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A comparison of the effectiveness of two methods of training upon the jumping ability of basketball players

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A COMPARISON OF THE EFFECTIVENESS OF TWO METHODS OF TRAINING
UPON THE JUMPING ABILITY OF BASKETBALL PLAYERS

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by

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Chairman

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A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Arts in the Division of
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of the State University of Iowa

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Chapter I
INTRODUCTION

Recent studies indicate that a program of weight training can improve the jumping ability of athletes.

In a study on arm strength in regard to jumping, McCloy states the following:

It should be remembered that arm strength in that case is not only strength of the arms themselves but also strength of the pectoral muscles, the serratus anterior, the latissimus dorsi, and the deltoid. Hence the strength involved is also strength of muscles that swing the arms as well as strength of arms alone.¹

¹ Charles H. McCloy, "The Apparent Importance of Arm Strength in Athletics," Research Quarterly, March, 1934, p. 9.

²
Chui found that after a three-month period of

² Edward Chui, "The Effect of Systematic Weight Training on Athletic Power," Research Quarterly, October, 1950, p. 190.

weight training, twenty-three college men made an average increase of 7.2 cm. in the standing Sargent jump and an average increase of 7.6 cm. in the running Sargent jump.

³
Capen reported that after forty-two college men

³ Edward K. Capen, "The Effect of Systematic Weight Training on Power, Strength, and Endurance," Research Quarterly, May, 1950, p. 87.

had engaged in a program of weight training for a period of

twelve weeks, they improved their performance in a number of events. There was an average increase of 4.6 per cent in strength and of 13.1 per cent in the performance of the standing Sargent jump. There was also an average gain of 10.8 per cent in the standing broad jump.

⁴
Keller found that eight high-school boys, after

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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), p. 15.

participating for eight weeks in a weight-training program, showed an average increase of 278 pounds in strength as measured by the McCloy Strength Test. He further found that after taking part in a weight-training program and in a high-jumping program for three weeks, the subjects showed an average increase of 3.50 inches in the heights jumped.

⁵
Garth found that nineteen college basketball

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Richard 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), p. 11.

players, after undergoing a systematic weight-training and jumping-exercise program for a period of six weeks, 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.

The studies listed above indicate that an increase in jumping ability can be accomplished by increasing the individual's strength through a program of weight training.

Statement of Problem

In this study, the effect of a program of jumping exercises was compared with the effect of a program of weight-training exercises upon the jumping ability of basketball players.

Chapter II

PROCEDURE FOR OBTAINING DATA

Subjects

The twenty-one members of the freshman basketball squad at the State University of Iowa for the season of 1954-55 were used as subjects. A table of random numbers⁶ was used to divide the twenty-one subjects into

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E. F. Lindquist, Statistical Analysis in Educational Research, p. 263.

three groups. Group I, composed of six men, took part in the regular practice routine of the freshman 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 weight-training program in addition to the regular practice routine.

Initial Testing

In order that the subjects might experience a degree of fatigue somewhat similar to that experienced in a game, they were required to pedal a bicycle ergometer for five minutes at a rate to produce 1,000 kg.-m. of work a minute. The brakefield current of the bicycle

was set at 30 m.-amp. to afford a standard resistance for all the subjects. Each subject then executed ten jumps, five times reaching with the left hand and five times reaching with the right hand as high as possible on a calibrated blackboard which was attached to the basketball backboard. The subject was allowed to assume a position as far from the backboard as desired, was restricted to one step or hop prior to the takeoff, and was required to jump from both feet. The test was given on two successive days, and the ten heights jumped each day were recorded.

Jumping-Exercise Program

Beginning with the third week of the basketball season, the six subjects in Group II participated in a jumping-exercise program three times a week for a period of eight weeks, performing the exercises prior to the beginning of the regular basketball practice session. On these occasions they performed a specified number of jumps identical to the jump used in the initial test. The first week of the program they executed ten jumps each night while reaching with their right hands, and ten jumps while reaching with their left hands. Each week thereafter they executed five more jumps while reaching with their right hands,

and five more jumps while reaching with their left hands than they had executed the preceeding week.

Weight-Training Program

Beginning with the third week of the basketball season, the nine subjects in Group III participated in a weight-training program three times a week for a period of eight weeks, performing the exercises prior to the beginning of the regular basketball practice session. The exercises used were the following: (1) Forward Raise, (2) Lateral Raise, (3) Walking Squat, (4) Press, (5) Curl, and (6) Heel Raise. A complete description of these exercises may be found in the Appendix.

For Exercises 1 and 2, dumbbells that could not be lifted twelve times were used. When the subject was able to lift the dumbbells twelve or more times, he was required to use heavier dumbbells for his next exercise period. For Exercises 3 and 6, a barbell with which the subject could perform no more than twenty executions was used. When this number of executions was exceeded, weight was added. For Exercises 4 and 5, a barbell which the subject could not lift more than twelve times was used, and the weight was increased when this number was exceeded.

Final Testing

When the eight weeks of the jumping-exercise program and the weight-training program had elapsed, the twenty-one subjects were tested as in the initial testing.

Chapter III

ANALYSIS OF DATA

The differences between the heights attained in the jump-and-reach performances at the beginning and at the end of the experiment were computed for all the subjects. These differences were derived for (1) the maximum heights attained when the subjects reached with their right hands, (2) the maximum heights attained when the subjects reached with their left hands, (3) the average heights attained when the subjects reached with their right hands, and (4) the average heights attained when the subjects reached with their left hands. Table I shows the results of variance analyses of the differences between the heights attained by the three groups in the initial test and in the final test. In each case the analysis of variance resulted in a value which indicated that the differences were the result of random variations.

Table II shows, for the three groups, the mean differences between the initial test and the final test. Tables III to VI show the summaries of the computations for each analysis of variance performed upon the differences between the heights attained in the initial test and in the final test. The heights attained by each subject in the initial test and in the final test appear in the Appendix.

Table I

F Values for Differences between Heights Attained
by Three Groups in Initial and Final Tests

Height Attained	F	Value Required for .05 Level of Confidence
Maximum (right hand)	5.67	19.44
Maximum (left hand)	1.28	3.55
Average (right hand)	1.17	3.55
Average (left hand)	1.31	3.55

Table II

Mean Differences (in.) between Maximum and Average Heights
Attained by Three Groups in Initial and Final Tests

	Maximum		Average	
	Right Hand	Left Hand	Right Hand	Left Hand
Group I	.58	.50	.63	.24
Group II	.58	.83	1.02	.86
Group III	.22	- .06	.19	- .13

Table III
 Summary of Computations for Analysis of Variance for
 Differences between Average Heights of Ten Jumps
 in Initial and Final Tests (Right Hand)

Source of Variation	Sum of Squares	df	Estimate of Variance
Between groups	2.4867	2	1.2434
Within groups	19.1678	18	1.0649
Total	21.6545	20	1.1676

Table IV
 Summary of Computations for Analysis of Variance for
 Differences between Average Heights of Ten Jumps
 in Initial and Final Tests (Left Hand)

Source of Variation	Sum of Squares	df	Estimate of Variance
Between groups	3.5034	2	1.7517
Within groups	24.0647	18	1.3369
Total	27.5681	20	1.3103

Table V
 Summary of Computations for Analysis of Variance for
 Differences between Maximum Heights Attained in
 Initial and Final Tests (Right Hand)

Source of Variation	Sum of Squares	df	Estimate of Variance
Between groups	.60	2	.30
Within groups	30.54	18	1.70
Total	31.14	20	5.67

Table VI

Summary of Computations for Analysis of Variance for
 Differences between Maximum Heights Attained
 Initial and Final Tests (Left Hand)

Source of Variation	Sum of Squares	df	Estimate of Variance
Between groups	3.06	2	1.53
Within groups	21.55	18	1.20
Total	24.57	20	1.28

Discussion of Findings

The results in this experiment are not in accord with those of previous studies in which jumping ability has been reported to improve as a result of weight-training programs. The following points are presented as possible explanations for the absence of statistically significant results in the present investigation:

(1) The subjects in the weight-training group may not have increased their strength because of (a) the irregularity of participation in the weight-training program, (b) the lack of enthusiasm on the part of the subjects in Group III since only that group was required to participate in the weight-training exercises, and (c) the lack of incentive on the part of the subjects since the experiment took place during the basketball season proper rather than during the preliminary season.

(2) The effectiveness of the weight-training program and of the jumping-exercise program may have been nullified by the fatigue which was induced in the subjects before each testing period.

(3) The type of jump employed as the testing device in this study and the types of jumps used in

previous studies may have yielded different results.

(4) The fact that this study was conducted in conjunction with another study in which the same persons were used as subjects may have affected the results of the present investigation.

Chapter IV

SUMMARY

The purpose of this study was to compare the effect of a program of jumping exercises with the effect of a program of weight-training exercises upon the jumping ability of basketball players.

Twenty-one members of the freshman basketball squad at the State University of Iowa were used as subjects. Nine players were placed on a systematic program of weight training for a period of eight weeks. Six players were placed on a systematic program of jumping exercises for eight weeks. Six players served as a control group.

The subjects in each of the three groups were tested before and after the experiment by means of jump-and-reach performances. Variance analyses of the differences in the heights attained in the initial and final tests resulted in values which indicate that the differences were the result of random variations.

In conclusion, neither the program of jumping exercises nor the program of weight-training exercises used in this study proved effective in developing the jumping ability of a group of basketball players.

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APPENDICES

Appendix A
DESCRIPTION OF WEIGHT-TRAINING
EXERCISES USED FOR STUDY

1. Forward Raise

Grasp dumbbell in each hand, and hold dumbbells at sides of body. Then, with forearms extended, raise dumbbells in continuous motion forward and upward to position directly overhead. Slowly return dumbbells forward and downward to starting position.

2. Lateral Raise

Grasp dumbbell in each hand, and hold dumbbells at sides of body. Then, with forearms extended, raise dumbbells in continuous motion sideward and upward to position directly overhead. Slowly return dumbbells sideward and downward to starting position.

3. Walking Squat

With barbell resting on shoulders behind neck, and with one foot approximately twelve inches in front of other foot, execute deep knee bend, and then return to upright position. After each knee bend, step forward with rear foot and execute another knee bend.

4. Press

Place barbell on floor in front of toes. To clean, bend trunk forward and downward, grasp barbell, and lift barbell rapidly to height of upper part of chest. To press, slowly raise barbell above head until forearms are fully extended, and then return barbell to chest. Repeat movements until required number has been completed, and then return barbell to floor.

5. Curl

With reverse grasp hold barbell in front of thighs. Flex forearms slowly until barbell is close to upper part of chest. (The forearms should be fully flexed on the upward movement. The movement should not be aided with a sway or jerk of the body.) Then slowly return barbell to starting position.

6. Heel Raise

Stand with toes and balls of feet resting upon plank two inches in thickness and with heels resting upon floor. With ordinary grasp hold barbell in front of thighs, and raise heels off floor as far as possible, supporting weight upon toes and balls of feet. Then lower heels until they are again in contact with floor.

Appendix B

DATA

Table VII

Maximum Heights (in.) Attained and Averages of Ten
 Heights Attained by Jump-and-Reach Performances
 (Right Hand) in Initial and in Final Tests

Subject	Initial	Maximum Final	Difference	Initial	Average Final	Difference
Group I						
1	122.0	120.5	-1.5	120.65	120.10	- .55
2	120.5	122.0	1.5	119.75	121.60	1.85
3	125.5	128.0	2.5	124.70	126.85	2.15
4	124.5	124.0	- .5	123.90	123.25	- .65
5	126.0	124.5	-1.5	124.65	124.15	- .50
6	121.0	124.0	3.0	120.40	121.90	1.50
Group II						
7	116.0	117.0	1.0	115.10	116.20	1.10
8	126.0	126.5	.5	124.00	125.60	1.60
9	120.5	122.0	1.5	119.95	121.55	1.60
10	130.0	130.5	.5	127.85	129.30	1.45
11	124.0	124.5	.5	122.95	123.40	.45
12	114.5	114.0	- .5	113.25	113.15	- .10
Group III						
13	121.0	121.5	.5	120.25	120.25	0
14	122.5	121.5	-1.0	121.15	120.30	- .85
15	119.0	118.5	- .5	118.50	117.65	- .85
16	117.0	118.0	1.0	116.00	116.70	.70
17	124.0	124.0	0	123.20	123.05	- .15
18	129.5	130.5	1.0	128.95	129.40	.45
19	119.5	121.5	2.0	118.05	120.45	2.40
20	114.0	113.0	-1.0	112.95	112.60	- .35
21	118.0	118.0	0	117.35	117.75	.40

Table VIII

Maximum Heights (in.) Attained and Averages of Ten
 Heights Attained by Jump-and-Reach Performances
 (Left Hand) in Initial and in Final Tests

Subject	Maximum			Average		
	Initial	Final	Difference	Initial	Final	Difference
Group I						
1	121.5	121.0	- .5	120.55	120.25	- .30
2	120.5	121.5	1.0	119.35	120.75	1.40
3	124.0	127.0	3.0	123.60	125.95	2.35
4	124.5	124.0	- .5	123.90	122.55	-1.35
5	125.5	125.5	0	124.60	123.80	- .80
6	121.5	121.5	0	120.75	120.90	.15
Group II						
7	116.0	116.0	0	115.25	115.15	- .10
8	124.0	125.5	1.5	123.00	124.40	1.40
9	120.5	121.5	1.0	119.45	120.85	1.40
10	131.5	131.5	0	129.40	130.85	1.45
11	124.0	125.0	1.0	123.25	123.95	.70
12	114.0	115.5	1.5	113.55	113.85	.30
Group III						
13	121.0	121.0	0	120.75	120.05	- .70
14	122.0	120.5	-1.5	120.90	119.95	- .95
15	119.0	118.5	- .5	118.65	117.50	-1.15
16	117.5	118.0	.5	116.05	116.95	.90
17	123.5	123.0	- .5	122.60	121.55	-1.05
18	131.0	131.0	0	129.55	129.70	.15
19	118.5	121.0	2.5	117.70	120.30	2.60
20	114.0	113.0	-1.0	113.35	112.40	- .95
21	118.0	118.0	0	116.85	116.85	0

Appendix C

WEIGHTS USED IN EXERCISES

Table IX

Weights (lb.) Used by Subjects in Group III at
Beginning and at Conclusion of Experiment

Subject	Forward Raise (1)	Forward Raise (2)	Lateral Raise (1)	Lateral Raise (2)	Walking Squat (1)	Walking Squat (2)
13	10	15	10	15	100	140
14	10	15	10	15	80	110
15	10	15	10	15	80	110
16	10	10	10	10	60	90
17	10	10	10	10	60	100
18	10	20	10	20	80	100
19	10	15	10	15	80	110
20	10	10	10	10	45	60
21	10	15	10	15	60	100

Table X
Weights (lb.) Used by Subjects in Group III at
Beginning and at Conclusion of Experiment

Subject	Press (1)	Press (2)	Curl (1)	Curl (2)	Heel Raise (1)	Heel Raise (2)
13	90	110	60	80	120	140
14	70	80	60	70	110	140
15	60	70	60	70	120	140
16	55	70	45	60	95	130
17	60	70	55	70	110	130
18	60	70	60	75	120	140
19	60	70	60	70	110	140
20	45	60	45	50	110	130
21	60	70	55	70	110	130