1967

Effect of Overload on the Accuracy of Throwing a Football

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EFFECT OF OVERLOAD ON THE ACCURACY OF THROWING A FOOTBALL

(TITLE)

BY

RICHARD HOPEK

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTER OF SCIENCE IN EDUCATION

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1967
YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

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DATE

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28 July 1967
DATE

DEPARTMENT HEAD

ACKNOWLEDGMENTS

The writer wishes to express his sincere appreciation to Dr. Maynard O'Brien, Dr. Walter Lowell, Dr. Robert Carey and Dr. M. Thomas Woodall for their valuable guidance, supervision and assistance in the completion of this study.

The writer also expresses his gratitude to the students who gave of their time and effort in making this study possible.

R.W.H.

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CHAPTER I

INTRODUCTION

Football coaches around the country have been searching for a method of training or developing an accurate passing quarterback for years.

With today's brand of football becoming more and more complex on both offense and defense, the modern football coach must find a better than average quarterback; and/or hope that he will develop with practice and experience if his teams are to be consistent winners.

If such a boy is not found, it is highly probable that the entire offense of the team will be geared to a running type game, where the offensive team must grind out the yardage little by little if it is to score. Taking this into account, we can assume that this will give the advantage to the defense, knowing ahead of time that the opponent's passing game is inadequate to worry too much about. We see, in the words of a famous "Big Ten" coach, Woody Hayes of Ohio State University, "... you just have to have the horses to sustain a solid running game; if not, you must be able to throw the ball with a fairly high degree of accuracy if you are to stand a decent chance of winning."[1]

We find such college coaches as "Bear" Bryant of Alabama, Darrell Royal of Texas, Bobby Dodd of Georgia Tech, and many others who have been

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[1]Glenn "Tiger" Ellison, Run and Shoot Football: Offense of the Future (West Nyack, N.Y.: Parker Publishing Company, Inc., 1965), p. 183.

blessed with fine young passing quarterbacks year after year. Unfortunately, the high school coach can't go out and recruit boys for his team; and likewise, the small college coach is usually unable to recruit the top boys to fill the needs of his team. The majority of time, they must develop a boy who, in most cases, has done very little passing or is very inexperienced.

It has been noted that in order to try to develop greater accuracy and distance in throwing, baseball coaches have had their players throwing overweighted balls very similar to those being used in a game, with the exception that they weigh more than a regulation ball. The weighted balls have been employed while warming up prior to doing any throwing in practice.[1]

Because of the apparent lack of knowledge of a reliable method of training which would improve accuracy in passing a football, the writer was prompted to conduct a study to investigate the possibility of employing the principle of overload (weighted football) over an extended period of time (training period) to improve the accuracy of throwing a football.

Statement of the Problem

The purpose of the study was to determine the effect of passing a weighted football, used during a training period, on the accuracy of throwing a regulation football.

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[1]William D. Bostwick, "The Effect of Weight Training on Speed and Endurance in Baseball Pitching," (unpublished Master's thesis, University of Illinois, Champaign, 1961), pp. 28-30.

Limitations of the Study

The results and conclusions of this study were limited by the number of subjects being used in the study. The study was also limited in that only subjects who had been quarterbacks, halfbacks, or fullbacks, who had some experience in passing a football in high school or college, were involved in the study. The length of time allotted for the study was a limiting factor, in that all subjects were to be involved in spring football drills starting April 10, 1967.

Definition of Terms

Passing. Passing is the throwing of a football with an overhand throw.

Overload. Overload is a load in excess of the normal load.[1]

Overload principle. The periodic demand on the organism that must be made progressively greater, and must always be greater than the current regular demand.[2]

t ratios. Units of statistical measurement used in the study to represent gains in analyzing experimental and control group results.

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[1]Noah Webster, Webster's New Twentieth Century Dictionary of the English Language (New York, 1956), p. 1192.

[2]Charles H. McCloy, "Adequate Overload," Journal of Health, Physical Education and Recreation, XLII, (March & April, 1945), p. 69.

CHAPTER II

REVIEW OF LITERATURE

Resource material which was available to the writer has revealed that very little experimentation has been done in the area of testing the application of the overload principle in throwing over an extended period of time. A number of studies have been conducted utilizing overload in warm-up, but none could be found that involved a training period.

In the study by Van Huss, Albrecht, Nelson and Hagerman,[1] concerned with overload warm-up on the velocity and accuracy of throwing a baseball, fifty members of the freshman baseball team took part with each subject acting as his own control. The subjects warmed up in their usual manner. Ten maximal throws were then taken with a regulation baseball (five ounces). The speed and accuracy of these throws was measured. After a ten-minute rest period, the subjects took the overload warm-up which consisted of fifteen throws with gradually increased velocity followed by ten maximal throws with an 11-ounce baseball. The speed and accuracy of ten additional throws with a regulation baseball were measured immediately following the overload warm-up. The test throws were measured using a chronoscope calibrated to 1/1,000 of a second, while throwing accuracy was determined from the ball's

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[1]W. D. Van Huss, L. Albrecht, R. Nelson, and R. Hagerman, "Effect of Overload Warm-up on the Velocity and Accuracy of Throwing," Research Quarterly XXXIII, (October, 1962), pp. 472-75.

contact with the target. At the conclusion of the study it was indicated that not only were the subjects throwing faster, but accuracy was improving as well.

Calvin[1] in his study used two groups of high school boys. The experimental group trained with weights for four months, three times per week, one hour per session. The control group participated in general physical education activities for the same amount of time. Both groups were tested before and after the training period to measure accuracy of movement. A target, painted on a canvas backdrop, with circles 1, 2, 3, 4, and 5 feet in diameter, was used. The subjects threw regulation baseballs ten times from a distance of 30 feet. The scores for hits were recorded and totaled. Calvin concluded that progressive resistive exercises (weight training) tended to affect favorably the throwing accuracy of high school boys.

Miner[2] conducted a study on the effect of weight training on the throwing power of eighteen baseball candidates of high school age. He used two different training methods over the 14-day period to determine what effect this training would have on the ability of subjects to increase their velocity of throwing a regulation size baseball accurately a distance of 100 feet at a target ten feet square. One group trained on four-, and later eight-pound barbells, using the simulated throwing motion. The other

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[1]Sidney Calvin, "Effect of Progressive Resistive Exercises on the Motor Coordination of Boys," Research Quarterly XXX, (December, 1959), pp. 395-99.

[2]Donald L. Miner, "The Effect of Weight Training on the Throwing Power of High School Baseball Players," (unpublished Master's thesis, University of Iowa, Iowa City, 1956), pp. 33-38.

experimental group used a 3½-pound weighted ball throwing it a number of specified times each practice session. Miner found that the weighted ball group was superior to the control group at the ten percent level of confidence. He found little correlation between the strength of the thrower and the velocity of the thrown ball.

Wall[1] in his article stated that his javelin throwers go through the same motion while using the lat machine (device of pulleys and weights with a handle on the end of the cable which is connected to the weights) as they do in the actual throwing of the javelin. He stated that not only was there a marked improvement in added distance, but also in the control of the javelin.

Smith and Harrison[2] in their study on the comparison upon speed and accuracy of performing a simple eye-hand coordinated task used six different groups composed of ten male students. Each subject was given a one-minute speed test-retest on a three-hole stylus punchboard. Five of the groups received different types of practice between the tests, while the sixth group acted as a control group and went through the actual motion of the task, without using the stylus or punchboard for practice. The writers concluded that only the increase of both speed and accuracy were of significance in the motor practice (actual practice with stylus on the target) and control groups.

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[1]Robert Wall, "The Lat Machine; Friend of the Javelin Thrower," Athletic Journal, XLVI, (December, 1965), pp. 22-24, 28.

[2]L. Smith and John Harrison, "Comparison of the Effects of Visual, Motor, Mental, and Guided Practice upon Speed and Accuracy of Performing a Simple Eye-Hand Coordination Task," Research Quarterly, XXXIII, (May, 1962), pp. 299-307.

Some studies seemed to support the idea that there was no benefit gained in using weighted objects for training or warm-up. Egstrom, Logan, and Wallis[1] concluded, in their study dealing with the acquisition of throwing skills involving projectiles of varying weights, that the group of subjects which used the lighter ball and then transferred to the heavy ball showed a marked improvement in accuracy as compared to the group of subjects that threw with the heavy ball and then threw the lighter ball. The subjects in the study were using their non-preferred hand only. Although the light ball group showed more improvement than the heavy ball group did, it was noted that both groups made significant gains.

Miller[2] conducted a study on the effect of instruction upon development of throwing for accuracy of first grade children. Two experimental groups and two control groups, composed of boys and girls respectively, were studied to see to what extent instruction in the overhand throw for accuracy is practicable. Each group received 26 twenty-minute periods of instruction in throwing or practice in games using a ball. Each group was tested five times. The results indicated no statistically significant differences between the mean gains of the experimental and control groups for either boys or girls. However, the experimental groups did have consistently higher mean gains for all test periods.

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[1]Glen H. Egstrom, Gene A. Logan, and Earl L. Wallis, "Acquisition of Throwing Skills Involving Projectiles of Varying Weights," Research Quarterly, XXXI, (October, 1960), pp. 420-25.

[2]James L. Miller, "Effect of Instruction on Development of Throwing for Accuracy of First Grade Children," Research Quarterly, XXVIII, (May, 1957), pp. 132-37.

Skubic and Hodgkins[1] in their study on effect of warm-up on speed, strength and accuracy used three groups of women physical education majors at the University of California. Each subject took related warm-up exercises immediately before each testing period. A regulation baseball was used for each test during the twelve weeks of the study. From the results of the study, the following conclusion was made: Related warm-up, performed immediately before each test failed to reveal any appreciable improvement in throwing a ball for accuracy and distance. Although not statistically significant, scores generally improved as a result of practice.

However, Witte[2] in testing 56 junior high school girls upon the effects of varying amounts of exercise of different length and intensity on accuracy in throwing a softball, used two groups, skilled and unskilled, in her test. The study indicated that the unskilled group improved significantly more than the skilled. But, when a high degree of intensive exercise (push-ups and pull-ups) was done immediately before throwing, both groups decreased. This would seem to support the theory that heavy or excessive amounts of weight applied during muscular contractions would tend to decrease rather than increase accuracy when throwing immediately followed the application of the excessive weight.

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[1]Vera Skubic and Jean Hodgkins, "Effect of Warm-Up Activities on Speed, Strength, and Accuracy," Research Quarterly, XXVIII, (May, 1957), pp. 147-52.

[2]Fae Witte, "Effect of Participation in Light, Medium, and Heavy Exercise upon Accuracy in Motor Performance of Junior High School Girls," Research Quarterly, XXXIII, (May, 1962), pp. 308-12.

This was also confirmed in the study by Van Huss, Albrecht, Nelson, and Hagerman,[1] in which it was found that overload warm-up impaired accuracy during the first few throws following the warm-up period.

Clifton[2] found no significant change in the ability to score field goals from various distances on the court of two groups, one using a weighted ball and the other a regulation ball. However, it was noted that those subjects who had used the heavier ball had shown a slightly larger increase than those shooting the regulation ball even though it did not meet the 2.01 critical ratio at the .05 level of significance.

The review of literature seemed to indicate that three theories have been formulated concerning the use of weights or weighted objects in the development of accuracy, speed, or velocity: (1) Weighted objects are of significant benefit, (2) Weighted objects are of no significance, (3) Weighted objects are a detriment.

In conclusion, the writer has noted that such studies as done by Zorbas and Karpovich,[3] Hairbedian,[4] and Wilkens,[5] have reported that

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[1]W. D. Van Huss et al, "Effect of Overload Warm-Up on the Velocity and Accuracy of Throwing," Research Quarterly, XXXIII, (October, 1962), p. 475.

[2]Robert L. Clifton, "Effect of Weight Training Upon Accuracy in Shooting Field Goals in Basketball," (unpublished Master's thesis, University of Iowa, Iowa City, 1951), pp. 22-24.

[3]William S. Zorbas and Peter V. Karpovich, "The Effect of Weight Lifting Upon the Speed of Muscular Contractions," Research Quarterly, XXII, (May, 1951), pp. 102-17.

[4]Ara Hairbedian, "Weight Training in Relation to Strength and Speed of Movement," (unpublished Master's thesis, Pennsylvania State University, University Park, 1952), pp. 39-42.

[5]Bruce M. Wilkens, "The Effect of Weight Training on Speed of Movement," Research Quarterly, XXIII, (October, 1952), pp. 287-93.

training with weights or weighted objects does not slow the speed of muscular contraction, which in turn, would affect the degrees of accuracy which an individual could attain.

CHAPTER III

METHODOLOGY

For the purpose of this study, twelve subjects enrolled for the spring quarter 1966-67 school year, who had had previous experience in football were selected. These subjects had been quarterbacks, halfbacks, or fullbacks in high school or college, with game experience in passing a football. The criteria for selection was established in order to make better use of the time available for the study. By doing so, any instructional period needed to teach the proper technique of throwing a football was eliminated.

The twelve subjects were then divided equally into two groups. By randomly assigning numbers to each subject and utilizing the table of random numbers,[1] the subjects were then placed in their respective groups, alternately. The two groups were namely Group R, the control group (the group using the regulation ball), and Group W, the experimental group (the group using the weighted ball). The two footballs used during the experiment were rubber coated balls with the weighted ball weighing 19.1 ounces as compared to the regulation ball of 14.4 ounces. A commercially weighted football was purchased for use in the study.

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[1]Herbert Arkin and Raymond R. Colton, Tables for Statisticians (New York, N.Y.: Barnes & Noble, Inc., 1950), p. 142.

TABLE I

DESIGN OF THE STUDY

Pre-Test	Training Period for Both Groups	Post-Test
	Number of Days	
1 2	3 4 5 6 7 8 9 10 11 12 13 14 15	16 17

The testing program consisted of a pre-test and a post-test, using the regulation football. The testing was first preceded by a warm-up period with the regulation football of a prescribed number of throws. The pre-test and post-test were both conducted over a two-day period. The total points for the two days were recorded. This was done in order to compensate for illness or poor dispositions on the part of the subjects due to factors beyond the control of the tester. The format of the tests was exactly the same as was used during the training period with the exception that both groups used the regulation ball for both the pre-test and post-test.

The training period was conducted over a period of 13 consecutive days, excluding Saturdays and Sundays. Each subject reported at a specified time each day and warmed up using the prescribed ball with another subject in the same group. Warmup consisted of twenty throws. The subject was then instructed to throw the prescribed ball 15 times each, from distances of 10 yards and 15 yards at a moving target, with a score for accuracy kept for each of the throws from the two distances. A time of six seconds was allowed for each throw, beginning when the tester gave

the command THROW and terminating at the command TIME. The target was constructed of a 26-inch middleweight bicycle tire, suspended five feet above the floor (measured from the bottom of the tire) by two nylon cords, connected to a pipe, extending horizontally twelve inches from a balcony railing 11½ feet above the floor. The target was set into motion by releasing it from a point 45 degrees from the vertical axis (running through the extending pipe on the railing) in order to maintain the same speed for each of the succeeding trials. Two vertical volleyball standards were set two feet on either side of the vertical axis. Points were only awarded if the ball passed through or contacted the target in this four-foot zone. A ball which had passed through or had passed through and contacted the target on the inside was recorded as two points. A ball which had passed by on the outside and contacted the target and/or hit the target and dropped down was recorded as one point. A thrown ball which missed the target or was not released within the prescribed time was recorded as no points.

The subjects were instructed to refrain from all types of throwing during the period of the experiment. The subjects were also encouraged periodically throughout the training period to concentrate and do their best. It is felt by the writer that each subject performed to the best of his ability while taking part in the experiment.

The experiment was conducted in the Lantz Gymnasium Fieldhouse Monday through Friday for a period of three and one-half weeks from March 15, 1967 to April 7, 1967.

CHAPTER IV

ANALYSIS OF DATA

The purpose of the study was to determine the effect on passing a weighted football, used during a training period, on the accuracy of throwing a regulation football. The initial and final means for the tests were determined by a method suggested by McCloy.[1] The standard error of the differences between the initial and final means and the critical ratio was obtained. The null hypothesis was rejected if the obtained t ratio was greater than 2.57 when applied within the group at each distance. When applied between the groups, the null hypothesis was rejected if the obtained t ratio was greater than 2.23 at each distance. The five percent level of confidence was chosen with five degrees of freedom used in comparisons within groups while ten degrees of freedom was used in comparisons between groups.

During the pre-test period, the researcher conducted a reliability check of the tests (from both the 10- and 15-yard distances) by employing the test-retest method. A rank order correlation was computed from each of the two tests. Correlation coefficients of +.82 at 10 yards and +.80 at 15 yards were obtained.

Table II shows a comparison between groups at the same distance, while Tables II and IV show the comparison of differences within groups at the same distance.

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[1]Charles H. McCloy and Norma D. Young, Test and Measurements in Health and Physical Education (New York: Appleton-Century-Crofts, Inc., 1954), pp. 430-31.

Findings

Comparison between groups. Table II presents this data. In a comparison of Group W against Group R at the 10-yard distance, it was noted that a mean gain of 3.00 points was attributed to Group W. However, in computing the t ratio, it was found to be .57; therefore, the null hypothesis was accepted. The .57 critical ratio was found to be between the .40-.60 level of significance. This seemed to indicate that there was no improvement in accuracy when the weighted ball was used for an extended period of time.

Furthermore, in the comparison of Group W against Group R at the 15-yard distance, a mean gain of 1.33 points appeared for Group W. The critical ratio was calculated and found to be .42, which was not significant for this study and the null hypothesis was accepted. The .42 critical ratio was found to lie between the .60-.80 level of significance and seemed further to support the findings of the test between Group W and Group R at the 10-yard distance.

TABLE II

COMPARISON OF DIFFERENCE BETWEEN GROUPS

AT THE SAME DISTANCES

Groups	Units	Mn. Gains Group W	Mn. Gains Group R	Mn. Diff.	t Ratio	L.S.
Groups W vs R 10 yards	Points	8.67	5.67	3.00	.57	.40-.60
Groups W vs R 15 yards	Points	3.50	2.17	1.33	.42	.60-.80

Comparison within groups. Tables III and IV present this data. In a comparison within Group R at the 10-yard distance, a mean gain of 5.67 points was found between the pre-test and post-test. The critical ratio was calculated and found to be 2.55 which did not meet the 2.57 t ratio needed for rejection of the null hypothesis at the .05 level of confidence and therefore the null hypothesis was accepted. It has been noted from the data in Table II that a program of throwing which used a regulation ball would appear to be as beneficial as one in which a weighted ball had been used. This would then support the point of view that training with a weighted ball would be of no significance in the development of accuracy.

In a comparison within Group W at the 10-yard distance, a mean gain of 8.67 points was found between the pre-test and post-test. The critical ratio was calculated and found to be 1.79 which was not significant for this study; therefore, the null hypothesis was accepted. Again, this seemed to support the point of view that the weighted ball was not beneficial for the improvement of accuracy.

TABLE III

COMPARISON OF DIFFERENCE WITHIN GROUPS

AT 10 YARDS

Group	Units	Mn. Pre-Test	Mn. Post-Test	Mn. Diff.	t Ratio	L.S.
Group R 10 yards	Accuracy Points	25.50	31.17	5.67	2.55	.05-.10
Group W 10 yards	Accuracy Points	23.50	32.17	8.67	1.79	.10-.20

In further comparison of Group R at the 15-yard distance, the mean gain was 2.17 points from the pre-test to the post-test. The critical ratio was calculated and found to be .71 which lies between the .40-.60 level of significance, which was not significant for this study; therefore, the null hypothesis was accepted.

However, in a comparison within Group W at the 15-yard distance, a mean gain of 3.5 points was found between the pre-test and post-test. The critical ratio was calculated and found to be 3.22. This t ratio of 3.22 indicated significance at the five percent level of confidence; therefore, the null hypothesis was rejected. To attribute for this significant gain at the 15-yard distance, an explanation may be due to the subjects having become familiar with the weighted football and/or improving the skills of throwing.

TABLE IV

COMPARISON OF DIFFERENCE WITHIN GROUPS

AT 15 YARDS

Group	Units	Mn. Pre-Test	Mn. Post-Test	Mn. Diff.	t Ratio	L.S.
Group R 15 yards	Accuracy Points	15.66	17.83	2.17	.71	.40-.60
Group W 15 yards	Accuracy Points	13.33	16.83	3.5	3.22*	.02-.05

*Significant at .05 level of confidence

By the use of the table of random numbers in assigning the subjects to their respective groups, it was assumed that the two groups were essentially equal at the beginning of the study. Any changes which supported the view that the effect of overload during a period of training was of statistical significance could not be confirmed in the concluded experiment. It was expected that improvement of throwing accuracy would occur in both groups due to the fact that practice is positively related to improvement in motor skills.[1] This may be an explanation for the slight improvement on the part of both groups. The analysis of data indicated that there was not a significant improvement in accuracy due to the use of the weighted football in this study.

Appendixes A and B contain the data compiled from the tests given before and after the training period.

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[1]Laurence E. Morehouse and Augustus T. Miller, Jr., Physiology of Exercise (St. Louis, Mo.: C. V. Mosby Company, 1963), p. 50.

CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

In an attempt to determine to what extent overload, in the form of a weighted football, used during a period of training affected accuracy at distances of ten and fifteen yards, a total of twelve male subjects were divided equally into two groups. Two tests were given each subject, a pre-test at the start of the study, and a post-test following the training period. Prior to each test and each practice session, preliminary warm-up was allowed, twenty throws with the prescribed ball. The score for each day was recorded according to the number of hits of the target, with each throw scored as zero, one, or two points.

A review of the data in Appendixes A and B appeared to indicate that accuracy was improving more in the weighted group than in the regulation group; however, this lacked statistical proof.

Conclusion

Although the group throwing the weighted ball showed more improvement (accuracy points) than did the group throwing the regulation ball, the statistical analysis of the data showed there was no significant difference between the gains made by either group.

Recommendations

Based on the experience of the writer in this study, the following recommendations are made.

A similar study should be conducted using a larger group of subjects with an equal number of subjects acting as controls.

Further investigation could be extended over a longer period of time to determine if there would be any indication that training with a weighted ball helps an individual to better perform activities involving arm movements, but may hinder an individual in the performance of fine skills in which the fingers and hands are mainly involved.

The possible use of mechanical testing devices or electrical devices could be employed to an advantage in further studies of this nature.

Similar studies should be conducted from greater distances than those tested in this study.

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APPENDIX

APPENDIX A

DATA FOR INDIVIDUALS

IN THE EXPERIMENTAL GROUP

GROUP W

Subject Number	10 Yards			15 Yards		
	Pre-Test Points	Post-Test Points	Gain/Loss	Pre-Test Points	Post-Test Points	Gain/Loss
1	26	32	+ 6	16	17	+1
2	33	36	+ 3	10	17	+7
3	9	38	+29	14	17	+3
4	32	36	+ 4	14	19	+5
5	15	30	+15	12	12	0
6	26	21	- 5	14	19	+5

APPENDIX B

DATA FOR INDIVIDUALS

IN THE CONTROL GROUP

GROUP R

Subject Number	10 Yards			15 Yards		
	Pre-Test Points	Post-Test Points	Gain/Loss	Pre-Test Points	Post-Test Points	Gain/Loss
7	17	30	+13	14	14	0
8	30	30	0	22	19	- 3
9	32	34	+ 2	19	13	- 6
10	27	37	+10	7	22	+15
11	25	26	+ 1	12	18	+ 6
12	22	30	+ 8	20	21	+ 1

VITA

The writer was born on May 28, 1940, in Hammond, Indiana. In May, 1954 he was graduated from grade school, having participated in both football and basketball. In September of 1954, the writer entered Oliver Perry Morton High School in Hammond, Indiana, where he was active in athletics: football, basketball, baseball, and track, as well as serving as senior class treasurer. He was graduated on June 8, 1958.

In the fall of 1959, the writer entered Eastern Illinois University. He pursued a course of study with a major in physical education and minors in industrial arts, health education, and driver education. While at Eastern Illinois University, the writer participated in baseball and football, earning four varsity letters in the latter. The writer was also a member and active in Sigma Tau Gamma Social Fraternity. In May, 1964, he was graduated with a Bachelor of Science in Education degree.

During the school years 1964-66, the writer was a teacher of physical education, driver education, and industrial arts and also coached football and wrestling at George Rogers Clark High School in Hammond, Indiana.

The writer was a graduate assistant in the School of Health, Physical Education, and Recreation at Eastern Illinois University during the school year 1966-67. He pursued a course of study in physical education, leading to the degree of Master of Science in Education.