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57

A COMPARISON OF A ROUTINE TRAINING PROGRAM AND AN EXER-GENIE ISOMETRIC-ISOTONIC CONDITIONING PROGRAM WITH RESPECT TO THEIR EFFECTS ON CARDIOVASCULAR CONDITION AND JUMPING ABILITY

A Thesis

Presented to

the Graduate Faculty

Central Washington State College

In Partial Fulfillment

of the Requirements for the Degree

Master of Education

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by

Kenneth R. Jacobs

July, 1969

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The writer wishes to express his appreciation to Dr. Everett Irish for his guidance and supervision during the formulation of this study. Appreciation is also extended to Dr. Unruh and Dean Nicholson for serving on the graduate committee and to Dr. Byron DeShaw, who willingly give his free time in assisting with the statistical analysis.

A very special thanks to my wife, Muff, who lovingly gave of her time, effort and patience.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

THE PROBLEM AND SCOPE

In recent years an abundance of information has come to the attention of physical educators pertaining to new and better methods of conditioning physical education students as well as athletes. Studies involving isotonic training with weights as well as those involving isometric training have been quite popular.

One of the newest and least known methods involves the principle of combining both isometric and isotonic training into one program. The complexity of such a program has seemingly been simplified by a new instrument called the Exer-Genie Exerciser. The author believed that this Exerciser might be an adequate replacement for previous programs used, therefore, the study was instigated.

I. THE PROBLEM

It was the purpose of this study to determine statistically the effect of an Exer-Genie isometric-isotonic conditioning program on the jumping ability and cardiovascular fitness of junior high school athletes, as compared to a group of junior high school athletes involved in a routine conditioning program using calisthenics. The Sargent Jump Test was used to determine jumping ability and the Cameron Heartometer was used to determine cardiovascular fitness. Each group was compared in view of time spent on conditioning.

Importance of the Study. The author believed that the relatively new device, the Exer-Genie Exerciser, might be an answer to a problem of time and space as well as conditioning. This device and Dean Miller's theory of combining the two most prevalent practices of conditioning, isometric and isotonic, into one, warranted a trial. Because there has been limited research on the Exer-Genie in terms of conditioning and building strength, a review of literature failed to provide data on its effect on the cardiovascular system. Because of this fact and the growing need for a systematic evaluation of the cardiovascular system, the Cameron Heartometer was deployed.

It is of the utmost importance for a student to develop leg strength and jumping ability as well as cardiovascular conditioning to effectively compete in basketball. In the past, this has been the author's purpose in using calisthenics. Therefore, there was a need to see if the Exer-Genie Exerciser could fulfill these needs.

II. DEFINITION OF TERMS USED

A Set. A set consists of a designated number of repetitions.

Repetition. Repetition refers to a complete cycle of the exercise to be performed. The cycle consists of the starting position, complete the range of motion and back to the starting position again.

Control Group. A group of twenty-four eighth and ninth grade basketball players from Chief Moses Junior High School in Moses Lake, Washington. This group used calisthenics in their regular conditioning program.

Experimental Group. A group of twenty-four eighth and ninth grade basketball players from Frontier Junior High School in Moses Lake, Washington. This group worked daily with the Exer-Genie Exerciser.

Sargent Jump Test. The Sargent Jump is a method of testing vertical jumping ability.

Pre-test. The test given to all participants befor the study was started.

First Post-test. The tests given to all participants upon completion of twelve weeks of the program.

Second Post-test. The test given to all participants eight weeks after the completion of the exercise program.

Cameron Heartometer. An instrument by which a systematic and objective recording of blood pressures, pulse pressure, heart rate and heart valve actions can be attained as defined by Dr. T. K. Cureton (11:232).

Exer-Genie Exerciser. A resistive instrument consisting of a small alloy cylinder enclosed in a metal sleeve with a nylon line or rope wound around an inner cylinder (16:1).

Isometric. Exercising without joint movement, therefore there is no change in the length of the muscle.

Isotonic. The type of exercising which allows the muscle to lengthen and shorten during the contraction period.

Systolic Amplitude. Indicates the magnitude of the myocardial action as a result of the contraction of the ventricles (11:236).

Obliquity Angle. The angle drawn from the maximum systolic point to the center of the graph, indicating relative energy of myocardial action (11:244).

Area Under the Curve. Indicates the blood pumped per cycle or stroke of the heart (11:235-6).

Pulse Rate. The number of times the heart beats per minute.

Rest to Work Ratio. The ratio of the systole contraction to the overall time of the diastole (From the point of closing of the semilunar values to the start of the next systole) (11:249).

III. SCOPE AND LIMITATIONS

This study was limited to forty-eight eighth and ninth grade basketball players from two junior high schools in Moses Lake, Washington.

The athletes were divided into two groups of twenty-four members each. One group, from Frontier Junior High School, worked each night at the beginning of practice with the Exer-Genie Exerciser. The second group, from Chief Moses Junior High School, had their regular program of calisthenics each night at the beginning of practice.

The study was extended through the entire 1968/69 basketball season, a period of twelve weeks. A pre-test was given at the beginning of the program and a post-test was given at the conclusion. In addition, a second post-test was given eight weeks after the termination of the regular program.

Evaluation of results was based on the Sargent Jump and the Cameron Heartometer tracings.

CHAPTER II

REVIEW OF THE LITERATURE

There has long been an aura of mystery surrounding certain sports and their relationship to weight training. Certain "old wives tales" have left the impression that weight training may leave one musclebound, thus reducing one's efficiency in a particular sport (27:57). Today, however, more and more knowledgeable people, including physical educators and coaches, are beginning to realize the importance of strength in athletics as well as fitness for daily living. Gene Hooks comments, "Strength is the key to success in modern athletics" (18:1).

Birger Johnson, an advocate of systematic training for basketball, believes that most athletic sports require strength and power in the execution of skills and probably the most effective way of obtaining these very vital essentials is some type of weight training (27:58).

Strength, flexibility, muscular endurance and circulatory-respiratory endurance are all important components of physical conditioning and need to be developed. The manner in which basketball is played exemplifies these needs (27:58). Studies have shown that various methods of training have proven to be highly effective in such areas as jumping ability (an increase of up to six inches), strength, flexibility and conditioning (18:2) (27:58) (3:131) (4:231). However, there is a great variance in the literature regarding the effects of isotonic and isometric training on the cardiovascular system. There is general agreement among professionals in physical education about the need for increased physical activity and knowledge of its effects. As Raab explains it:

> Steadily increasing lack of physical exercise, as it prevails among the super-civilized, motorized, automatized and television-sitting population of the West has, likewise, come under scrutiny as a possible factor in degenerative heart disease (10:240).

Continual, methodical stressing of the body by subjecting it to progressively increasing work loads results in responses that are seemingly directed toward making its reaction to increased metabolic rates more successful. These changes may be summarized as:

1. Lower resting heart rate.
2. Lower heart rate for any submaximal workload.
3. Greater maximal stroke volume.
4. Less ventilation required per unit of oxygen utilized.
5. Greater maximal oxygen consumption.
6. Less utilization of anerobic energy.
7. Capacity for a greater oxygen debt (22:313).

In analyzing both isotonic and isometric training, most researchers agree that isotonic training has a directly beneficial effect on the cardiovascular system, although not to a great degree, and that isometric training has little or no effect on the cardiovascular system (25:21). It should be noted that the heart muscle is very similar to the skeletal muscles, and that an athlete who strengthens his skeletal muscles will in turn strengthen his heart. However, there is a difference between the types of exercises which increase the skeletal muscle and that which will strengthen heart muscle. For example, in muscle building with heavy resistances, exercises may be kept fairly low in terms of repetitions and sets, so that the muscle can be worked to maximum effort. In this type of exercise there is not a great amount of increase in the heart rate or respiration, thus it is of little benefit to the heart. However, in endurance programs there is a great deal of stress put on the heart, therefore a great increase in cardiovascular and respiratory functions, but little or no increase in the skeletal muscles (17:16). Shvartz found differential effects depending upon the amount of resistance. At one-half maximal resistance he found no differences in effect on heart rate, but with an increase up to maximal resistance he found a two-fold increase in heart rate with isometrics and only a proportional increase with isotonics (28:125).

New records are being set in the field of athletics each year. Modern athletes, as well as their coaches, realize that regular training will no longer suffice if they hope to attain the high standards now being set. Therefore, there is a definite need for muscular development. It is general knowledge that the amount of tension a muscle must exert to overcome a resistance is the key to muscular development. A muscle which contracts against a resistance that demands exertion will increase in strength. The amount of increase is dependent upon the amount of resistance. The main principle in any method of strength development is that the muscle must be overloaded in order than an increase in strength be realized. Both isotonic and isometric training lend to this principle of strength development (18:12).

There have been numerous research studies conducted comparing isometric training programs with isotonic training programs (22:1-26) (25:18-21) (26:109-113). Some of the studies have shown that isometric training is more beneficial for strength development, others have shown isotonic to be of more value, and still others show no appreciable difference between the two programs (4:131-135) (25:18-21) (24:98). Many of the propondents of the isotonic programs state that while strength gains are in evidence, the isometric program does little or nothing for endurance, flexibility and particularly cardiovascular fitness (14:58-9) (25:21). Conversely, Gentile argues that isometric training requires little or no equipment, the program can be conducted anyplace and, most importantly, it requires very little time (13:24).

It is well known that isotonic muscle contractions will develop muscular strength (4:131). Richard Berger states, "Dynamic overload training is more effective for increasing vertical jumping ability than the static overload training" (5:23).

Capen points out that the use of overloads of weight will produce hypertrophy of muscle and consequently an increase in strength (9:91). McCloy theorized that an overload on a muscle will result in a more adequate blood supply to that muscle as well as an increase in strength and that the greater oxygen supply brought by this blood flow would improve muscular endurance (6:91). De Vries favors the isotonic method for strength gains over isometric, as mentioned in his text, Physiology of Exercise (12:307).

It was believed for many years that the most efficient way of developing strength was regimen of boring repetitions with increasing amounts of weight. Recently, however, isometric or static contraction has become popular. Isometric training is not new, but it has been readily used only within the last decade. As early as the 1920's scientists that were experimenting with frogs noticed that a leg that was tied down grew significantly after trying to free itself (25:21). Isometrics have generally been found to produce substantial strength gains (22:1-26) (13:24-6) (4:131-5). Mathews and Krause concluded that isometric type contractions resulted in greater strength gains than did the isotonic type (22:26). Arthur Stienhouse contends that repetition is not necessary to build strength. However, he also contends that isometric contractions do nothing for the heart or lungs and the program would ideally be suited as a supplement to a program involving endurance type activities, such as running, which would benefit the cardiovascular system (25:18-21). According to reports credited to E. A. Muller, a single daily isometric contraction of a muscle, continued for six seconds and demonstrated at two-thirds maximum effort will result in maximum strength gains (18:17).

Muscular strength can be improved both by training statically or dynamically. Of course, one advantage of static training is that a great number of exercises can be performed five or six days a week without undue fatigue (4:134).

With an abundance of rationale supporting systematic training for athletes the question emerges, which method is best? Berger says that muscular strength can be gained by both isometric and isotonic methods, but that the kind of training resulting in the most rapid strength increase had not been clearly established (4:131).

In summation then, one can state that specific weight training routines will enable an athlete to run faster, jump higher, throw farther, swim faster, etc. The fact remains that many methods of training are being used at the present time (9:56). Progressive resistance programs have been widely used with popular accord. However, moderately heavy resistance programs have been hampered by the cost of equipment and time and space required. One possible answer to this problem of selecting a program to best suit the objectives of one's program might be an instrument that allows both isometric and isotonic exercising easily supplemented with a program of running. This instrument would not only allow specific muscle groups to be exercised but would have implications for total body development (2:16-7).

Such an instrument is now available. It is known as the Exer-Genie Exerciser. The Exer-Genie Corporation was formed in 1961, but it was not until 1964 that this device came into prominence. In 1964, Dean Miller, track coach at San Jose State College, recognized the Exer-Genie Exerciser as a breakthrough and proposed a theory which combined these two types of training. This theory was to tire the muscle isometrically and then, without stopping or relaxing, move through the complete range of motion and complete the isotonic phase (16:1). In other words, in order to build a muscle one must first fatigue it. With the isometric phase of the Exer-Genie one first fatigues the muscle and then completes the range of motion for endurance and flexibility, thus eliminating boring repetitions.

Years of study and observation of his theory of holding isometrically and then exercising the fatigued muscle isotonically, convinced Mr. Miller that strength, endurance, flexibility and technique could be improved in a minimum of time (16:2).

Some of the advantages of the Exer-Genie, as opposed to other programs, are:

1. Low cost.
2. Little storage problem.
3. Light weight and versatility.
4. Can be set up anywhere.
5. Can be the sole program or used as a supplement (16:1-2).

Since 1964, the Exer-Genie has gained in popularity and use. Not only have many school systems adopted this device, but such professional teams as the Green Bay Packers, Los Angeles Rams, San Francisco Giants, Cleveland Indians, Minnesota Vikings, Los Angeles Dodgers and many others have also incorporated this into their training programs. The Exer-Genie Exerciser is readily adapted to any particular motion of sport and the progressive overload can be adjusted or changed by simply changing the dial, thus giving the selected amount of resistance (16:1).

The Exer-Genie consists of an engineered cylinder and a nylon rope that can be pulled back and forth through this cylinder with equal resistance in either direction. The Exerciser works on the principle of friction. A quick adjustment permits the user to place up to four hundred pounds of friction on the rope as it passes through the cylinder (13:24).

One of the most time consuming necessities of athletics is conditioning. It has been found that the Exer-Genie Exerciser has lowered a major portion of this time requirement without loss of conditioning, thus enabling the coach to spend more time on the fundamentals of the sport involved (13:24-26) (20:55) (23:30). Dom Gentile, assistant trainer for the Green Bay Packers states:

> The device permits an individual or a squad to perform the equivalent of an hour of weight training or lifting in just six minutes and the equivalent of sixty sit-ups in just thirty-five seconds (13:24).

The coaching staff of the Green Bay Packers, the first professional team to make use of the Exer-Genie, found that it permitted the isolation of muscles and muscle groups for concentrated work. Not only that, but that it virtually eliminated the necessity of long calisthenics sessions (13:24).

Fred Lewis, basketball coach at Syracuse University, concurred with Gentile. Lewis' program employed Exer-Genie Exercisers set at ten pounds of resistance in a "buddy system". This allowed him to avoid using time to readjust resistances among individuals. The "buddy system" worked in such a way that while one player was working, his partner handled the trailing rope and controlled the additional amount of resistance necessary to make the first player work to his full capacity. After one player had exercised, the two exchanged positions. In this pilot program of conditioning basketball players at Syracuse, Lewis theorized that the isometric phase of the exercise would build strength and the isotonic phase would increase flexibility and endurance. At the conclusion of the season, though his work was not validated by statistics, Lewis surmised, "In our opinion, its use in our program developed strength, endurance, speed and flexibility in the quickest and most effective way possible" (29:47).

Head coach Jim Oler of Brevard Junior College, Cocoa, Florida, cites the fact that his squad of last year, using the Exer-Genie Exerciser for the first time instead of the traditional calisthenics, was noticeably better conditioned. This, plus the outstanding test results run on the vertical jump, dips and pull-ups, have convinced Jim Oler that the Exer-Genie has a definite place in his program of conditioning. In conclusion, Oler states, "We found that the Exer-Genie Exerciser reduced our conditioning period by about half" (1:34).

The results of other studies indicate the popularity and versatility of the Exer-Genie. It is used not only in general physical fitness programs (2:16-24), and for isolated muscles and groups of muscles (13:24-26), but also has proven worthwhile in studies done in football, basketball and baseball (20:44) (13:24-26) (21:55-58).

CHAPTER III

PROCEDURES

In this study a test group utilizing the Exer-Genie Exerciser was compared with a calisthenic group to determine whether the Exer-Genie program had any effect on the jumping ability of junior high school athletes. In addition, both groups were subjected to the Cameron Heartometer procedure to determine both the original degree of fitness and the effects of the Exer-Genie program on their cardiovascular system.

The subjects used were forty-eight students taken from two separate junior high schools. Both groups of students were members of their respective school's basketball teams. The two groups were tested by the Sargent Jump Test to determine any differences in ability at the onset of the study. The results of this test, as well as the results of the Heartometer test, are found in the section containing tables.

The Sargent Jump Test--Testing Procedure

Each participant in both the experimental group and the control group was given detailed instructions on how to perform the Sargent Jump.

There are various ways to measure the Sargent Jump. The method devised for this study closely resembles the "chalk jump" method. On the wall was a sheet of paper four feet long and four feet wide, marked with horizontal lines every half inch. The paper was placed six feet from the gymnasium floor.

In this method the subject stands with the arm fully extended and "marks" the wall. He then jumps and "marks" the wall at the height of the jump. The difference between the first and the second marking was recorded. "Marking" the wall was done by coating the fingers with ink from an ink pad and then jumping and touching the wall.

This jump was performed by swinging the arms downward and backward, after having taken a crouching position with knees bent approximately to a right angle. The subject paused briefly in this position, thus eliminating the possibility of a double jump, and leaped upward as high as possible (17:56). As the subject reached the highest point he "marked" the wall. The subject jumped three times and the best effort was recorded.

The students involved in the study were taught this technique and were required to practice it before the test was administered. This procedure was followed in the pretest and both post-tests for each participant.

The Cameron Heartometer--Testing Procedure

Before the initial administration of the test, each student was informed of the importance of his complete cooperation and of the technique involved in using the Cameron Heartometer.

The subject was instructed to sit with both feet on the floor and head aligned straight ahead. The left arm was to be placed on the table approximately level with the heart with the palm up. Each subject was instructed to relax and fix his gaze at a line on the blackboard. Emphasis was placed on not moving or tensing the muscles as this would cause irregularities in the tracings. In order to eliminate any apprehension, the testor used a normal, friendly tone of voice. After the student had been seated confortably, the cuff, or band, was snugly applied, with the center of the compression bag squarely over the brachial artery. During this time, his age, height and weight were recorded.

The machine has a clutch knob with three positions. Blood pressure was read with the clutch in the out position. The graphing was done with the clutch in the in position and the neutral or intermediate position was used for cutting off current. The first step was to pull the clutch knob on the upper left side of the cabinet all the way out. After making sure the valve on the inflation system was completely closed, the testor started the inflation, pausing two or three seconds after each inflation.

The machine was carefully observed for the pulsation of the indicator lights. The lowest pressure at which either light flashes regularly indicates the diastolic blood pressure. This pressure was recorded by pushing the clutch knob all the way in, thus graphing. When the graphing of the diastolic pressure was approximately one inch long, the clutch knob was pulled all the way out. The inflation was then increased until the light ceased to flash. This indicated that the artery had collapsed, which in turn indicated that the pressure in the cuff was above the systolic level. The cuff pressure was slowly deflated at a rate of three to five millimeters per two second intervals and was checked by watching the recession of the blood pressure pen on the graph. This was continued until the light pulsated for a count of ten. This is the systolic, or maximum blood pressure. The clutch knob was pushed in all the way to graph the systolic pressure, (approximately one inch), and then the knob was pulled all the way out, thus stopping the rotation of the graph. The cuff pressure was then deflated quickly until the blood pressure pen was ten to fifteen millimeters below the diastolic mark. Immediate increase of the pressure to ten or fifteen millimeters above the diastolic mark was attained. For best graphing results, a distance of between ten and twenty millimeters was utilized. After attaining this level the operator pushed the clutch knob all the way in and a thirty second heartograph was made. The pulse wave was centered over the two hundred and twenty pressure line on the graph. This was done in order to obtain the most accurate readings. Centering the pulse wave line properly can be done by repeatedly engaging and disengaging the clutch. Upon completion of the graph, the pressure was promptly released (23:17-23).

This procedure was followed in the pre and post-testing of all participants.

The Exer-Genie Exerciser--Experimental Procedure

The training program with the Exer-Genie Exerciser was scheduled for each night of practice with the exception of game days. Each student was instructed to keep a written account of any extracurricular activity to determine any effects of unprogrammed activities.

In order for all of the participants in the experimental group to complete the exercises in a minimum of time, they were assigned separate stations. Nine Exercisers were used, with three students at six of the stations and two students at the remaining three stations. There were five stations of exercises to be completed. They were: (1) squats, (2) dead lifts, (3) running, (4) bicycle, and (5) toe raises.

While one subject was working with the Exer-Genie the other was providing resistance, thus the proper amount of rest for each participant was insured. Because of the portability and versatility of the Exerciser, the students did not have to rotate to new stations. They merely adapted the harness for the next exercise.

At the beginning of the program each individual had warm-up exercises. These consisted of toe-touching, side straddle hop, trunk twisters, and running two laps around the gymnasium.

While the participants were warming up the Exer-Genie Exercisers were set up. No equipment was needed except the Exer-Genie, the two foot by three foot base board with attachment hooks, and wall hooks.

After the warm-up exercises had been completed the boys in the experimental group were positioned at one of the nine Exercisers. A chart showing the exercises, the number of repetitions and the number of sets for each exercise is presented below. This chart is similar to the one posted on the gymnasium wall for each participant to observe.

Exercises	Repetitions	Sets
Warm-ups		
1. Toe-touching	5	1
2. Trunk twistors	5	1
3. Side Straddle Hop	5	1
4. Running	2	1

Resistance Exercises	Repetitions	Sets
1. Squats	3	1
2. Dead Lifts	3	1
3. Bicycle	10	1
4. Running	2	1
5. Toe Raises	3	1

The subject had the option to use the grips or the shoulder harness when working with the Exerciser. It was found, after a one-week period, that the shoulder harness was most effective since it put the stress solely on the legs and not on the arms or back.

For the correct understanding of the exercises involved in the study an explanation of each is as follows:

Number 1-Squats. The subject places feet shoulder-width apart and assumes a squatting position on the base board. The back is straight and the head up. The subject grasps the grips with palms up. The Exer-Genie resistance had been set at five pounds. Due to large differences in strength we set each Exerciser at five pounds tension. Thus, we relied on each partner to supply the major portion of resistance. The student then attempted to stand erect. The partner, while grasping the trailing cord, prevents the subject from moving. This is the isometric phase. After a count of five seconds the partner then slowly eases the resistance just enough for the subject to attain the erect position. This is the isotonic phase. This portion of the exercise also takes approximately five seconds. Thus, the first of three repetitions is completed in ten seconds, as are the remaining two repetitions before the partners exchange places. In each phase the thrusting movement is executed with as much force as possible.

Number 2-Dead Lifts. The subject stands erect with back straight and head up. The legs are in approximately a hundred thirty-five degree angle to the floor. The student adjusts the harness to the correct height. The resistance is set at five pounds and the partner supplies the remainder of resistance necessary. The student then attempts to stand erect, exerting against this resistance as forcefully as possible. This is the isometric phase. After a count of five seconds the partner slowly lets the subject complete the range of motion, finishing the isotonic phase. The exercise takes ten seconds. The first subject completes three repetitions before exchanging positions with his partner.

Number 3-Running. At the running station, the Exer-Genie Exerciser is attached to a hook extending from the wall. The subject puts on the harness. The resistance is set at five pounds. The first subject to run is the one nearest to the wall. He takes a sprinter's stance with back nearly parallel to the ground and head up. He starts from the wall and runs against the resistance of the Exerciser as well as that of his partner. He runs until his partner has been drawn back to the wall, approximately thirty feet. He then makes his resistance available to the second subject who begins his own run. The first subject will then be drawn to the wall at which time he is ready to start his second run. Each subject finishes two runs before he completes the exercise.

Number 4-Bicycle. The subject lies in a supine position and places his feet in the stirrups or grips. He extends one leg as far as possible, which in turn draws the other knee close to the chest. The feet are held approximately eighteen inches from the floor. It was found that by a mutual agreement of testor and subject a set amount of resistance could be attained. The resistance was charted over the twelve week period and the progress noted. The resistance varied greatly among the individuals, thus taking some time to reset the resistance on the Exerciser. In this exercise, like the running, the Exerciser was attached to the wall. This particular exercise utilized only the isotonic phase of exercising. Complete extension of first one leg and then the other constituted one repetition.

The subject performed ten repetitions in sequence and retired.

Number 5-Toe Raises. The student stands erect with feet shoulder width apart, heels on the gymnasium floor and toes on the base board. The back is straight, head up and arms extended straight in front of the body. His partner grasps the trailing cord in both hands, while putting one foot on the base board for balance. The student grasps the handles with palms down. He attempts to rise to his toes and exerts maximum pressure against this resistance for a count of five seconds. He repeats the exercise three times. This particular exercise involves only the isometric phase.

The control group, which was from the other junior high school, ran calisthenics each night approximately fifteen to twenty minutes. This group was under the supervision of Mr. William McBee. The calisthenics used were not only for endurance and flexibility, but for strength as well. The calisthenics chosen were typical of a great many basketball teams and were ones that both Frontier and Chief Moses have used in the past (1:34).

An explanation of each drill will follow for the correct understanding of that drill.

Side Straddle Hop. The subject stands erect with hands at the sides. He then jumps into the air bringing the arms in a wide arc to an overhead position and the legs out to a straddle position. He then returns to the starting position by jumping again, bringing the arms in the same arc to the original position and the legs back together.

Squat Thrust. For this drill the subject stands erect with the hands at the sides. On the count of "one" he squats to the floor, putting the hands on the floor between the knees. On "two" he thrusts the legs out behind in a push-up position. He brings them back to the squat position on "three" and stands erect on "four".

Leg Lifts. The subject lies in the supine position. At the count of "one" he raises the legs approximately eight to ten inches off the floor, keeping the legs straight. At the count of "two" he stretches the legs as widely as possible. At the count of "three" he brings the legs back together again and at the count of "four" the legs are lowered to the floor.

Jumping Beans. The subject takes a crouching position, legs shoulder width apart and head up. On the coach's whistle, the subject jumps as high as possible, thrusting their arms as high as possible and return to the floor on the balls of the feet.

Tip Toes and Reach. Each student or subject stands erect, back straight, head up and feet shoulder width apart. At the count of "one" the student rises to his tip toes and extends his arms overhead, "reaching for the sky". At the count of "two" he returns to the floor.

Push-ups. The subject takes a front-leaning position with the body supported on the finger tips and balls of feet. The arms are straight and at right angles to the body. On the count of "one" he lowers his body so that only the chest touches the floor. He then pushes back to the starting position on the count of "two".

Running in Place. The subject stands erect in a normal running position. On the coach's whistle he brings the knees as high as possible and continues running. On the second whistle the subject lowers the legs to a normal level and jogs slowly. On the third whistle the subject stops.

Sprints. In addition to the calisthenics the control had a daily regimen of sprints. The subjects lined along the base line at one end of the gymnasium. At the sound of the coach's whistle the subjects sprint the complete length of the gymnasium floor and back.

Running. The subjects start at a predetermined spot on the gymnasium floor and jog around the outer edge of the floor. At the sound of the coach's whistle the subjects sprint at top speed until the second whistle is sounded at which time they settled into a jog once again.

A chart showing the exercises, the number of repetitions and the number of sets for each exercise previously mentioned is shown below.

Exercises	Repetitions	Sets
1. Side Straddle Hop	10	2
2. Squat Thrust	10	2
3. Leg Lifts	10	1
4. Jumping Beans	10	2
5. Tip Toes and Reach	10	1
6. Push-ups	10	2
7. Running in Place	10	1
8. Sprints	2	10-20
9. Running	5	1

After participating in this program for twelve consecutive weeks both the control group and the experimental group were post-tested with the Sargent Jump Test and the Cameron Heartometer. The results were immediately recorded. Eight weeks after the termination of the program, both groups were again tested, but only with the Sargent

Jump. This was to determine if any significant difference might exist after eight weeks of no supervised training. Charts showing the results of the pre-tests and both post-tests for both groups are shown in the section containing tables and charts.

CHAPTER IV

ANALYSIS OF DATA

In this study an experimental group, working with the Exer-Genie Exerciser, was compared with a control group to determine the effect, if any, on the jumping ability and cardiovascular fitness of junior high school athletes. Each group consisted of twenty-four junior high school athletes, each being a member of their respective school's basketball team. Each group was pre-tested on the Sargent Jump Test and the Cameron Heartometer.

After the pre-testing was completed the experimental group worked with the Exer-Genie Exerciser each night of practice throughout the basketball season. This regimen included turnout over the vacation periods. The only time the group did not utilize the Exer-Genie was on the day of the game. The control group had no formal training. They were involved in a routine conditioning program consisting of calisthenics. They, like the experimental group, worked each night and only on game day did they omit this conditioning program.

The athletes participated in this program for the duration of the basketball season--a period of twelve weeks. They were then post-tested on the Sargent Jump and the Cameron Heartometer. Eight weeks after the termination of the program each participant was again post-tested, but only with the Sargent Jump.

In analyzing the Sargent Jump Test results the Fisher t was used. The mean score relationships were checked at the .05 and .01 levels of significance with 23 degrees of freedom.

Sargent Jump

The mean score of the pre-test experimental group on the Sargent Jump was 17.25, with a standard deviation of 2.20. The mean score of the control group was 17.04, with a standard deviation of 1.93. This results in a mean difference of .21 and a t score of .34, which is not significant at the .05 level. The pre-test results show that there was no appreciable difference between the two groups at the beginning of the study.

The first post-test mean score of the experimental group was 19.75, with a standard deviation of 2.24. The mean score of the control group was 18.04, with a standard deviation of 1.97. This results in a mean difference of 1.71 and a t score of 2.73, which is significant at the .05 level. The results show that the experimental group using the Exer-Genie Exerciser made a significant gain in jumping ability between the pre-test and the post-test as compared to the control group.

The second comparison shows the growth within the experimental and control groups.

The Sargent Jump pre-test mean score for the experimental group was 17.25. The post-test score was 19.75, which is an increase of 2.50. This results in a t score of 3.79, which is significant at the .01 level.

The Sargent Jump pre-test mean score for the control group was 17.04. The post-test mean score was 18.04, which is an increase of 1.00. This gives a t score of 1.75, which is not significant at the .05 level. The results show that the experimental group made the larger gains in jumping ability between the pre-test and the post-test when comparing each group against itself.

The next test, given eight weeks after the termination of the regular program, showed a mean score of 19.25 for the experimental group. The mean score of the control group on the second post-test was 18.00. This results in a mean difference of 1.25. This results in a t score of 2.12, which is significant at the .05 level.

The results indicate that the experimental group maintained a significant difference in jumping ability eight weeks after the completion of the study.

The figures illustrating the above facts can be found in the Appendix.

Cameron Heartometer

The Cameron Heartometer was used to test cardiovascular fitness. In analyzing the Heartometer results the standard score of "z" was used instead of the "t" score. The "z" was favored over the "t" because the distribution was somewhat skewed.

Area Under the Curve

The mean score of the pre-test experimental group was .240. The mean score of the control group was .302, a mean difference of .062. This results in a z score of .23, which is not significant at the .05 level.

The pre-test results show there was no appreciable difference between the two groups at the beginning of the study.

The post-test mean score of the experimental group was .350. The mean score of the control group was .325, a mean difference of .025. This gives a z score of .13, which is not significant at the .05 level.

The results indicate that after the post-test there is no statistical difference between the two groups.

Systolic Pulse Wave Amplitude

The mean score of the pre-test experimental group was 1.01. The mean score of the control group was 1.02, a mean difference of .01. This results in a z score of .14, which is not significant at the .05 level. These results show no significant difference between the two groups at the beginning of the program.

The post-test mean score of the experimental group was 1.25. The mean score of the control group was 1.11, a mean difference of .14. This results in a z score of 2.00, which is not significant at the .05 level. It should be noted that 2.06 would have been significant at the .05 level. However, the results of the post-test show there is no statistical difference between the two groups.

Rest to Work Ratio

The mean score of the pre-test experimental group was 2.51. The mean score of the control group was 2.89, a mean difference of .38. This results in a score of 1.73, which is not significant at the .05 level. This shows that no appreciable difference existed between the two groups at the beginning of the program.

The mean score of the post-test experimental group was 2.83. The mean score of the control group was 2.86, a mean difference of .03. This results in a z score of .14, which is not significant at the .05 level. These results indicate that upon completion of the post-test there is no statistical difference between the two groups.

Obliquity Angle

The mean score of the pre-test experimental group was 21.5. The mean score of the control group was 22.0, a mean difference of .5. This results in a z score of 1.32, which is not significant at the .05 level. These results show that there is no appreciable difference between the two groups at the beginning of the test.

The post-test mean score of the experimental group was 20.4. The mean score of the control group was 21.8, a mean difference of 1.4. This results in a z score of 3.18, which is significant at the .01 level. The results indicate that after the post-test there is significant difference in the obliquity angle.

Pulse Rate

The mean score of the pre-test experimental group was 85.6. The mean score of the control group was 78.2, a mean difference of 7.4. This results in a z score of .54, which is not significant at the .05 level. The results show no significant difference between the two groups at the beginning of the program.

The post-test mean score of the experimental group was 76.6. The mean score of the control group was 78.0, a mean difference of 1.4. This results in a z score of .09, which is not significant at the .05 level. These results show that after the post-test there is no statistical difference between the two groups.

The figures illustrating these facts can be found in the Appendix.

CHAPTER V

SUMMARY AND CONCLUSIONS

The program consisted of forty-eight basketball players from two separate junior high schools in Moses Lake, Washington. One group of twenty-four eighth and ninth grade basketball players was from Frontier Junior High School. The second group was from Chief Moses Junior High School. The program compared the experimental group which was from Frontier and which worked with the Exer-Genie Exerciser with the control group which was from Chief Moses and which worked with their regular training program consisting of calisthenics. The comparison was made in view of the effects on jumping ability and cardiovascular fitness as well as with the amount of time spent in each program.

Each group was pre-tested with the Sargent Jump Test and the Cameron Heartometer at the beginning of the program. The program's duration was twelve weeks, after which each group was post-tested to determine any changes in jumping ability or cardiovascular fitness. Eight weeks later they were again tested, using only the Sargent Jump Test, to determine any further changes in jumping ability.

An analysis of the data from the Sargent Jump Test revealed that there was no significant difference in the pre-tests. However, after the completion of the twelve week program and the Sargent Jump post-test results were analyzed, it was apparent that the experimental group had increased the greatest amount in jumping ability. The results proved significant at the .05 level. The results obtained from the second post-test, given eight weeks after the termination of the regular program, indicated that the experimental group maintained a significant difference in jumping ability over the control group. This difference was significant at the .05 level. The results support the conclusions of De Vries that isometric-isotonic gains are maintained (12:307).

In analyzing the statistical results from the Cameron Heartometer tracings it was found that for the Area Under the Curve, the Rest to Work Ratio, the Systolic Pulse Wave Amplitude and the Pulse Rate, there was no statistical difference between the groups either at the pre-test or post-testings. The results indicate that there is little if any effect on the cardiovascular system as a result of the experimental program. This supports the findings of Stienhaus (25:18-21), and Shvartz (28:125). In analyzing the Angle of Obliquity it was found that while no statistical difference existed in the pre-test results, there was a mean difference of 1.4 in the post-test. This resulted in a z score of 3.10, which is significant at the .01 level. There seems to be no basis for this difference.

The author recommends that further study be made with a larger number of subjects. It is also recommended that a program using the Exer-Genie Exerciser be conducted involving larger areas of body development. This study should compare the results of three groups, one using only weight training in an isotonic program, one using only isometrics and the third group using the Exerciser.

In summary, when considering the amount of time spent on the conditioning of both groups of athletes, it is the author's conclusion that once the regimen is learned and that the athletes know what is expected of them, the Exer-Genie program requires the same amount or less time than the traditional calisthenics program.

In view of the statistical results, the Exer-Genie program is superior with respect to the development of jumping ability, and can hold its own in the maintenance of cardiovascular fitness when compared to a regular conditioning program using calisthenics.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Alexander, Bill. "A New Style of Basketball Conditioning," Scholastic Coach, October, 1967, pp. 79.

2. Alexander, John F., Stephen L. Martin, and Kenneth Metz. "Effects of a Four-week Training Program on Certain Fitness Components of Conditioned Male University Students," Research Quarterly, 39:16-24, March, 1968.

3. Ball, Jerry R., George Q. Rich, and Earl L. Wallis. "Effects of Isometric Training on Vertical Jumping," Research Quarterly, 35:231-5, May, 1963.

4. Berger, Richard A. "Comparison Between Statis Training and Various Dynamic Training Programs," Research Quarterly, 34:131-5, May, 1963.

5. __________. "Effects of Dynamic and Statis Training on Vertical Jumping Ability," Research Quarterly, 34:419-24, December, 1963.

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

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

8. Clarke, Harrison H. Application of Measurement to Health and Physical Education. New York: Prentice-Hall, Inc., 1950. 493 pp.

9. Coker, Chuck. "All Sports Weight Training Program," Athletic Journal, April, 1967, pp. 113.

10. Colloquium on Exercise and Fitness. Edited by Seward C. Staley. Robert Allerton Park, Monticello, Illinois: 1959. 248 pp.

11. Cureton, T. K. Physical Fitness Appraisal and Guidance. St. Louis: C. V. Mosby Company, 1947. 556 pp.

12. De Vries, Herbert A. Physiology of Exercise for Physical Education and Athletics. Dubuque, Iowa: Wm. C. Brown Company, 1966. 422 pp.

13. Gentile, Dom. "A New All-Around Exerciser," Scholastic Coach, January, 1966, pp. 94.

14. Higdon, Hal. "Let's Tell the Truth About Isometrics," Today's Health, 43:58-9, June, 1965.

15. Hoffman, Bob. Simplified System of Barbell Training. York, Pennsylvania: York Barbell Company, 1961. 350 pp.

16. Holkesvick, E. E. "Fact Sheet." Exer-Genie Corporation, Fullerton, California, August 15, 1968. (Mimeographed)

17. Homola, Samuel. "The Heart in Athletics," Scholastic Coach, October, 1967, pp. 79.

18. Hooks, Gene. Application of Weight Training to Athletes. New Jersey: Prentice-Hall, Inc., 1962. 254 pp.

19. Karpovich, P. V. "Warm Up and Physical Performance," Journal Lancet, 77:87-8, October, 1957.

20. Lewis, Fred. "A Dynamic Approach to Body Conditioning," Athletic Journal, June, 1966, pp. 70.

21. Logan, Gene A., Wayne C. McKinney, and William Rowe, Jr. "Effect of Resistance Through a Throwing Range-of-Motion on the Velocity of a Baseball," Perceptual and Motor Skills, 23:55-58, 1966.

22. Mathews, Donald K. and Robert Krause. "Effects of Isometric and Isotonic Exercises on Elbow Flexor Muscle Group," Research Quarterly, 28:1-26, March, 1957.

23. Monroe, Keith. "Six Seconds for Exercise," Reader's Digest, 75:51-4, July, 1959.

24. Murkland, Harry B. and Lois Pearson. "Oof," Newsweek, 59:78, January 15, 1962.

25. Rogin, Gilbert. "Get Strong Without Moving," Sports Illustrated, 15:18-21, October 30, 1961.

26. Salter, Nancy. "The Effects of Muscle Strength of Maximum Isometric and Isotonic Contractions at Different Repetition Rates," Journal of Physiology, 130:109-113, October, 1955.

27. *Seal-O-San Coaches Digest*. Huntington Laboratories, Inc., 1962. 62 pp.

28. Shvartz, Esar. "Effect of Isotonic and Isometric Exercises on Heart Rate," *Research Quarterly*, 37:121-5, March, 1966.

29. Steitz, Edward. "Increase the Explosive Power of Your Athletes," *Athletic Journal*, February, 1959, pp. 68.

30. Stienhaus, Arthur. "Some New Theories of Exercise," *The Physical Educator*, 22:21-2, March, 1965.

31. Walsh, George. "Get Trim and Strong in Seconds," *Sports Illustrated*, 15:34-38, December 4, 1961.

APPENDIX

TABLE I

STATISTICAL RESULTS OF THE EXPERIMENTAL AND CONTROLLED GROUPS FOR THE SARGENT JUMP

EXPERIMENTAL GROUP

Pre-test Mean	Post-test Mean	Diff. of Mean	t	Significance
17.25	19.75	2.50	3.79	.01

CONTROLLED GROUP

Pre-test Mean	Post-test Mean	Diff. of Mean	t	Significance
17.04	18.04	1.00	1.75	N.S.

A COMPARISON OF THE PRE-TEST MEANS BETWEEN THE EXPERIMENTAL AND CONTROLLED GROUP

Experimental Pre-test Mean	Controlled Pre-test Mean	Mean Difference	t	Significance
17.25	17.04	.21	.34	N.S.

A COMPARISON OF THE POST-TEST MEANS BETWEEN THE EXPERIMENTAL AND CONTROLLED GROUP

Experimental Post-test Mean	Controlled Post-test Mean	Mean Difference	t	Significance
19.75	18.04	1.71	2.73	.05

TABLE I (continued)

A COMPARISON OF THE SECOND POST-TEST MEANS BETWEEN THE EXPERIMENTAL AND CONTROLLED GROUPS

Experimental 2nd Post-test Mean	Controlled 2nd Post-test Mean	Mean Difference	t	Significance
19.25	18.00	1.25	2.12	.05

TABLE II

STATISTICAL RESULTS OF THE EXPERIMENTAL AND CONTROLLED GROUPS FOR THE AREA UNDER THE CURVE

PRE-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	.240	.062	.23	N.S.
Control	.302			

POST-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	.350	.025	.13	N.S.
Control	.325			

TABLE III

STATISTICAL RESULTS OF THE EXPERIMENTAL AND CONTROLLED GROUPS FOR THE SYSTOLIC PULSE WAVE AMPLITUDE

PRE-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	1.01	.01	.14	N.S.
Control	1.02			

POST-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	1.25	.14	2.00	N.S.
Control	1.11			

TABLE IV

STATISTICAL RESULTS OF THE EXPERIMENTAL AND CONTROLLED GROUPS FOR THE REST TO WORK RATIO

PRE-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	2.51	.38	1.73	N.S.
Control	2.89			

POST-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	2.83	.03	.14	N.S.
Control	2.86			

TABLE V

STATISTICAL RESULTS OF THE EXPERIMENTAL AND CONTROLLED GROUPS FOR THE OBLIQUITY ANGLE

PRE-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	21.5	.5	1.32	N.S.
Control	22.0			

POST-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	20.4	1.4	3.18	.01
Control	21.8			

TABLE VI

STATISTICAL RESULTS OF THE EXPERIMENTAL AND CONTROLLED GROUPS FOR THE PULSE RATE

PRE-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	85.6	7.4	.54	N.S.
Control	78.2			

POST-TEST

	MEAN	MEAN DIFFERENCE	Z SCORE	SIGNIFICANCE
Experimental	76.6	1.4	.09	N.S.
Control	78.0			