relationship by Chui reported in 1950 included three tests of jumping: the standing Sargent jump, the standing broad jump, and the running Sargent jump. Chui used two groups of subjects in his study. Group A, composed of twenty-three subjects, performed weight training exercises using dumbbells and barbells. Group B, composed of twenty-two subjects, did not use any form of weight training, but participated in the required physical education program at the University of

Iowa. This experiment, which covered a three-month period, showed the gains for Group A over Group B to be an average of 7.2 cm. in the standing Sargent jump, six inches in the standing broad jump, and 7.6 cm. in the running broad jump.¹ Another study by Capen at the University of Tennessee a few months later also involved the relationship between weight training and jumping ability. This study, conducted over a twelve-week period, likewise made use of two groups: Group A, consisting of forty-two members of a weight training class and Group B, consisting of twenty-nine members of a physical conditioning class which did not participate in weight training. This experiment showed the gains of Group A over Group B to be an average of 13.1 per cent in the standing Sargent jump and 10.8 per cent in the standing broad jump. Capen found a *t* of 2.14 for athletic power, which was significant at the 2 per cent level.

During the same year in which the studies of Capen

¹Edward Chui, "The Effects of Systematic Weight Training on Athletic Power," Research Quarterly, 21:188-94, October, 1950.

²Edward K. Capen, "The Effects of Systematic Weight Training on Power, Strength, and Endurance," Research Quarterly, 21:83-93, May, 1950.

and Chui were completed, Klotz conducted a study of fifty-two male college students, comparing a weight training program to the vertical jump. He concluded that the vertical jump was an inverse linear function of the load and that the amount of work done tended to remain constant for the various loads. Klotz concluded that the greater the muscular strength, the greater the average jump.³

Keller did a study comparing the relationship of strength and weight training to ability in the running high jump. Keller found that eight high-school boys, after participating for eight weeks in a weight training program and in a high-jumping program for three weeks, showed an average increase of 3.50 inches in the heights jumped.⁴

Garth experimented with nineteen varsity basketball players at the State University of Iowa. He found that after undergoing a systematic weight-training and jumping exercise

³ Donald D. Klotz, "A Mechanical Analysis of the Vertical Jump as Affected by Variations in Weight and Strength," Unpublished Doctor's Dissertation, pp. 34-35. Iowa City: State University of Iowa, 1948.

⁴ Elden P. Keller, "A Study of the Relationship of Strength and Weight to Ability in the Running High Jump," (M. A.) Thesis. State University of Iowa, 1953, as cited in Roberts, p. 2.

program for a period of six weeks, the subjects increased an average of 2.47 inches in the maximum heights jumped when they reached with their right hands, and an average of 2.46 inches in the maximum heights jumped when they reached with their left hands.⁵

One of the first college coaches to experiment with weight training was O'Conner, the basketball coach at the State University of Iowa. Iowa's team, which used various weight training exercises, placed second in the Big Ten competition in 1954 and won the championship in 1955. O'Conner said, "the weight training program made my players stronger in the arms and wrist. It also made them stronger physically for the rugged work under the basket."⁶ Sills and McCloy, who were testing O'Conner's basketball players, reported that three boys increased their jumping heights as much as three inches.⁷

⁵Richard P. Garth, "A Study of the Effect of Weight Training on the Jumping Ability of Basketball Players," (M. A.) Thesis. State University of Iowa, 1954, as cited in Roberts, p. 2.

⁶Frank Sills and Charles H. McCloy, Strength and Health, July, 1955.

⁷Ibid.

Sports College News reports research in which vertical jumping ability was increased eight inches after a weight training program. Seventeen athletes took part in a weight training program in which the following exercises were involved: 1) locked-knee bouncing with weights, 2) fast knee bends with weights. The test used was the Sargent Jump. The athletes were measured three times before the weight training program began to determine performance levels. They were then tested once each week for the remainder of the program. The highest increase in jumping ability was thirteen inches and the lowest was five and one-half inches.⁸

Ness and Sharos conducted a weight training program for four weeks to determine the effect of weight training on the vertical jump. The weight training program consisted of deep knee bends and heel raising with heavy resistant weights. They used the following four tests as the criteria: (1) Sargent jump, (2) leg lift, (3) right ankle plantar flexion, (4) left ankle plantar flexion. The results showed that weight training increased the Sargent jump 3.23 inches and the controlled, or non-weight training group, decreased .27

⁸Sports College News, "Improve Jumping Ability Eight Inches in Training," October, 1955.

inches. They found a t of 5.37 which showed a significant difference at less than the 1 per cent level of confidence.⁹

Brown and Riley did a study involving forty basketball candidates from the Springfield College freshmen squad. The candidates were divided into Groups A and B. Group A was composed of the weight training subjects and Group B was composed of the control group. The objective of this study was to determine the effect of leg strength and the vertical jump. The weight training program lasted five weeks during which time the subjects performed the exercise of heel raising with resistive weights. The results were measured by the use of the following tests: (1) Sargent jump, (2) leg lift, (3) right ankle plantar flexion, (4) left ankle plantar flexion. In the Sargent jump Group A increased 2.9 inches, while Group B increased only .6 inches. The subjects in Group A were able to lift 161 pounds with their legs. Group B lifted only 70.4 pounds. Brown and Riley concluded that a weight training program of five weeks, using only the heel

⁹ Phillip E. Ness and Charles Sharos, "The Effect of Weight Training on Leg Strength and the Vertical Jump," Unpublished Masters Thesis, Springfield College, Springfield, Mass., June, 1956, pp. 55-56.

raising exercise, will increase leg strength and jumping ability.¹⁰ They found the t for Group A to be 11.0 and for Group B the t was 11.2. Both were significant at less than the 1 per cent level of confidence.

Another study by Burnham at McMurray College in Abilene, Texas, of ten varsity basketball players proved interesting. The study lasted six weeks with each player working one hour and twenty minutes three times a week. All ten players improved their jumping capabilities by a mean gain of 3.2 inches.¹¹

Only three studies contradictory to those previously discussed were found by the writer. One of these studies was conducted by Hoffman at South Dakota State College. He tried to determine the effect of two weight training programs on the explosive power of the subjects. One program consisted of weight training exercises in which five to eight executions were employed and the other program consisted of

¹⁰Robert J. Brown and Douglas R. Riley, "The Effect of Weight Training of Leg Strength and the Vertical Jump," The authors' thesis (M.S.), Springfield College, Springfield, Mass., 1957.

¹¹Stan Burnham, "Develop Your Rebounders with Weight Training," Scholastic Coach, XXX No. IV, (December, 1960), p. 16, 17, 23.

weight training exercises in which ten to thirteen exercises were utilized. The subjects used in this study were members of four weight training classes and members of the freshmen basketball squad at the college. The experiment lasted eight weeks, with two training periods per week. Hoffman concluded that no difference in jumping heights resulted between the group employing weight training exercises and basketball practice. He further concluded that any increase in jumping height was not significant.¹² The t-value obtained between the two groups was 0.91, which was considerably below the t-value of 2.70 necessary for significance at the 5 per cent level.

Roberts, at the State University of Iowa, experimented with twenty-one members of the freshman basketball squad. He divided them into three groups. Group I, composed of six men, took part in the regular practice routine of the freshmen squad. Group II, composed of six men, took part in a jumping-exercise program in addition to the regular practice routine. Group III, composed of nine men, participated in a

¹²James A. Hoffman, "A Comparison of the Effect of Two Programs of Weight Training on Explosive Force," Thesis (M.S.), South Dakota State College.

weight-training program in addition to the regular practice routines. The subjects in each of the three groups were tested before and after the experiment by means of the jump-and-reach performance. Roberts concluded that neither program of jumping exercise proved effective in developing the jumping ability of a group of basketball players.¹³

Nipper conducted a study on the effect of weight training of the vertical jumping ability of thirteen varsity basketball players at Northwestern State College. In this program which lasted for six weeks, the players were chosen by the varsity basketball coach. The players were divided into two groups, a control group consisting of six players, and an experiment group consisting of seven players. Both groups participated in regular basketball practice. The experimental group participated in a systematic weight training program in addition to the basketball practices. The mean gain for the experimental group was 1.712 which was not

¹³ John Roberts, "A Comparison of the Effectiveness of Two Methods of Training Upon the Jumping Ability of Basketball Players," (M.A.) Thesis, State University of Iowa, (Iowa City), 1956.

statistically significant.¹⁴ Nipper concluded that weight training had no significant effect on the jumping ability of varsity basketball players.

¹⁴John W. Nipper, "The Effect of Weight Training on the Vertical Jumping Ability of College Varsity Basketball Players," Unpublished Study, Northwestern State College, Spring, 1960, pp. 6-12.

CHAPTER III

PROCEDURE

This chapter pertains to the procedure used in the selection of the subjects, the measurement used for determining the jumping height, and the exercise program utilized in the study.

I. SUBJECTS

Seventy-one students from two freshmen weight training classes at the University of Tennessee were used in this study during the winter quarter, 1963. All of the subjects had been rated in the lower 30 per cent of a conditioning class at the end of the preceding quarter. They were told that they were to participate in a ten-week program of jumping exercises supervised by the writer in addition to the normal weight training program.

II. MEASUREMENTS

The chalk jump test and the Sargent jump test¹ were administered to seventy-one subjects at the beginning and at the end of the ten-week period. The Sargent jump was later excluded from the study because of the inability of some subjects to perform the jump in the correct manner.

Testing of the subjects was conducted over the first and the last five days of the ten-week period. A one-week rest period was allowed during the ninth week of the study in order to eliminate any fatigue or staleness among the subjects.

The following procedure was utilized in the administration of the test. A board very similar to a basketball backboard in size and shape was placed adjacent to a concrete supporting beam in the weight training room. The board extended from a point eight feet above the floor to a point twelve feet above the floor. Red lines were drawn horizontally on the board at six inch intervals. Black horizontal lines were drawn between the red lines at one-inch intervals.

¹Charles H. McCloy and Norma D. Young, Test and Measurements in Health and Physical Education, Appleton-Century-Crafts, Inc., New York, 1954, pp. 70-71.

While administering the tests, the writer stood on a ladder approximately five feet from the board at an elevation of approximately ten feet.

The following procedure was used by the subjects performing the chalk jump. Each subject assumed a crouched position, on the floor, just below the board. From this position each subject jumped as high as he could, fully extending his body, and hitting the board with his right hand. All of the subjects jumped successively; this performance was repeated twice, until each subject had jumped three times. The highest jump for each subject was recorded. The subjects were closely observed to make sure that each one jumped from a stationary position.

III. EXERCISE PROGRAM

The subjects were assigned to two previously scheduled weight training classes which met two days a week and were taught by the writer. Group A, which was composed of thirty-five subjects, jumped rope for a period of three minutes with a one-and-one-half-pound ankle weight strapped around each ankle. The subjects were instructed to jump as high as possible every jump during the three-minute period. Group A

CHAPTER IV

FINDINGS

The purpose of this chapter is to show the results of this study concerning the two training methods utilized. The t-statistic was the statistical method used for analyzing the data.¹ The difference found between the ankle weights (Group A) and the squat jumps (Group B) are found below.

I. ANKLE WEIGHTS

The mean difference for Group A was found to be 0.19 inches. This increase was found to be statistically significant at only the 28 per cent level of confidence. These results are shown in Table I.

II. SQUAT JUMPS

The mean difference for Group B was found to be 0.75 inches. This increase was found to be statistically

¹E. F. Linquist, Statistical Analysis in Educational Research (Chicago: Houghton Mifflin Company, 1940), pp. 56-59.

TABLE I
MEAN GAIN IN VERTICAL JUMP FOR GROUPS A AND B

Group	Initial Mean	Final Mean	Mean Difference	t	Level of Confidence
A	113.97"	114.16"	0.19"	1.12	28 per cent
B	112.65"	113.40"	0.75"	3.75	Less than 1 per cent

significant at less than the 1 per cent level of confidence. These results are shown in Table I.

III. COMPARISON OF GROUP A TO GROUP B

In comparing the ankle weight method of training to the squat jump method of training, it was found that the difference was statistically significant at the 5 per cent level of confidence. This is shown in Table II.

TABLE II
COMPARATIVE DIFFERENCE IN MEAN GAIN BETWEEN
GROUPS A AND B

Mean Gain		Difference	t	Level of Confidence
Group A	Group B			
.19	.75	.56	2.0	5 per cent

CHAPTER V

DISCUSSION AND CONCLUSIONS

This chapter was concerned with a discussion of various aspects of the study which were not explained in the preceding chapters and to state the conclusions which, in the judgment of the writer, are supported by the evidence.

I. DISCUSSION

It was the purpose of this study to determine whether any significant differences were evidenced between two methods for developing vertical jumping ability. The two methods used were rope jumping with ankle weights and squat jumping with a fifteen-pound dumbbell in each hand.

At the beginning of this study, the writer assumed that the squat jumping exercise would be more fatiguing than the ankle weight method. It was for this reason that the squat jumping exercises lasted only one-half as long as the ankle weight jumping exercises. In spite of this effort to equalize the two methods, the squat jump subjects showed a greater improvement than did the ankle weight subjects.

The motivation of the subjects, which is pertinent to every experimental study, was identical for both groups. The ankle weight group was encouraged to jump as high as possible on every jump, while the squat jumping group was encouraged to use the correct form in exercising every jump. The subjects in both groups worked hard and were very cooperative.

A possible limitation to this study is that the subjects had been rated in the lower 30 per cent of a conditioning class the preceding quarter. The extent to which these subjects would limit a study of this type is not known, but the writer feels that a group which is more athletic or physically stronger than the group tested might have made greater improvements.

II. CONCLUSIONS

According to the evidence presented in the preceding chapter, both methods resulted in improving jumping ability; however, there was a difference in the amount of improvement. The increase in jumping ability with ankle weights lacked statistical significance, whereas the increase in jumping ability resulting from the squat jump program with dumbbells

was statistically significant at less than the 1 per cent level of confidence. A comparison of the two methods showed a statistical difference that was significant at the 5 per cent level of confidence in favor of the squat jumping technique.

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