THE VALUE OF AN INTEGRATED WEIGHT PROGRAM TO IMPROVE SPEED AND AGILITY

by

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ABSTRACT

The purpose of this study was to determine if there is a significant amount of improvement in speed and agility of the M.S.C. freshman basketball team of 1962-1963 after they had been exposed to an integrated weight training program for a thirty-six day pre-season training period.

Literature was reviewed to show the value of strength in athletics, the progress of weight training over the years, various methods of gaining strength, and the relationship of weight training to major basketball skills. An experiment, using the M.S.C. freshman basketball team was conducted over a thirty-six day pre-season training period. The group was divided into an experimental group of seven boys and a control group of seven boys. Both groups were tested on speed and agility and then twelve additional pounds of weighted equipment consisting of a ten pound vest type jacket and an additional pound in each shoe was worn for the entire practice session over a thirty-six day training period. The groups were again tested and the results were analyzed.

The study revealed that (1) Some method of weight training is necessary to develop an athlete so that he might achieve and reach his potential; (2) Speed and agility cannot be improved unless over all body strength is improved; (3) A coach's decision as to whether he should use the isotonic, isometric, circuit training, or a combination of these is largely determined by ease of administering, cost, time available, and psychological effect on participants; (4) An integrated weight training program using twelve additional pounds of equipment is of no significant value in striving to improve speed and agility in pre-season basketball drills as measured by the F.R.A. test.

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CHAPTER I

INTRODUCTION

During the last several years, the role of weight training and its relationship with other sports has been the subject of conversation and research by coaches and players alike. It is a generally accepted opinion of the majority of coaches that the overall body strength of an individual has a positive correlation with the individual skills a player needs to perform at his most efficient level. All coaches who are employed and relieved of their coaching duties on their win-loss record, agree that "Coaching is a battle against time." This era, in the world of sports, we see more bigger, stronger, faster, and agile athletes than ever before. Competition demands all coaches to concern themselves with the overall body strength of their athletes. The various methods to obtain the maximum results have been decisions for coaches to make. This study is concerned with the value of an integrated weight training program.

The Problem and Procedures

Statement of the problem. It was the purpose of this study to determine if there is a significant degree of improvement in speed and agility of players who have been exposed to a pre-season integrated weight training program.

Procedures. The procedures used in this investigation were as follows. The first step was to review literature on the value of strength, show the progress of weight training through the years,

explore the various methods of developing strength and finally the relationship of weight training to basketball skills. The second step was to conduct an experiment using the M.S.C. freshman basketball team as the sample. These fourteen boys were divided into a control group of seven and an experimental group of seven. Both groups were pre-tested on October 11 involving speed and agility. During the practice periods between October 11 and November 16, the experimental group wore weighted equipment during the entire practice time while the control group wore the conventional practice uniform. An end test involving the same skills was again conducted in the exact manner as the pre-test on November 16. The results of this experiment were then determined and conclusions drawn.

Definitions of Terms Used

Weight training. This term refers to the activity involving weight in the form of equipment or isometric devices used to over load various muscles of the body.

Major skills. The major skills in basketball that have been tested in this study are speed and agility.

F.R.A. Test. A "forward run and agility" test consisted of the boy being timed in seconds running the length of a 90 foot basketball court, retrieving a small block of wood, and running back to his original starting position.

Experimental group. The "experimental group" shall be the seven players that wear weighted equipment during the entire practice time for

the duration of the 36 day experimental period.

Control group. The "control group" is the seven players that do not wear any weighted equipment in addition to the usual practice uniform.

Isometric exercise. Isometric exercise is exerting near maximum resistance against an immovable object for a number of seconds without moving.

Isotonic exercise. Isotonic exercise is completing a full range of movement with the muscles involved in moving a specific weight.

Limitations of the Study

Information obtained from speed and agility tests administered to the 1962 M.S.C. freshman basketball team provided the investigator with experimental data for analysis. The P.E.A. test was used as the measuring device to measure speed and agility as the major basketball skills to be analyzed. Thirty-six practice sessions were held between the pre-test and the end-test. The experimental group and the control group consisted of seven players each, therefore limiting the total sample to fourteen boys.

CHAPTER II

REVIEW OF THE LITERATURE

In research of material concerning weight training procedures, this investigator found an abundance of information on developing overall body strength, biased programs for isolated muscle groups, and off season conditioning programs for athletes in various sports.

Value of Strength

Emphasis in all the material was placed on the theory that strength is the key to success in modern athletics. Hooks says, "The coach who capitalizes on this knowledge is destined for success. The coach who doesn't is destined for mediocrity."[1] Coaches and competing athletes agree that a skilled man with strength always has an advantage over a man who depends on skill alone. A well conditioned athlete finds it easier for him to move his body effectively because his muscles have the ability to carry him through the necessary movements.[2]

Strength as defined by Morehouse and Miller is the ability of a muscle to work against resistance. They say that the amount of muscular force which can be exerted against a resistance depends upon (1) the size of the muscles, (2) the proportion of the constituent fibers

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[1]Gene Hooks, Application of Weight Training to Athletics (New Jersey: Prentice-Hall, Inc., 1962), p. 1.

[2]Jim Murray, Peter V. Karpovich, Weight Training In Athletics (New Jersey: Prentice-Hall, Inc., 1956), p. 5.

engaged in the action, (3) the coordination of the muscle groups, (4) the physical condition of the muscles and (5) the mechanical advantage of the levers employed.[3]

Lawther further clarified the meaning of strength when he wrote:

> Men who do heavy work become strong in the muscles used in the work. They may remain relatively weak in any muscles not used in their occupation. This statement brings out the point that an individual has specific strengths, not strength in general. Each muscle or muscle-group combination has its particular contractile pull. A person may be strong in certain types of movements but weak in others.[4]

The value of strength in athletics is not a new idea by any means. The fact that high school and college coaches have accepted its importance has been reflected in their teams for years. Agreement is almost unanimous that "the good big man will always beat the good little man." The statement would be even more true if it read, "the good strong man will always beat the good weak man."

One has only to look at the size and strength of the outstanding teams in the world today to realize the value of strength in athletics. Very seldom does a lineman weigh less than 225 pounds, or a back less than 200 pounds. In professional basketball the skinny player is a thing of the past, and in college basketball he is at a terrific disad-

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[3]Laurence E. Morehouse and Augustus T. Miller, Physiology of Exercise (St. Louis: C. V. Mosby Company, 1953), p. 209.

[4]John D. Lawther, Psychology of Coaching (Englewood Cliffs: Prentice-Hall, Inc., 1955), pp. 263-264.

vantage. Professional baseball players are not as big as football and basketball players, but they certainly are bigger and much stronger than the average man. The same is true in other sports. These players are big not just in bulk, but in muscle. They are successful because they are highly skilled, but when players of equal skill meet, the stronger one has a tremendous advantage.

To be successful, the coach must make the same effort to promote strength building in his athletes as he does teaching techniques. No one can ignore the fact that over all body strength is one of the most noticeable traits of successful athletes. The muscle groups that are used frequently show the greatest strength which necessitates isometric, isotonic, or circuit training to develop the whole body. Successful athletes have sufficient strength to accomplish the skills demanded of them in their particular sport.

Progress of Weight Training

The period in history when weight lifting actually started is unknown, however it is known that the early Greeks participated in some form of weight lifting, probably for competitive purposes. In the early history of weight lifting, heavy rocks were undoubtedly used as the weights to be lifted. In later years a bar was used with round balls on each end into which lead pellets could be dropped to increase the weight. Filling and emptying the balls was a rather time-consuming chore which soon prompted an improvement in the type of equipment. The

improved equipment utilized iron plates which would slide onto the ends of the bars. With slight modifications this is the type of weight lifting equipment that is used today.[5]

During World War II weight training gained considerable attention, particularly in the physical reconditioning and rehabilitation programs of the armed forces. Here the equipment was used in bringing the atrophied muscles of disabled service men back to normal and in maintaining muscle tone in the unaffected muscles of the hospitalized. This popularity has carried over into the rehabilitation programs of the Veterans Administration, communities, and private organizations.

Following World War II, many health studios have been established, particularly in the larger cities of the nation. These studios specialize in elaborate exercise equipment and cleanliness of establishment, and they have programs for both men and women.

It is noticed that the history of this activity has been one of growth outside of the physical education profession and outside of our school programs. In the late 1930's and early 1940's few colleges and practically no secondary schools offered weight training as one of the activities in their physical education programs. Since World War II, however, it has become more accepted as a valuable activity in the physical education program.[6]

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[5]Hollis F. Fait and others, Physical Education Activities (Philadelphia: W. B. Saunders Company, 1956), p. 235.

[6]Jack R. Leighton, Progressive Weight Training (New York: The Ronald Press Company, 1961), p. 7.

It has been found that the promoters of this type of physical activity have recently established three definite programs of weight training, weight lifting, and body building. Weight training is concerned with the development of increased physical activity that is greater muscle endurance, greater strength, increased speed of movement, and greater power.

Weight lifting is concerned with how much weight the performer is able to lift overhead, using a certain type of lift. Usually competition is held for several different body-weight divisions, and the winner in each division is determined by the total poundage lifted with three different types of lifts. For many years weight lifting has been a competitive athletic event at the state, national, and international levels, including the Olympic Games.

Body building is concerned with increasing the size of the muscles and developing a well-proportioned body. Most "body builders" develop their physiques for aesthetic reasons. Contests are held regularly to determine the person with the best physique or best build, and the one with the most developed body. Such titles as: Mr. California, Mr. America, and Mr. Universe are awarded the winners.

During the past twenty years a number of research studies have investigated the effects of weight training. These effects have been compared with the effects of engaging in other types of physical activity for an equal period of time. The majority of these studies have been conducted for periods of six weeks to a semester, with male college

students serving as subjects. In the majority of these studies, a greater gain in overall strength occurred in weight training groups than in control groups. In addition, the weight training groups generally made a larger gain in the strength of selected muscle groups, in speed of movement, and in power. Other benefits have been found to accrue from engaging in a weight training program. An increase in local muscular endurance is usually a result of increased muscular strength. When weight training exercises stimulate an increased range of motion and are included in the program, an increase in the flexibility of certain joints also result.[7]

The most recent literature in developing strength and muscular endurance has been the work of Sid Gillman and Alvin Roy of the San Diego Chargers professional football team. They have presented a new isometric contraction with weights and explosive power system based upon research done on muscle strength for the San Diego Chargers "in and out" of season and at several universities in the United States and foreign countries (Hungary, Russia and Poland).[8] Gillman and Roy maintain that their program trains the muscles and the nervous system to give a maximum coordinated effort in the position of the needed force. Sid Gillman and Alvin Roy feel, "No athlete is ever strong enough."[9]

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[7]Donald R. Casady, Donald F. Mapes, Louis E. Alley, Handbook of Physical Fitness Activities (New York: The MacMillan Company, 1965), p. 52.

[8]Sid Gillman and Alvin Roy, Strength Program "In and Out" of Season (San Diego: Sid Gillman-Alvin Roy Publishing Company, 1964), p. 6.

[9]Ibid., p. 8.

The progress of weight training up until the past two decades has been slowed down by unfounded rumors. The recent publicity of athletes doing envious feats in various sports as well as being accomplished weight lifters has been a major factor in the general acceptance of weight training. Wilt Chamberlain, All Pro Basketball Player, and All Pro Fullback, Jimmy Taylor, of the Green Bay Packers, have had a tremendous influence on young athletes and coaches by being faithful in their weight training programs in the off season. The professional athletes are proving more every year that one must be physically strong to stay competitive. Weight training has shown more rapid progression in the number of participants in the last five years than in the entire history of the activity. One might say the professional ranks have shown the way and now our colleges and high schools are striving to catch up.

Actually, weight training equipment has changed very little in comparison with the basic devices that were used in the early history of the sport. The progress and acceptance of weight training was enhanced by the rehabilitation programs during World War II. Until that time, weight training was rarely found in the curriculum of physical education programs in our secondary schools and colleges. Distinguishing weight training, weight lifting, and body building as specific types of training was one of the contributing factors in speeding the progress of this activity. Successful performers in all sports have endorsed weight training as being very necessary in preparing for their particular

sport.

Methods of Developing Strength

Various methods of gaining strength such as isotonics, isometrics, and circuit training are now being used for specific results. An isotonic contraction involves a change of length in the muscle, either shortening or lengthening. This type of contraction is referred to also as a dynamic contraction, since definite and easily discerned movement takes place.[10]

The writer finds isotonic weight training to be the most widely used program until the more recent popularity of isometric training and the combination of both methods.

To this investigator's knowledge, only one study has compared an isometrically trained group and a isotonically trained group.[11] Both groups were pre-tested with a static strength test and a dynamic strength test. At the conclusion of the 12 week training period, both groups were re-tested with the same test. The results showed that while both groups gained strength, the group which exercised with the dynamic exercise improved more in the dynamic strength test. The group which worked out with the static exercise showed a greater strength in static strength.

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[10]Carl E. Klafs and Daniel D. Arnheim, Modern Principles of Athletic Training (St. Louis: The C. V. Mosby Company, 1963), p. 93.

[11]Bob O'Connor, "Scientific Weight Training", Scholastic Coach, September, 1964, p. 54.

On the basis of this study it seems that dynamic exercises would be more valuable for strength as used in most athletics. However, there may be some aspects of athletics which can profit more from static than dynamic exercise, for example, the beginning of the put in the shot put.

O'Connor[12] discusses several variables in weight training. A rather obvious variable is the fact that all boys have a different number of fibers in a given muscle. The boy with more muscle fiber has a greater potential of strength.

Another variable is the effectiveness of the lever action. The shorter and heavier muscled boy has an advantage over the tall slender boy. The mesomorph, generally has the advantage over ectomorph due to more muscle fiber and more efficient levers. Endurance and superior height, however, allow the ectomorph to participate successfully in some sports.

The variable that has the most effect on strength progress is the desire of the boy to work hard and faithfully at the prescribed exercises. For best results, most isotonic exercises require the boy to work the muscles involved to exhaustion. Unless a boy is determined to improve, he will stop before he has over worked the muscle.

There is a fourth variable which is the method used in developing strength. If you over load the muscle or muscles to be strengthened, the method has little or no significance as to strength improvement.

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[12] Ibid., p. 94.

The coach is often faced with the decision as to which method he will teach or combination of such. If finances are not the determining factor, he should not choose strictly isotonic equipment or go the isometric route. In the past one half decade, isometric methods have been the most popular. This seems to have been prompted by studies showing isometric groups having a more rapid strength gain. Isometric exercises are easily designed and administered. Commercial equipment dealers have saturated the market with various ropes, gadgets, etc. attracting attention to the relatively new method of isometrics.

In discussing the isometric methods as compared with isotonic methods, students in weight training classes generally agreed that the fact that you can see and feel movement in isotonic weight training allows one to be satisfied mentally that he is progressing. Also, actually knowing how much weight is being lifted seems to be an important feeling of the participants.[13] This writer contends that the spirit of competition is much more evident in weight lifting exercises than in the isometric program.

The psychological effect of a player's knowing he is stronger and more powerful than his opponent is a significant feature of his playing ability, whether he is a participant in football, baseball, basketball or most any modern sport involving physical activity. Athletes with

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[13]The consensus of opinion in a group interview of one weight training class of 35 freshman students at Montana State College, Bozeman, Montana on February 11, 1965.

knowledge of superior physical strength are able to approach a game or match with a feeling of confidence in their physical ability that is immeasurable. Many coaches brainwash their players into superhuman efforts by selling them on the idea that they are as physically strong as their favored opponents. It is much easier to teach mental toughness to an athlete who is already physically tough. It has been reported that every starting lineman on the 1958-1959 Louisiana State University team could dead lift 400 pounds.[14] If this is true, imagine the psychological advantage those players enjoyed, knowing they could move a man approximately twice the size of the one they generally faced in Saturday's game.

Although it seems that weight training has established itself as a valuable aid to athletic training or "conditioning" programs, one may be surprised to discover that even now there is no complete agreement as to the best method for muscle training. The usually accepted idea that one has to give his all in order to gain more, isn't necessarily true.[15]

This last statement by E. A. Muller's laboratory in Germany has had a tremendous impact upon methods of muscular training, and indicate that a single daily isometric contraction continued for six seconds and

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[14]Ace Higgins, "Football's Weightlifting All-American," Strength and Health, November, 1959, p. 34.

[15]Peter V. Karpovich, Physiology of Muscular Activity, (Philadelphia: W. B. Saunders, 1959), p. 33.

using only two-thirds of maximum strength will give the best results in gaining muscular strength.

Their reasoning is based on the belief that if maximum effort is exerted, the muscle capillaries are compressed and oxygen supply becomes inadequate. It seems that this oxygen deficit is an important factor in the gaining muscular strength.

This study by Muller has probably been the most significant in modern times. This study indicates the factor of time spent exercising and how it relates to the decline of strength when exercising ceases.

> In an investigation of men, it was demonstrated that with daily muscle exercise, the strength quickly increased, and at the termination of the exercise just as quickly decreased. It's held therefore that through daily conditioning a strength level is attained. Through weekly exercise it's maintained several weeks, thus strength loss is delayed more and more. Also, after lengthy training of weekly, single exercises, an increased retardation in the strength decline occurs. It's assumed that conditioning has a doubly opportune chance: a rapid rise in muscle strength and a persisting consolidation at times of the attained degree of strength. With a rapid cessation of exercise, the second cannot keep pace with the first.[16]

This study has very obviously been the major factor in the selling of isometrics to the believers in weight training. Also, the emphasis on time required for a complete work out has been a major topic of commercial advertisers. Isometrics can be performed at any time of the day in about any type of wearing apparel, since doing the exercises

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[16]Theodore Hettinger and E. A. Muller, "Die Bedentung des Trainings verlaufs fur die Trainings Festigkeit von Muskeln", Arbeits-physiologic, Bd: 452-458 (Translated by John D. Lawther).

does not soil one's clothes or cause sweating.

Although no equipment is required for performing isometric exercises, several commercial products that can be useful in performing isometric exercises have been marketed. These devices increase the number and variety of exercises that can be performed. Isometric exercise equipment ranges from a piece of rope and an accompanying exercise chart to sophisticated devices that automatically lock a handle at any desired distance from the platform on which the exerciser stands, and that have dials which indicate the force being exerted at any given time and the maximum force that was exerted during the performance of the exercise.

The proponents of isotonic weight training maintain the working of a muscle is constant and is controlled by the weight they are working with. So much energy must be exerted to move a specific weight a certain distance and this, being a law of physics, is not subject to change.[17] No other activity can offer such a gradual change in activity resistance. The weights come in denominations as small as 1 1/4 pounds which permits changes on a bar bell of as little as 2 1/2 pounds. The speed or cadence of exercise performance is slow to moderate. All these factors make this activity one of the most suitable for men and women, in varying stages of condition, of varying ages, and in all walks of life.

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[17]Jack R. Leighton, Progressive Weight Training, (New York: The Ronald Press Company, 1961), p. 13.

However, the Sid Gillman and Alvin Roy method of developing explosive power does not agree with this slow to moderate cadence.[18] They propose every exercise is a competitive lift; every exercise is an explosive action; every exercise is a feat of strength; every exercise is an all out action, an all out effort. Using the Charger system, you approach the bar bell, get set, using correct form, tear the weight from the platform, lift it to the chest level in one explosive move and then lower it to the platform.

One must keep in mind who is using this method and for what purpose it is designed. This exercise is used to develop one of the most desirable attributes of a football player and that is to be explosive in movement. The mental satisfaction of this type of work is also a contributing force of acceptance with the participants.

This writer finds another method of physical conditioning that employs both weight training and conditioning exercises. The method has achieved considerable popularity in England and is finding favor in this country as a means of achieving optimum fitness in a systematized, controlled fashion. The method was originally introduced by Morgan and Adamson about 1957 at the University of Leeds, England. It was immediately accepted by physical educators, coaches, and trainers as an excellent and self-motivating means of increasing strength, flexibility, and

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[18]Gillman and Roy, op. cit., p. 11.

endurance in an orderly fashion, within a group. The intensity and vigor of circuit training is indeed challenging and enjoyable to the performer. Studies in various areas of athletics have indicated not only that this system produces positive changes in motor performance but also that general fitness, muscular power endurance, and speed have shown decided improvement.[19]

This investigator has had personal experience with this method of circuit training and agrees very strongly with the fact that general fitness is definitely improved.

Circuit training is based on the premise that the athlete must do the same amount of work in a shorter period of time or must do considerable more work within the limits of an assigned training period. Numerous variations of this system are in use, but all employ certain common factors: (1) the use of progressive resistance exercises; (2) the use of physical conditioning and apparatus exercises, the former being performed either with or without weights; (3) a circular arrangement of the activities that permits progression from one station to another until all stations have been visited, the total comprising a "circuit"; and (4) a limiting time factor within which the circuit must be completed.[20]

In working with this method, coaches agree this system lends

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[19]Klafs and Arnheim, op. cit., p. 108.

[20]Klafs and Arnheim, loc. cit.

itself to handling large groups efficiently and productively. It is a practical method, entailing some preliminary planning, but beyond that it needs little coordinating. Athletes find it motivating since it makes conditioning fun and challenging through competition against teammates and time.

The method of developing strength is the phase of this activity which is showing the most change. The desire to obtain maximum or big results in a limited amount of time can be listed as the reason for many methods now fighting for approval as the best one. Isotonic training proposes the need for movement with resistance simulating a particular motion of a skill will do the most for the muscles worked. Isometric training has the time factor, limited equipment, and fast strength gain in their favor and has capitalized on commercial advertisements. Circuit training appeals to educators who are faced with handling large groups and objectives of general physical fitness, endurance, and competition.

Relationship of Weight Training to Basketball Skills

All who have witnessed a basketball contest will agree this sport demands a great amount of physical effort from the individual performer. It calls for quickness and physical reflexes, strong muscular leg support, and an abundance of stamina. As the game advances in its techniques of play, the physical requirements necessary for team success are proportionately increased. Good conditioning founded upon sound training habits is the determinant in many close ball games. A coach may be

facing an opponent with better personnel or an opponent shooting an abnormal percentage, or his team may be experiencing a cold night. These factors usually spell defeat. Coaching ability will avail itself slightly in these circumstances. However, a team that is beaten because of the superior condition of the opponent, can sometimes place the blame. It may rest principally upon the coach for not realizing the importance of conditioning as the foundation for team success.[21]

A weight training program was used by the varsity basketball squad of the State University of Iowa. At Iowa the program was worked out by McCloy, Wendler, Sills, and graduate student Dick Garth, who was preparing a thesis on "The Effect of Weight Training on the Jumping Ability of Basketball Players." Garth found the average jumping ability of the Hawkeye players improved 2.7 inches as measured by a standard jump-for-height test. In addition to improved jumping, Dr. McCloy reported that the players improved from 15 to 25 per cent in strength, and Coach Frank (Bucky) O'Connor said the weight training program made his team "stronger physically for the rugged work under the baskets."[22]

The first Iowa team to use the planned weight training as a group was predominantly composed of sophomores, but placed second in the Big Ten. As juniors, still using the weights, they won the confer-

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[21]Pete Newell and John Benington, Basketball Methods, (New York: The Ronald Press Company, 1962), p. 38.

[22]Murray and Karpovich, op. cit., p. 123.

ence championship.[23]

Wilt Chamberlain of the Philadelphia 76ers is the best example of the value of strength in basketball. According to Bill Neider, an avid weight trainer who won the gold medal in the shot put at the 1960 Rome Olympics, he has never been beaten at arm wrestling and has only been tied by one man. That man was Wilt Chamberlain.[24] Chamberlain's height and powerful physique give him a tremendous advantage in under-the-board play. Although Chamberlain may never have weight trained, he has somehow acquired astounding strength to accompany his tremendous size. He can simply overpower the opposition.

Many very skilled basketball players are not strong enough to be successful. It's true that a basketball is relatively light and to shoot, pass, or dribble it does not require much strength. However, the situation is far different when opposition is provided. The player must control the ball while being guarded closely by an opponent; he must make goals in spite of slapping hands; he must stand under the basket and jump high to retrieve a rebound; and to be successful he must protect the ball from aggressive opposition. Superior strength will not accomplish these things for a player who lacks desire, aggressiveness, coordination, agility, or any of the other characteristics

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[23]Murray and Karpovich, op. cit., p. 122.

[24]Tex Maule, "The Shotput Explosion", Sports Illustrated (April 25, 1960), p. 30.

important to basketball. It is a fact, however, that the best basketball players in the game today, excluding only a few of the back court wizards, are strong and powerful athletes.[25]

Shooting is unquestionably the most important basketball fundamental. The best ball handlers are relatively unimportant to a team if they aren't able to put the ball in the basket consistently. It takes a great deal of individual and team strategy to clear a player for a shot; when a player gets the opportunity he should be able to score.

The most popular and widely used shot in modern basketball is the one hand jump shot. Most of today's top pro stars use the jump shot as their favorite scoring weapon. Jerry West, Elgin Baylor, Wilt Chamberlain, Bob Petit, Jack Twyman and many others rely heavily on the jump shot. These great scorers have two things in common: (1) The ability to jump high into the air for the shot and (2) perfect control for shooting accuracy. When an offensive player can spring high into the air for a jump shot, he has a distinct advantage in shooting. He is not only close to the basket, but there is less chance of the shot being blocked.

Gene Mozee says, "Mastering the fundamentals of the jump shot so that it can be performed with maximum precision and accuracy requires many hours of devoted practice. Conditioning and preparing the player

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[25]Hooks, op. cit., p. 136.

for maximum performance should definitely include weight training."[26]

Mozee has established the objectives of a sensible weight training program and they can be summarized as follows:

1. To improve leg spring so that greater height can be obtained for the jump shot.

2. To improve jumping ability so that the player controls more jump-balls, rebounds, tip-ins and, because he gets up higher, it will give him a better chance to block an opponent's shot.

3. To improve stamina and strength of the entire body so that you can still run, jump and shoot efficiently near the end of the game, i.e., resist fatique better.

4. To strengthen the hands, wrists, fingers, forearms, upper arms and shoulders which assist in bringing the ball to the shooting position and aid in the act of shooting. This helps you control the ball better.

5. To improve general body condition and health, so that the athlete is able to play up to the maximum of his ability. A tired, poorly conditioned player is more susceptible to injuries and is unable to reach his full potential, not only hindering his own performance but his team as well.[27]

Conditioning drills should be differentiated from fundamental individual and team drills. Each is distinct in its purpose. Fundamental drills are for the purposes of conditioning the individual's reflex, increasing his skills, and achieving a unity of team play. The objective of the conditioning program is to increase stamina and endurance through

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[26]Gene Mozee, "Improve Your Jump Shot," Physical Power, Volume 3, Number 5.

[27]Ibid., p. 16.

prolonged physical exercise that taxes the reserve of each player. Fundamental drills tone the reflex; conditioning drills strengthen the muscle.

Numerous state tournaments are now being held at the high school level of competition and the many smaller and larger college tournaments insure successful teams of post-season competition. This indicates the necessity of a gradual conditioning program that will preclude staleness and allow a team to meet tournament play with a normal mental perspective and physical preparedness. Thus the need can be recognized for a balanced conditioning program that will enable a team to meet its early season opponents and still be prepared to show to its best advantage in the late season contests.

Many qualities go into the making of a good basketball player. Agility, intelligence, reaction, coordination and desire are some of the more important. Strength can be linked with all of these directly or indirectly. The State University of Iowa has been the leader and pioneered the effect of weight training and what it can do for basketball players. In basketball as in all sports, some drills are designed to improve fundamentals while others are primarily for conditioning purposes. A coach should have a primary objective of either improvement of a fundamental or conditioning rather than both combined in every drill.

Summary

Strength is a physiological component of many essential elements necessary for a well-conditioned athlete. Strength is a common component found in all successful professional athletes. Explosive power is a must for an athlete to start quickly and to jump high. A player can charge quicker and harder if he has developed explosive strength. Agility, endurance, possibility of injury, and mental attitude are all directly related to the body strength of an individual. The coaches who do not make time and facilities available for developing the strength potential of their athletes are ignoring one of the most important factors in building a championship team.

With slight modifications, the basic equipment being used today in weight lifting is the same as that used since the early history of the sport. Until recent years, the major purpose of weight lifting appears to have been theatrical entertainment. However, in the past 30 or 40 years the activity has gained popularity among people primarily interested in competitive lifting. That interest in and popularity of weight lifting still exist is evidenced by the growing number of participants in the sport. During World War II, it was demonstrated that the convalescent period of many hospital patients recovering from injuries or operations could be drastically reduced if the patients participated in weight training. Weight training used in the Army and Navy hospitals also furthered interest in weight lifting as a sport. Until after World War II, weight training had not been a part of the physical education

curriculum in our schools. The momentum of the progress of weight training rapidly improved when the activity distinguished weight training, weight lifting, and body building as separate training for specific results.

In the past decade, the method of developing strength is experiencing many exciting changes. The general acceptance of weight training as a very necessary part of an athlete's preparation for competition has added impetus to the method that will produce big results fast.

Isotonic weight lifting allows the trainee to actually see and feel himself lifting, pushing, or pulling a specific weight. This motion of the muscles against resistance can closely simulate specific movements an athlete must accomplish in individual fundamentals of his sport.

Isometric training offers the athlete the convenience of working out in a minimum of time and with relatively inexpensive equipment with the promise of big results within a relatively short period. Commercial products have influenced the public on this type of training.

Circuit training is attractive in that this sytem provides objectives of general physical fitness, endurance, and competition for large groups of participants.

The game of basketball places stress on the ability of a boy to start, stop, jump and generally out-maneuver his opponent. Our most highly successful basketball players in the game today are all physically strong. The pace of basketball has rapidly increased since the origin of the sport. Endurance at a rapid rate demands all the strength a boy

can give. Scheduling and the step by step elimination of teams on their way to a championship calls for a type of training that will maintain the sharpness of players and elude the threat of going stale.

CHAPTER III

EXPERIMENTAL PROCEDURES

The experimenter was able to have an opportunity to work with the M.S.C. freshman basketball team of 1962-1963 in this portion of the investigation. Coach Gerald Stockton made time available during his preseason practice sessions to make this experiment possible.

As was found in the review of literature, speed and agility are classified among the most desirable skills all coaches strive to develop in their athletes. Advertisements of a commercial product in athletic equipment has made claims that excite many coaches in what it will do to improve the major skills of basketball players. Specifically, this equipment is ten pound weighted jackets of the vest type which are to be worn by a player during the entire practice session. They also have specially constructed shoes that have an extra pound built in the sole of the shoe. This is a total of twelve additional pounds above the weight of the conventional practice uniform.

The principal of this type of weight training is to over load an athlete and require the same fundamental skills and freedom of movement during practice sessions. This philosophy is very attractive to coaches in that they hope to carry on their normal practice session of fundamentals and team drills simultaneously with a weight training program. While improving the over all body strength, they are also increasing speed and agility at a more rapid rate than if they did not

use this over load principle.

Seven boys formed the experimental group and seven additional boys made up the control group. Instructions were given to the experimental group to check out the weighted equipment prior to practice and wear it for the entire session.

On October 11, the F.R.A. test was administered to both groups in their normal practice gear before practice began for that day. Upon completing the test the experimental group was allowed time to put on the weighted equipment and the entire squad went through drills of fundamental skills. Both groups practiced for the same length of time every day for the next 36 days. Integrity of the experimental and control groups was forgotten for the time as all boys were exposed to the same drills with and opposing one another.

A typical practice during this experimental period was as follows:

3:00-3:15 Warm Up
3:15-3:25 Set Shots
  1. 2 rebounders - others shooting from 4-5-6 holes
3:25-3:35 Drives to One Hole
  1. Drives from 5 and 6 holes to one until you have made 8 out of 10
3:35-3:40 Free Throws
  1. 2 at each basket - around the horn
3:40-4:00 VS Full Court Press into 2 Game
4:00-4:15 Specialities
4:15-4:25 Delay vs 2 Time Press
4:25-4:40 Free Throws
  1. Make 2 at each basket until you've hit 8 in a row[28]

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[28]This practice schedule was taken from the files of the basketball office of M.S.C.

On November 16, the F.R.A. test was once again conducted with all boys in their normal practice uniform minus the weighted equipment for the experimental group. The test preceded the practice session for that day as it did on October 11.

Proponents of commercial products are attempting to give the coach a device capable of strengthening athletes without allowing separate practice time for weight training. The principle is very attractive, however this investigator ran an experiment to see if speed and agility would improve significantly in a pre-season trial of the equipment. A pre-test was given, the variable of weighted equipment was introduced and worn by the experimental group and an end test followed.

Measuring Device

The F.R.A. test was designed for the purpose of testing speed and agility. Individually, these skills are important to a basketball player, however, the combination of both skills are demanded of an individual to be successful. An observer of basketball can easily see that straight away speed alone is very rarely seen on the court. The majority of movement is the stop and go type with the ability to reverse directions rapidly. The F.R.A. test incorporates both speed and agility in an attempt to simulate action during a basketball game.

A stop watch is used to time the individual in seconds and fractions thereof. From a two point stance, on the command of "go", the player runs 90 feet on the court, picks up a small block of wood and then

runs back to his original starting position. The entire distance is 180 feet. Should a player drop the block of wood, he was given another chance until he succeeded. Two stop watches were used and if they differed a compromising time was recorded.

Combining speed and agility in one test, provided a measuring device that adapted itself to what the game of basketball requires of these two major skills. The F.R.A. test requires the examinee to run 90 feet, pick up a block of wood and run back to the original starting position. The time is recorded in seconds.

Experimental Results

The data obtained from the F.R.A. tests are summarized in the following tables. The figures presented in Tables I-V justify the statements following the tables.

In Table I are the times recorded in seconds of the two groups and the variation of time from the fastest to the slowest.

Table I. Pre-test and end-test times and means for both groups in seconds

Pre-test		End-test	
Experimental Group	Control Group	Experimental Group	Control Group
9.2	9.1	8.5	9.0
9.5	9.5	8.6	9.0
9.5	10.0	8.7	9.0
9.5	10.0	8.7	9.3
9.5	10.0	9.3	9.5
10.0	10.2	9.5	9.8
10.5	10.2	10.3	10.0
Time Variation	Time Variation	Time Variation	Time Variation
1.3	1.1	1.8	1.0
Mean 9.67	Mean 9.85	Mean 9.22	Mean 9.37

Table I shows on the pre-test, the times varied 1.3 for the experimental group as compared to 1.1 for the control group. On the end-test, the times varied 1.8 for the experimental group as compared to 1.0 for the control group. The experimental group's means changed .45 seconds and the control group's means changed .48 seconds between the time the pre-test and end-test was given.

The pre-test given on October 11 was to determine if there was a significant difference in the times of the control group versus the times of the experimental group.

Table II. Significant difference of means of both groups on pre-test

Group	Means	S.D.	t value	Significance at 1% level
Experimental	9.67	.91	.65	No
Control	9.85	.41		

In Table II, the differences between the means of the groups for the pre-test indicates that the two groups were well matched. There is no significant difference in these two groups in the F.R.A. test at the 1% level. Therefore, the null hypothesis of no significant difference between the means of both groups on the pre-test is accepted.

The end-test given on November 16 was to determine if there was a significant difference in the times of the control group versus the times of the experimental group.

Table III. Significant difference of means of both groups on end-test

Group	Means	S.D.	t value	Significance at 1% level
Experimental	9.22	.67	-.51	No
Control	9.37	.41		

In Table III, the differences between the means of the groups for the end-test indicates there is no significant difference in these two groups in the F.R.A. test at the 1% level. Therefore, the null hypothesis of no significant difference between the means of both groups on the end-test is accepted.

In Table IV are the time differences for individuals of both groups between the pre-test and the end-test.

Table IV. Difference of amounts of gain for both groups

Experimental	Control
.9	1.0
.8	.7
.7	.7
.3	.5
.2	.2
.2	.2
.0	.1
Variation of gain .9 Mean Change .44	Variation of gain .9 Mean Change .48

Table IV shows the amount of gain to vary from .0 seconds to the maximum gain of .9 seconds for the experimental group. The control group ranges from a gain of .1 seconds to 1.0 seconds for a maximum gain of .9 seconds also. The mean change for the experimental group is .44

seconds as compared to a mean change of .48 seconds for the control group between the pre-test and the end-test.

To determine if there was a significant difference in the amounts of gain in speed and agility of both groups on the F.R.A. test, the mean changes of both groups were tested by means of the (student) t-test.

Table V. Significant difference of amounts of gain for both groups

Group	Means	S.D.	t value	Significance at 1% level
Experimental	.44	.35	-.23	No
Control	.48	.33		

In Table V, the differences between the means of the groups in the amount of gain indicates there is no significant difference at the 1% level. Therefore, the null hypothesis of no significant difference between the experimental group and the control group is accepted.

From analysis of the data on the pre-test, it can be concluded that both groups were evenly matched, as there was no significant difference between the means at the 1% confidence level. Thus, the experiment had a good beginning. Likewise, no difference between the means of both groups was found significant beyond the 1% confidence level on the end-test. To determine if there was any difference between the amount of gain for the control group versus the experimental group the means of the amounts of gain were tested. There was no significant difference found beyond the 1% level of the amounts of gain in means for both groups.

Therefore, the variable of twelve additional pounds of weighted equipment worn by the experimental group for the pre-season training period, provided no significant gain in speed and agility as measured by the F.R.A. test.

Summary

For this portion of the investigation, the writer used the 1962 M.S.C. freshman basketball team. A commercial product of weighted equipment, whose advertisements claimed would increase speed and agility along with over-all strength gain while being worn during basketball practice, was used. This equipment consisted of ten pound weighted jackets and an extra pound in each shoe.

A pre-test minus the weighted equipment was given on October 11, consisting of speed and agility of which each individual's time was recorded in seconds. An experimental group of seven boys wore the additional pounds of weighted equipment for the next thirty-six days of practice. The integrity of both the experimental group and the control group was forgotten during the practice sessions and individuals of both groups worked with and against one another. An end-test exactly like the pre-test was given on November 16 minus the weighted equipment for the experimental group.

The measuring device was the F.R.A. test which measures both speed and agility. The examinee was required to run ninety feet, pick up a block of wood and then run back to his original starting position.

His time was recorded in seconds.

The results of the experiment were then tested several times to determine if there was a significant difference of improvement between the control group and the experimental group in speed and agility as measured by the F.R.A. test. Both groups were evenly matched at the beginning of the experiment. No significant difference was found between the experimental group and the control group when the pre-tests and end-tests were analyzed. The mean change in amounts of gain between the pre-test and end-test was analyzed and it was found to be of no significant difference at the 1% level in mean change of both groups. Therefore, the variable of twelve additional pounds of weighted equipment worn by the experimental group for the pre-season training period, provided no significant difference between the experimental and control groups on speed and agility as measured by the F.R.A. test.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The acceptance of weight training by coaches as an added impetus in the physical development of athletes is now virtually unanimous. Weight training is now considered a necessary phase of preparation to compete. Various methods of training with weights are attracting coaches' attention, however the theories as to which method produces the best results in the least amount of time are as varied as there are methods.

Summary

In summary, the purpose of this investigation was to determine the value of an integrated weight program to improve speed and agility.

The first step in proceeding with the study was to consult literature on the value of strength, show the progress of weight training, explore the various methods of developing strength and finally the relationship of weight training to basketball skills. An experiment on the value of an integrated weight training program using the M.S.C. freshman basketball team was conducted using weighted equipment during pre-season practice sessions. Pre-tests and end-tests were given and analyzed to determine if there was a significant amount of improvement in speed and agility.

Speed and agility are shown to be directly related to the overall body strength of an athlete. Strength is a common component found in all successful athletes and is known as the key to success in athletics.

The momentum of weight training progress has rapidly increased due to endorsement of well known professional athletes. Distinguishing weight training, weight lifting and body building as separate activities for specific results was a major factor in its progress.

Isotonic, isometric, and circuit training are very popular methods of developing strength. The convenience of administering, time, cost, and psychological effect are all factors which influence a coach's decision as to which method or combination of methods he will use in his program.

The game of basketball places stress on the ability of a boy to start, stop, jump and generally out-maneuver his opponent. Strength is very definitely the major necessity to accomplish these skills.

The 1962 Montana State freshman basketball team members were tested on speed and agility and then divided to form an experimental group of seven boys and a control group of seven boys. The experimental group then wore twelve pounds of additional equipment consisting of a weighted vest and weighted shoes during the entire practice session for a thirty-six day pre-season practice period. The control group wore the conventional practice uniform. The groups were again tested and the test results were analyzed to determine if there was a significant amount of improvement in the experimental group over the control group. No difference on speed and agility was found significant at the 1% level on the pre-test and the end-test of both groups as measured by the F.R.A. test. The means of the amounts of gain were tested to

determine if there was a significant difference between the groups. There was no significant difference found beyond the 1% level of the amounts of gain in means for both groups. Therefore, the variable of twelve additional pounds of weighted equipment worn by the experimental group for the pre-season training period, provided no significant gain in speed and agility as measured by the F.R.A. test.

Conclusions

Analysis of the study warrants the following conclusions:

1. Some method of weight training is necessary to develop an athlete so that he might achieve and reach his potential.

2. Speed and agility cannot be improved unless over all body strength is improved.

3. A coach's decision as to whether he should use the isotonic, isometric, circuit training or a combination of these is largely determined by ease of administering, cost, time available, and psychological effect on participants.

4. An integrated weight training program using twelve additional pounds of equipment was of no significant value in improving speed and agility as measured by the F.R.A. test.

Recommendations

The findings of the study prompted this investigator to recommend the discontinuance of weighted equipment in pre-season basketball drills

at M.S.C. Implications on whether or not heavier weights for a shorter time period during practice or for a longer trial time during the season are recommended for further study.

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