THE EFFECT OF WEIGHT TRAINING ON THE JUMPING ABILITY OF HIGH SCHOOL BASKETBALL PLAYERS

Thesis for the Degree of M. A.

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Leslie John Gratton

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THE EFFECT OF WEIGHT TRAINING ON THE JUMPING ABILITY OF HIGH SCHOOL BASKETBALL PLAYERS

By

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A THESIS

Submitted to the School of Graduate Studies of Michigan State University of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

College of Education

1958

THE EFFECT OF WEIGHT TRAINING ON THE JUMPING ABILITY OF HIGH SCHOOL BASKETBALL PLAYERS

STATEMENT OF THE PROBLEM To determine the effects of weight training and free maximal vertical jumping on the jumping ability of high school basketball players.

METHODOLOGY The boys used in this experiment were eight high school basketball players sixteen years of age. Four experimentals were matched on vertical jumping ability with four controls.

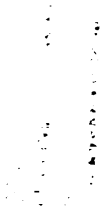
After matching the subjects as to vertical jumping performance one of each pair was randomly selected to become the experimental or, weight training group. This group participated in a weight training program three days per week for a period of six weeks. Both groups took twenty maximal vertical jumps three days per week. Ten jumps were taken with each hand.

SUMMARY AND CONCLUSIONS A comparison of the "t" values for the experimental and control groups shows that each group improved significantly. The mean increase for the experimental group was 2.025 inches, as compared with a mean improvement of 1.25 inches for the control. The mean difference of the two groups is .775 inches. This difference was statistically significant ($t=5.406$, $p=.05$).

On the basis of the evidence presented the following conclusions have been drawn:

1. A program of weight training and maximal vertical jumping improves vertical jumping ability.
2. Free maximal vertical jumping also improves vertical jumping ability.
3. Weight training plus maximal vertical jumping will improve vertical jumping ability more than free jumping alone.

I wish to take this opportunity to acknowledge the guidance and assistance of Dr. Wayne Van Huss in the preparation and completion of this paper.



This paper is dedicated to my mother, Mrs. Isabelle Wagner, without whose early guidance this would not have been possible; and to my wife, Lois, for her faith in my ability.

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

In recent years there has been an increase in interest in the effects of weight training on the performance of athletes. In jumping ability, studies have been completed which reflect significant gains with free vertical jumping and weight training when compared to controls. None of these studies, however, have determined whether the improvements recorded were due to the weight training or the maximal vertical jumping.

I. THE PROBLEM

Statement of the problem To determine the effects of weight training and free maximal vertical jumping on the jumping ability of high school basketball players.

Importance of the study Coaches and physical educators are always striving for new and better training methods. It is hoped that this study will contribute to our knowledge in this area.

In the present study the experimental program did not start until after the Christmas recess so as to

avoid as much confusion as possible with the regular basketball conditioning changes.

II. DEFINITIONS OF TERMS USED

Weight training A program of training in which a systematic program of weight lifting is followed.

Press An exercise in which the barbell is grasped with palms toward the thighs and pulled to the upper chest. It is then pushed to a position where the arms are fully locked overhead; it is then lowered to the chest. This completes one press.

Curl The barbell is grasped with palms away from the thighs and raised to a position across the thighs as the exerciser stands erect. Then it is raised to the sternum by flexing the arms, the barbell moving in an arc as the elbows remain at the sides.

Sideward raise The exerciser should stand in a position of attention with dumbells held at the side, arms straight. Keeping the arms straight and knuckles up, the dumbells are raised directly to the sides in a fullsemi-circular arc until they are fully extended.

Forward raise This exercise is performed in the same manner as the sideward raise with the exception that the arm is raised forward to a position over the head.

Walking squat This exercise is accomplished by placing the barbell in a position across the back of the neck. The exerciser then places one foot in front of the other and lowers his body to a full squat; he then raises his body to a fully extended position, places the other foot forward, and repeats the exercise.

III. LIMITATIONS OF THE STUDY

Possible limitations of this study are:

1. Length of training period only six weeks.
2. Only one age group of boys tested.
3. Inability to control outside activities of boys participating in the study.
4. Unequal motivation of subjects.

CHAPTER II

REVIEW OF THE LITERATURE

Prior to review of the literature the factors involved in the Sargent, or vertical jump were considered. Strength, power, speed of muscular contraction, coordination, and leverage seemed to be the most important. It was with these factors in mind, that the literature was reviewed.

I. LITERATURE PERTINENT TO WEIGHT TRAINING IN ATHLETICS

Weight training is still a young and relatively untried method of athletic training, though it has been recognized for a century as one of the fastest techniques to develop strength. Until recently coaches were afraid to use weights in their training programs, because of a fear of muscle tightness, or muscle boundness. Within the last few years research has shown that weight training apparently does not affect the flexibility of the athlete. Wilkins stated, "the chronic weight lifter is not muscle bound in a sense that his speed of movement is impaired. His speed is as great as that of other students studied

and improves as much or more during a semester of weight training."[1]

Karpovich cites an incident with a former weight lifting champion, and Mr. America, John Grimek. Mr. Grimek and John Davis, another weight lifting champion, were giving demonstrations in weight lifting at Springfield College. Karpovich asked John Grimek to scratch his back between the shoulder blades because, as a boy, he had been told that professional wrestlers and strong-men could not do this simple task. Needless to say Mr. Grimek was able to do this, with either hand, and from above or below the shoulders.[2]

Masley compared three groups, a beginning weight lifting class, a beginning volleyball class, and a sports lecture class, before and after a semester of training. The results did not confirm the contention that weight training contributes to a loss of coordination and speed. Larger increases in speed and coordination resulted from a six weeks course in weight training than from a similar period of volleyball or inactivity.[3]

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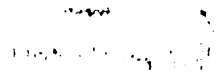
[1]B. M. Wilkins, "The Effect of Weight Training on Speed of Movement," Research Quarterly, 23:361-369 October, 1952.

[2]J. Murray and P. Karpovich, Weight Training in Athletics (New Jersey: Prentice-Hall, 1956), pp. 47-48.

[3]J. W. Masley, A. Hairbedian, and D. N. Donaldson, "Weight Training in Relation to Strength, Speed, and Co-ordination", Research Quarterly, 24: 308-315, October, 1953.



Ouellette found that a weight training program on the quadriceps muscle group had no deleterious effect on sprint running times and that the trend was toward faster times.[4] McCormic investigating the effects of weight training on one hundred yard swimming performance found there were no deleterious effects from the use of weights and that the trend was again toward faster times.[5] Whether this trend toward faster times is related to speed of movement, or to greater endurance as a result of strength is not known. Evidence that weight training does not have a detrimental effect upon the speed of elbow flexion and extension but that it actually increases along with an increase in strength has been shown by John Endres.[6]

Chui reported that weight training had a beneficial effect upon performance tests requiring a combination of speed and strength. In his weight training group, a mean gain of 7.2 cm. in the vertical jump was reported with no losses. In his required physical education group a mean

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[4]R. C. Ouellette, "The Effect of Quadriceps Development on Sprint Running Time", M. A. Thesis, Michigan State University, 1955.

[5]A. McCormic, "The Effects of Progressive Resistance Exercise on the Upper Extremities and Its Effects on One Hundred Yard Swimming Performance", M. A. Thesis, Michigan State University, 1956.

[6]J. P. Endres, "The Effect of Weight Training Exercise Upon the Speed of Muscular Movement", M. S. Thesis, University of Wisconsin.

gain of 3.86 cm. was indicated with a mean loss of 2.14 cm.[7] Capen obtained results similar to Chui's. He showed that both a weight training group and a conditioning group showed an increase in the Sargent jump, but in every case the weight group improved more than the conditioning group.[8]

Potter compared the ten, twenty, and thirty RM progressive resistance exercise programs on strength and hypertrophy. In each program a significant gain in strength was indicated. No statistically significant differences were found between the groups studied in static and dynamic strength decrement or muscle hypertrophy.[9]

McCloy in an early study concerning the importance of arm strength in the Sargent jump, found arm strength and total strength to correlate highly with jumping ability.[10]

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[7]E. Chui, "The Effect of Systematic Weight Training on Athletic Power", Research Quarterly, 21:190, October, 1950.

[8]E. Capen, "The Effect of Systematic Weight Training on Power, Strength, and Endurance", Research Quarterly, 21:87, May, 1950.

[9]D. R. Potter, "The Effects of Ten, Twenty, and Thirty RM Progressive Resistance Exercise Programs on Strength and Hypertrophy", M. A. Thesis, Michigan State University, 1957.

[10]C. H. McCloy, "The Apparent Importance of Arm Strength in Athletics", Research Quarterly, 5:9, March, 1934.

CHAPTER III

METHODOLOGY OF THE STUDY

The present study was undertaken to determine the effects of weight training as contrasted with training improvements based on free vertical jumping.

Subjects The boys used in this experiment were eight high school basketball players approximately sixteen years of age. Four experimentals were matched on vertical jumping ability with four controls. The subjects were matched as closely as possible on body type.

How selected Each member of the team was tested to determine the height to which he could jump from the floor. The average of the six jumps was taken and the boys matched as to height jumped.

How tested Each boy was asked to stand with his toes against the wall and his hands over his head in a relaxed position. The boy was asked not to stretch, but to try and achieve his maximum reach. The reach was recorded in inches. He was then asked to stand beside the wall and jump as high as he could and touch the board located on the wall. Each boy jumped six times, three with his right hand, and three with his left hand. All six jumps were recorded.

The distance jumped was obtained by subtracting the height which each boy could reach standing, from the height he could jump and reach.

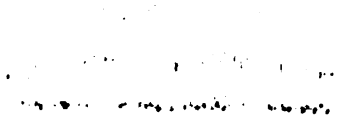
Groups After having matched the subjects as to jumping ability one of each pair was randomly selected to become the experimental group. This group reported to the gym three mornings per week for a period of six weeks to participate in the weight training program. Both groups took twenty maximal vertical jumps three days per week. Ten jumps were taken with the right hand and ten with the left hand.

Equipment Very little equipment was used or needed in this experiment. The following was used:

1. Barbells and weights.
2. Dumbells and weights.
3. Jumping board.

The jumping board was a piece of blackboard, two feet by three feet, with a wooden frame around it. This board was marked off in inches, and hung on the wall. The bottom of the board was located seven feet from the floor.

Weight training program The program consisted of five basic weight lifting exercises. The first exercise was the press; each boy was asked to press the maximum amount of weight that he could while making seven repetitions. After reducing the amount of weight to approximately 80 per cent of the maximum he could press seven



times, he then repeated the exercise pressing the weight fifteen times. As he grew stronger the amount of weight in every case was increased. When he was able to press his maximum ten times, the maximum was then increased to where he could only press it seven times. When twenty repetitions were reached in the second set the weight here was also increased. The second exercise performed was the curl; again the student was asked to curl the maximum weight he could curl seven times. He then reduced the weight to about 80 per cent of his maximum for seven times, and repeated the exercise fifteen times. The same criteria for increasing the amount of weight lifted, that applied to the press, also applies here. The third exercise was the sideward raise. This exercise was performed with the maximum amount of weight the boy could raise ten times. When he reached thirteen repetitions the weight was increased. The fourth exercise, the forward raise, was performed exactly like the sideward raise in regard to the number of times weight lifted, and to increasing the weight. The fifth and last exercise was the walking squat. In this exercise the boy did twenty walking squats under maximum load. When he could do twenty-five the load was increased. In addition to this program, each boy in the experimental group, made a total of twenty jumps for maximum height. Ten of these twenty jumps were made with the right hand and ten with the left, and were always done on the same

day they lifted weights. This made a total of sixty jumps a week.

The amount of weight lifted at each session was recorded for the experimental group. The height jumped on the first, fifth, and tenth jumps were recorded for both groups.

Statistical analysis The data was tabulated and statistically analyzed using the "t" test. Comparisons were made between groups, and from the start to the end of the testing programs.

CHAPTER IV

ANALYSIS OF DATA

The purpose of this study was to determine the effect of a weight training program on vertical jumping ability. Using the Sargent Jump Test, to determine the height from the floor each boy on the basketball team could jump, four matched pairs were selected for the experiment. One boy from each pair was placed on a weight program. This program consisted of seven weight lifting exercises which were performed three times per week. In addition they also took ten vertical jumps with each hand three times per week. The control group had only to jump ten times with each hand three times per week. This program was carried on for a period of six weeks with the following results.

Presentation of data Table I shows the amount of weight lifted, for each exercise, the first week of the experiment. It also shows the final weight each boy was capable of handling at the end of the six weeks period.

TABLE I

INITIAL TO FINAL: WEIGHTS LIFTED (LBS.)

Exercises	EXPERIMENTAL SUBJECTS							
	Ca		Br		Fo		Ed	
	I	F	I	F	I	F	I	F
Press Max.	85	135	75	100	75	105	65	85
Press 80%	75	105	70	85	65	85	50	65
Curl Max.	65	105	65	80	60	95	55	65
Curl 80%	60	90	50	70	50	85	50	60
Side Raise	23	30.5	15.5	25.5	15.5	30.5	13.5	18
Front Raise	23	30.5	15.5	25.5	15.5	30.5	13.5	18
Walk. Squat	105	135	90	120	90	110	80	85

I=Initial Test F=Final Test

Discussion A comparison of the "t" values for the experimental and control groups shows that each group improved significantly. The mean increase for the experimental group was 2.025 inches, as compared with a mean improvement of 1.25 inches for the control. The mean difference of the two groups is .775 inches. This difference was statistically significant ($t=5.406$, $p=.05$).

On the evidence presented it is safe to state:

1. A program of weight training and jumping will improve

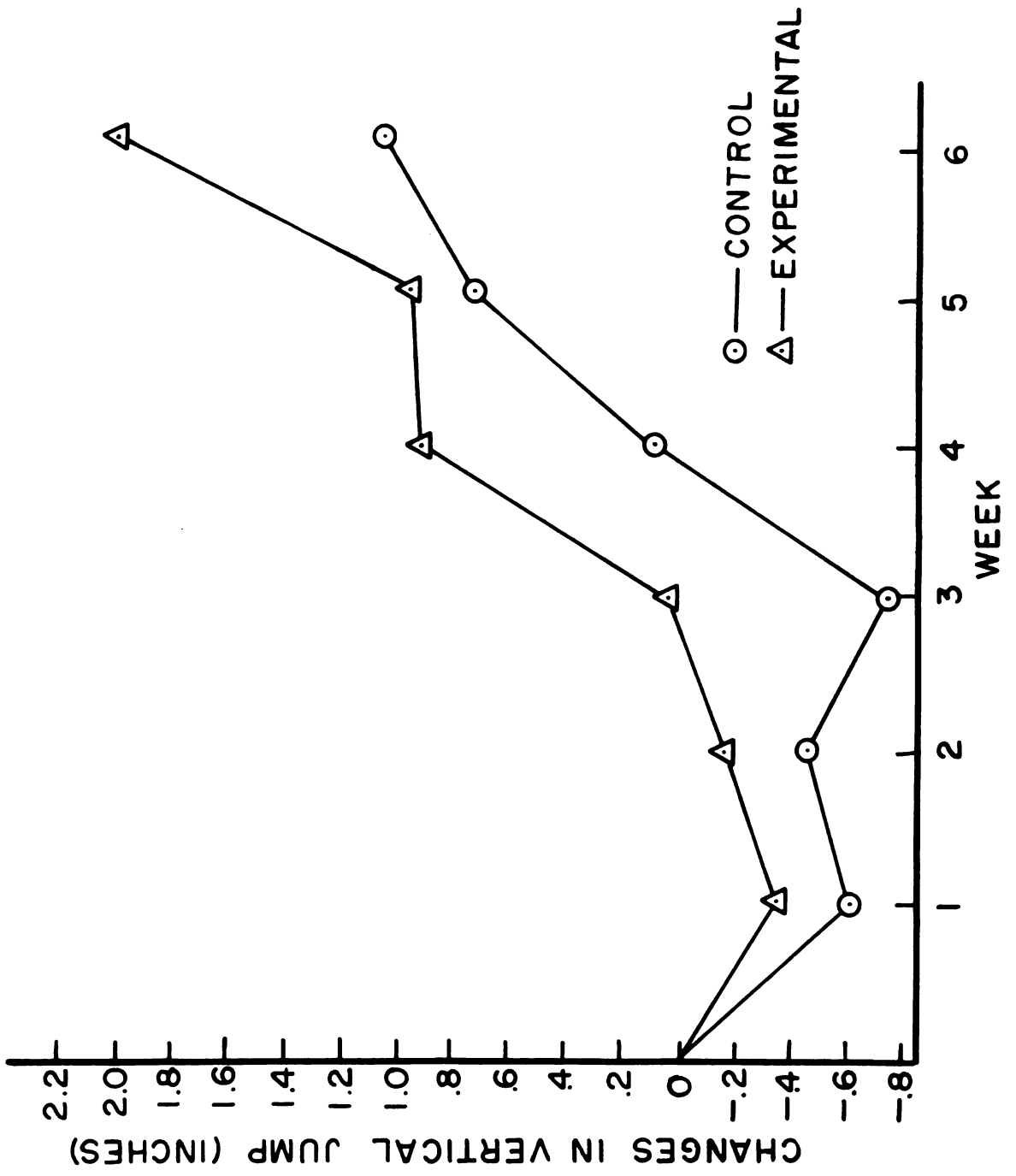
vertical jumping ability. 2. Free jumping will also improve vertical jumping ability. 3. Weight training and jumping will improve vertical jumping ability more than free jumping alone.

TABLE II

VERTICAL JUMPING: INITIAL TO FINAL

Control Group				Experimental Group			
	Initial (in.)	Final (in.)	Increase (in.)		Initial (in.)	Final (in.)	Increase (in.)
Cat	21.0	22.6	1.6	Fo	21.0	23.0	2.0
Ne	22.0	23.5	1.5	Ca	22.0	24.5	2.5
Bi	22.6	23.6	1.0	Br	22.6	24.6	2.0
Ma	22.8	23.7	.9	Ed	22.8	24.4	1.6
		M	1.25*			M	2.02*

*The improvements of both groups were statistically significant. (control: t=7.12, p=.01: experimental: t=10.99, p=.01)


CHANGES IN VERTICAL JUMP (INCHES)
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
-.2
-.4
-.6
-.8
1
2
3
4
5
6
WEEK
CONTROL
EXPERIMENTAL

CHAPTER V

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

Summary This study was undertaken to determine the effect of a six weeks weight training program on the jumping ability of high school basketball players. To conduct the experiment, pairs of subjects, matched on vertical jumping ability were selected to participate in the experiment. The study was conducted the last six weeks of the season so as to reduce the possibility of early season conditioning being a factor in the final results. The experimental group was placed on a weight program consisting of seven basic weight lifting exercises plus ten vertical jumps with each hand. At the end of the six weeks period all subjects were retested to determine the amount of increase from the first to the sixth weeks. The improvement in vertical jumping ability was statistically significant for both groups (Control: $t=7.12$, $p=.01$; Experimental: $t=10.99$, $p=.01$). The difference between groups (.775 inches greater for the experimental group) was also statistically significant ($t=5.406$, $p=.05$).

Conclusions

1. A program of weight training and maximal vertical jumping improves vertical jumping ability.

2. Maximal vertical jumping also improves vertical jumping ability.

3. Weight training plus maximal vertical jumping improves vertical jumping ability significantly more than just maximal vertical jumping.

Recommendations

1. Conduct this experiment again for a longer period of time, possibly twelve weeks to determine if jumping ability will continue to improve as long as this program is followed.

2. This program could also be conducted with college players to see if the same results could be obtained with a different age group.

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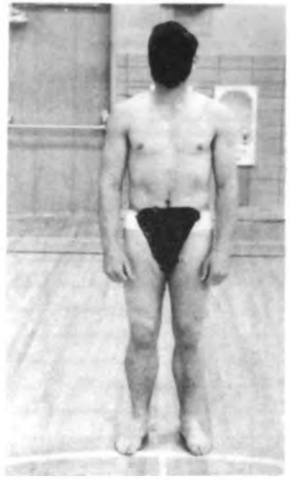
APPENDIX



Ca - exp.
Matched With
M. - control

Fa - exp.
Matched With
Cat - control

Br - exp.
Matched With
Bi - control

Ed - exp
Matched With
Mi - control

MICHIGAN STATE UNIVERSITY
DEPARTMENT OF HEALTH, PHYSICAL EDUCATION, AND RECREATION

GRADUATE STUDIES AND RESEARCH

TABULATION SHEET

DATE OF TABULATION _____

TOPIC Day by Day Tabulation of Height Jumped

TABULATED BY Leslie Gratton

Eugene Catlin	Right 1st	Hand 5th	10th		Left 1st	Hand 5th	10th			Dan	Nestor	Right 1st	Hand 5th	10th		Left 1st	Hand 5th	10th			
1	9'1"	9'2"	9'2"		9'2"	9'2"	9'3"					9'3"	9'1½"	9'2½"		9'1"	9'1½"	9'1½"			1
2	9'1"	9'2"	9'2½"		9'1"	9'1"	9'1"					9'3½"	9'1"	9'1½"		9'2"	9'1½"	9'2"			2
3	9'1"	9'2½"	9'2"		9'2"	9'1"	9'1"					9'2"	9'1½"	9'2"		9'2"	9'2"	9'1½"			3
4	9'1"	9'2"	9'1"		9'1"	9'1"	9'1½"					9'2"	9'1½"	9'1"		9'2"	9'2"	9'2"			4
5	9'3"	9'2"	9'2"		9'2"	9'1"	9'1½"					9'2"	9'1"	9'1½"		9'1"	9'2"	9'2"			5
6	9'1"	9'1"	9'1"		9'1"	9'1½"	9'1½"					9'2½"	9'2½"	9'2½"		9'2½"	9'2"	9'2"			6
7	9'2"	9'3½"	9'2½"		9'2½"	9'2"	9'1"					9'2½"	9'2"	9'1½"		9'2½"	9'2"	9'2½"			7
8	9'2½"	9'2"	9'2"		9'2"	9'2"	9'1"					9'2"	9'2"	9'1½"		9'2"	9'2"	9'2"			8
9	9'1"	9'1"	9'1½"		9'1"	9'0"	9'0"					9'1½"	9'2"	9'1½"		9'2"	9'2"	9'1½"			9
10	9'1½"	9'3"	9'2"		9'1"	9'0"	9'1½"					9'2½"	9'2"	9'2"		9'2"	9'2"	9'2½"			10
11	9'3½"	9'3"	9'3"		9'2"	9'2"	9'1"					9'2"	9'2"	9'2"		9'2½"	9'2"	9'2"			11
12	9'1"	9'1"	9'1"		9'1"	9'1"	9'1"					9'2½"	9'2"	9'2½"		9'2½"	9'2"	9'2½"			12
13	9'1"	9'2"	9'1"		9'1½"	9'1"	9'1"					9'3"	9'2½"	9'2½"		9'3"	9'2"	9'2½"			13
14	9'1"	9'2"	9'2"		9'2½	9'1½"	9'2"					9'2"	9'1"	9'1"		9'2½"	9'2"	9'2"			14
15	9'5"	9'4½"	9'3"		9'3"	9'2"	9'3"					9'3"	9'2½"	9'3"		9'4½"	9'3"	9'4"			15
16	9'2½"	9'3"	9'2"		9'0"	9'1½"	9'1"					9'2"	9'4"	9'2"		9'3½"	9'3½"	9'3"			16
17	9'3"	9'3"	9'2½"		9'2"	9'1½"	9'2"					9'3"	9'3½"	9'2½"		9'3"	9'3½"	9'3½"			17
18	9'4"	9'4"	9'4½"		9'3"	9'3"	9'3"					9'4"	9'4½"	9'3½"		9'3"	9'3"	9'3"			18
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	Jim Cameron Right Hand 1st	Right Hand 5th	Right Hand 10th		Left Hand 1st	Left Hand 5th	Left Hand 10th			Gary Brantley Right Hand 1st	Right Hand 5th	Right Hand 10th		Left Hand 1st	Left Hand 5th	Left Hand 10th			
1	9'3"	9'2"	9'2"		9'2"	9'2"	9'1"			9'3"	9'3"	9'3"		9'3"	9'3"	9'4"			1
2	9'2"	9'3"	9'2½"		9'1"	9'1"	9'1"			9'2½"	9'3"	9'3"		9'2"	9'2½"	9'3"			2
3	9'3"	9'2½"	9'3"		9'2"	9'1"	9'1½"			9'3"	9'2½"	9'3"		9'1½"	9'2½"	9'1"			3
4	9'4"	9'1"	9'1"		9'1"	9'1"	9'1"			9'2"	9'3"	9'2½"		9'1"	9'1½"	9'1"			4
5	9'4½"	9'4"	9'3½"		9'2½"	9'3"	9'2"			9'3"	9'3½"	9'2½"		9'1½"	9'2"	9'2"			5
6	9'3½"	9'3½"	9'1½"		9'1½"	9'1"	9'1"			9'4"	9'3"	9'3"		9'2"	9'2½"	9'2"			6
7	9'2"	9'2"	9'2"		9'3"	9'1½"	9'3"			9'3"	9'3"	9'2"		9'2"	9'2½"	9'0"			7
8	9'4"	9'2"	9'3"		9'2"	9'2"	9'2½"			9'3½"	9'3"	9'2"		9'1"	9'2"	9'2"			8
9	9'3"	9'3½"	9'3"		9'2½"	9'2"	9'4"			9'3"	9'3"	9'2"		9'2"	9'2"	9'2"			9
10	9'4½"	9'3½"	9'3½"		9'3"	9'3"	9'3½"			9'4"	9'4"	9'3"		9'3"	9'3"	9'1"			10
11	9'2"	9'3½"	9'4"		9'3"	9'3"	9'2½"			9'4"	9'4½"	9'3½"		9'3"	9'3"	9'3"			11
12	9'4½"	9'4½"	9'3½"		9'3½"	9'3"	9'2"			9'4½"	9'4"	9'3"		9'2½"	9'3"	9'2"			12
13	9'3½"	9'3½"	9'4"		9'2"	9'2"	9'3½"			9'4"	9'3"	9'3"		9'2"	9'2½"	9'2"			13
14	9'5-"	9'4"	9'5-"		9'3"	9'2½"	9'2"			9'2"	9'3"	9'3"		9'2"	9'3"	9'1"			14
15	9'5-"	9'5-"	9'3½"		9'2½"	9'3½"	9'3"			9'3½"	9'3"	9'2"		9'3-"	9'4½"	9'3½"			15
16	9'4"	9'3"	9'4½"		9'3"	9'3"	9'2½"			9'5-"	9'4½"	9'4"		9'4"	9'3"	9'3"			16
17	9'3½"	9'4"	9'2½"		9'3"	9'2"	9'3½"			9'6"	9'4½"	9'4"		9'4"	9'3"	9'3"			17
18	9'4½"	9'4½"	9'5-"		9'4"	9'5-"	9'4"			9'4½"	9'5-"	9'5-"		9'5½"	9'5½"	9'5-"			18
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TABULATED BY Leslie Grathon

Jim Fox	Right 1st	Hand 5th	10th		Left 1st	Hand 5th	10th			Doug	Eddy	Right 1st	Hand 5th	10th		Left 1st	Hand 5th	10th			
1	9'1"	9'1½"	9'1"		9'1"	9'1½"	9'0"					9'2½"	9'1"	9'1"		9'3"	9'3½"	9'3"			1
2	9'1"	9'2"	9'2"		9'1"	9'1½	9'1½					9'1"	9'1½"	9'1½"		9'2"	9'2"	9'1½"			2
3	9'1"	9'1"	9'1½"		9'0"	9'1½"	9'1"					9'2"	9'1"	9'2"		9'3"	9'1"	9'3"			3
4	9'3"	9'1½"	9'2"		9'1"	9'1½"	9'1½"					9'1"	9'1½"	9'1½"		9'1"	9'3"	9'2"			4
5	9'3"	9'2"	9'2"		9'1"	9'1"	9'1"					9'3"	9'3"	9'2"		9'2"	9'2"	9'2"			5
6	9'1"	9'1"	9'1"		9'1"	9'0"	9'1"					9'2"	9'1½"	9'2½"		9'3"	9'2½"	9'1½"			6
7	9'2"	9'2"	9'0"		9'0"	9'1"	9'1"					9'2½"	9'2"	9'2"		9'2"	9'3"	9'2"			7
8	9'2"	9'2½"	9'1"		9'1"	9'1"	9'1"					9'2"	9'2"	9'1"		9'2"	9'2"	9'2"			8
9	9'3"	9'2½"	9'1½"		9'1"	9'2"	9'1½"					9'1"	9'2"	9'1½"		9'1½"	9'2"	9'1"			9
10	9'2"	9'2"	9'2"		9'2"	9'2"	9'1½"					9'2"	9'2½"	9'1½"		9'1½"	9'2"	9'1½"			10
11	9'2"	9'1"	9'1"		9'2"	9'1½"	9'1½"					9'4"	9'3"	9'3"		9'2"	9'4"	9'2½"			11
12	9'2"	9'2½	9'2"		9'2"	9'1½"	9'1½"					9'4"	9'3½"	9'3"		9'3"	9'4"	9'3"			12
13	9'1"	9'1½"	9'0"		9'1½"	9'1½"	9'1"					9'3"	9'2½"	9'2"		9'2"	9'2½"	9'2"			13
14	9'3"	9'2"	9'4"		9'2"	9'2"	9'2"					9'3"	9'3"	9'2"		9'3"	9'2½"	9'4"			14
15	9'3"	9'2"	9'1½"		9'2½"	9'1½"	9'1½"					9'3"	9'2½"	9'3"		9'3"	9'3½"	9'3"			15
16	9'3"	9'2½"	9'2"		9'2"	9'2"	9'1"					9'3½"	9'2"	9'3"		9'3"	9'3"	9'3"			16
17	9'3"	9'3"	9'2½"		9'2"	9'2"	9'3"					9'2½"	9'2"	9'2"		9'3"	9'3"	9'2½"			17
18	9'3"	9'3"	9'4"		9'2½"	9'2½"	9'3"					9'4"	9'3½"	9'3½"		9'4"	9'4½"	9'4"			18
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TABULATED BY Leslie Gratton

Phil Bigelow	Right Hand 1 ST	Right Hand 5 TH	Right Hand 10 TH		Left Hand 1 ST	Left Hand 5 TH	Left Hand 10 TH			Bob Mann	Right Hand 1 ST	Right Hand 5 TH	Right Hand 10 TH		Left Hand 1 ST	Left Hand 5 TH	Left Hand 10 TH			
1	9'1"	9'1"	9'1½"		9'1"	9'1"	9'1"				9'3"	9'3"	9'3"		9'4"	9'4"	9'3"			1
2	9'0"	9'1"	9'1"		9'0"	9'0"	9'1½"				9'3"	9'3½"	9'4"		9'3"	9'2"	9'3½"			2
3	9'0"	9'1"	9'1"		9'1"	9'1½"	9'1"				9'3½"	9'4"	9'2"		9'3"	9'3"	9'3½"			3
4	9'1"	9'1½"	9'1½"		9'1"	9'1½"	9'1"				9'3½"	9'3"	9'3"		9'3"	9'4"	9'3"			4
5	9'1"	9'2"	9'1"		9'1"	9'1"	9'1½"				9'2"	9'2"	9'2"		9'1"	9'2"	9'2"			5
6	9'0"	9'1"	9'1½"		9'1"	9'1"	9'0"				9'3"	9'3"	9'4"		9'4"	9'3"	9'3"			6
7	9'0"	9'1"	9'2"		9'1½"	9'1"	9'1"				9'3"	9'3"	9'2"		9'3½"	9'3"	9'3"			7
8	9'1"	9'1"	9'1"		8'11"	9'1"	9'0"				9'3"	9'3"	9'2"		9'3½"	9'3"	9'2½"			8
9	9'2½"	9'1"	9'2"		9'1"	9'2"	9'2"				9'2"	9'2½"	9'2"		9'3"	9'2"	9'2"			9
10	9'1"	9'1½"	9'1"		9'2"	9'1½"	9'2"				9'2"	9'2"	9'1½"		9'3"	9'3"	9'2"			10
11	9'2"	9'2"	9'2"		9'2½"	9'2"	9'2½"				9'3"	9'2"	9'2½"		9'4"	9'4"	9'3½"			11
12	9'1"	9'3"	9'4"		9'2"	9'1½"	9'3"				9'3"	9'4"	9'3"		9'5"	9'4"	9'3"			12
13	9'2"	9'2"	9'1½"		9'2"	9'2"	9'2"				9'3½"	9'3"	9'3"		9'4½"	9'3½"	9'3"			13
14	9'0"	9'1½"	9'0"		9'2"	9'1½"	9'2"				9'3"	9'3½"	9'4"		9'4"	9'3½"	9'3"			14
15	9'1½"	9'1"	9'0"		9'2"	9'2½"	9'2"				9'4"	9'3½"	9'3"		9'5"	9'4"	9'4"			15
16	9'2"	9'2"	9'1"		9'2"	9'1½"	9'1½"				9'3"	9'3½"	9'2½"		9'4½"	9'2½"	9'3"			16
17	9'1"	9'0"	9'1½"		9'1"	9'2"	9'1"				9'3"	9'3½"	9'3"		9'4½"	9'3-½"	9'4"			17
18	9'2"	9'1½"	9'2"		9'2"	9'3"	9'2½"				9'4"	9'4"	9'4"		9'4½"	9'4½"	9'4½"			18
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TABULATED BY Leslie Gratton

	Doug Eddy	Press Max.	Press 80%	Curl Max.	Curl 80%	Forward Raise	Sideward Raise	Walking Squat				Jim Fox	Press Max.	Press 80%	Curl Max	Curl 80%	Forward Raise	Sideward Raise	Walking Squat			
1		65	50	55	50	13½	13½	80				1	75	65	60	50	15½	15½	90			1
2		65	50	55	50	13½	13½	80				2	75	65	60	50	15½	15½	90			2
3		70	55	55	50	15½	15½	80				3	75	65	60	50	15½	15½	90			3
4		70	55	55	50	15½	15½	80				4	75	65	60	50	15½	15½	90			4
5		70	55	55	50	15½	15½	80				5	80	70	75	70	23	23	95			5
6		70	55	60	50	15½	15½	80				6	80	70	75	70	23	23	95			6
7		75	55	60	50	15½	15½	80				7	90	80	80	75	23	23	95			7
8		75	55	60	55	15½	15½	80				8	90	80	80	75	23	23	95			8
9		75	55	60	55	15½	15½	80				9	90	80	80	75	25½	25½	95			9
10		75	55	60	55	15½	15½	80				10	90	80	80	75	25½	25½	95			10
11		75	55	60	55	15½	15½	80				11	90	80	80	75	25½	25½	105			11
12		75	55	60	55	15½	15½	80				12	90	80	80	75	25½	25½	105			12
13		80	60	60	55	18	18	80				13	100	85	90	80	25½	25½	105			13
14		80	60	65	60	18	18	85				14	100	85	90	80	28	28	105			14
15		80	60	65	60	18	18	85				15	105	85	90	80	28	28	105			15
16		85	65	65	60	18	18	85				16	105	85	95	85	28	28	110			16
17		85	65	65	60	18	18	85				17	105	85	95	85	30½	30½	110			17
18	Jim Cameron											Crazy Brantley										18
19		85	75	65	60	23	23	105				19	75	70	65	50	15½	15½	90			19
20		105	85	65	60	25½	25½	105				20	80	70	65	50	18	18	90			20
21		105	85	70	65	25½	25½	105				21	85	70	65	55	20½	20½	90			21
22		105	85	70	65	25½	25½	105				22	85	70	65	55	20½	20½	90			22
23		115	90	80	70	28	28	115				23	85	70	65	55	20½	20½	90			23
24		115	90	80	70	28	28	115				24	85	75	65	55	20½	20½	95			24
25		125	90	80	70	28	28	115				25	90	75	70	60	20½	20½	95			25
26		125	90	80	70	30½	30½	115				26	90	75	70	60	20½	20½	100			26
27		125	90	90	80	30½	30½	115				27	90	75	70	60	20½	20½	100			27
28		125	105	90	80	30½	30½	115				28	90	75	70	60	20½	20½	110			28
29		125	105	105	90	30½	30½	115				29	90	75	70	60	20½	20½	110			29
30		125	105	105	90	30½	30½	115				30	95	80	75	65	25½	25½	115			30
31		130	105	105	90	30½	30½	130				31	95	80	75	65	25½	25½	115			31
32		135	105	105	90	30½	30½	135				32	95	80	75	65	25½	25½	115			32
33		135	105	105	90	30½	30½	135				33	100	85	80	70	25½	25½	120			33
34		135	105	105	90	30½	30½	135				34	100	85	80	70	25½	25½	120			34
35		135	105	105	90	30½	30½	135				35	100	85	80	70	25½	25½	120			35