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EFFECT OF ISOMETRIC, ISOTONIC AND
EXER - GENIE TRAINING ON THE
VERTICAL JUMP

Thesis for the Degree of M. A.
MICHIGAN STATE UNIVERSITY

J. PAUL KING

1968

THESIS

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ABSTRACT

EFFECT OF ISOMETRIC, ISOTONIC AND EXER-GENIE ON THE VERTICAL JUMP

by J. Paul King

Statement of the Problem

This study was designed to test the Exer-Genie as a means of developing the vertical-jumping ability of Caucasian high school boys. To do this, two generally tested weight programs, isometrics and isotonics, were contrasted with a relatively new program utilizing the Exer-Genie. Exer-Genie exercise may be thought of as a combination of isometrics and isotonics in one continual movement.

Methodology

Four required physical education classes were used to select students for the study. All of the students were considered normally healthy individuals. None of them were participating in interscholastic athletic competition at the time of the study. The subjects were matched according to their vertical-jumping ability and placed in four groups: three experimental groups and a control group. Each group participated in a structured program of training every school day for a period of six weeks.

Each experimental group participated in three exercises each day. The exercises used by the three experimental

groups were kinesiologicaly similar. The control group participated in three to four minutes of general calisthenics. In addition to the special exercises of the four groups, each group participated in the regular class activity each day.

The subjects were tested on the vertical jump every Monday. This was permitted only after a one-minute, three-quarter speed run-in-place and five vertical practice jumps at three-quarter effort. Each subject was then given the chance to jump three times, with the average of the three being recorded. The one-minute run-in-place also preceded the regular workout each day.

The data collected was then analyzed, using Freidman's two-way analysis of variance by ranks, and by analysis of co-variance of randomized blocks.

Conclusion

Because of school absenteeism, thirty-six subjects made up the final sample. Subject to limitations of sampling, the following conclusions may be drawn. The analysis of co-variance and Freidman's two-way analysis of variance showed the results to be nonsignificant at the .10 level. Because this study lacked significance, there is some question whether it is economically wise to spend the money needed to set up an Exer-Genie training program. Due to a large type II statistical error, final judgment should be reserved until further evidence can be obtained.

EFFECT OF ISOMETRIC, ISOTONIC AND
EXER-GENIE TRAINING ON THE
VERTICAL JUMP

By

J. Paul King

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Department of Health, Physical Education and Recreation

1968

Approved: _____

William W. Weaver

ACKNOWLEDGMENTS

The writer wishes to express his sincere appreciation to Dr. W. W. Heusner for his expert guidance and advice.

To the highly cooperative students at Flint Ainsworth High School, to my family, Roberta and Tim, and to Mrs. Helen Burton, and to a countless number of other individuals, I give my sincere thanks.

J. P. K.

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CHAPTER I

INTRODUCTION

Misunderstandings have a tendency to develop from the many magazine articles printed each year. One good example would be Burham's (12) article, in which he indicates that during the basketball season of 1957-58, his team was out rebounded in twenty-three of twenty-five games. After inserting a weight-training program, Burham's team reversed the previous year's statistics and out rebounded his opponents in twenty-three of twenty-five games. Much essential data is lacking in the article; however, many coaches might automatically assume that the weight training program was the reason for the complete reversal in performance.

Because the Exer-Genie, a fairly new exercise device, has reportedly been used with much success by college and professional athletes, it was the desire of the writer to test the Exer-Genie under controlled conditions on high school students. A comparison of three programs of exercise was made to determine the training effects on vertical-jumping ability. It also was the writer's desire to be as economical as possible in the construction of the training programs.

Significance of the Study

Several studies (4, 13, 14, 18, 20, 22) have shown that a mean increase in vertical-jumping ability can be obtained by the use of isotonic training programs. Fewer studies have been conducted involving a comparison of isometric and isotonic training programs. Almost no studies were found in which the two types of exercise were combined into a single training program. Preliminary investigations by Miller (23), seem to indicate that combining isometric and isotonic exercises, in that order, might be the best training program yet produced for increasing vertical-jumping ability.

The purpose of this study was to focus attention on some of the many problems involved in conducting a training program to improve the vertical-jumping ability of high school boys. An attempt was made to answer such questions as: How much increase can be shown in vertical-jumping ability in a six-week period? What is the best type of exercise to improve vertical-jumping ability? Will an inexpensive (isometric or isotonic) training program give satisfactory results, or will the Exer-Genie provide a greater vertical-jump increase which is significant enough to warrant the more expensive program?

Statement of the Problem

This study was designed to identify and compare the effects of three different training programs, (a) isometrics,

(b) isotonics, and (c) the Exer-Genie, on the vertical-jumping ability of Caucasian high school boys.

Terminology Used

Isometrics.--A system of exercises in which muscles are contracted so that there is little shortening but a great increase in the tone of the muscle fibers involved.

Isotonics.--A system of exercises in which muscles are contracted so that there is shortening and lengthening as the spanned joint moves through its range of motion.

Exer-Genie.--A small, lightweight exercising device. A typical Exer-Genie exercise program begins with a ten-second isometric contraction. The Exer-Genie then allows the muscles to continue through their range of motion isotonically against a pre-determined amount of resistance.

Normally Healthy.--Free of noticeable physical defects and/or disease, and able to participate in daily physical education activities.

Warm-Up.--A period of moderate activity to prepare the muscles for more vigorous activities.

Vertical Jump.--A test to determine the vertical-jumping ability of an individual.

Limitations

The unavoidable limitations of this study were as follows:

1. There was no control over diet, sleep, and other daily living habits.

2. Nothing is known about any past training programs of the subjects.

3. Self-motivation may have been lacking; however, encouragement was given daily to each group.

4. It is fully realized that the legs are not the only part of the body involved in the vertical jump. However, the training programs incorporated only the basic leg movements involved in the vertical jump.

5. The performance of the Sargent Jump may be affected by one or both of two factors: (a) the skill, motor ability, or coordination necessary to perform the jump correctly and (b) the ability to do one's best at any given time (15).

CHAPTER II

REVIEW OF LITERATURE

The ability to jump is very valuable to a basketball player, and coaches are continually trying to improve this asset. The amount of spring a player can develop is proportional to the strength of the extensor muscles of the knee and ankle (1). In other words, in jumping for a rebound, the stronger the leg muscles the greater can be the crouch for a second and third effort in rebounding.

Though leg spring is only one of the attributes of a good basketball player, it is probably the most desirable asset for rebounding. The key muscles in jumping are the knee extensors, the ankle plantar flexors, and the extensors of the hip (5). The leg is not the sole body component involved in the vertical jump; but to limit the problem, it was the only component considered in this study.

When one talks about vertical jumping ability, he is speaking especially of "leg strength" as measured by a dynamometer. After working on the relationship between explosive leg strength and performance in the vertical-jump, Smith (16) discovered that strength exerted against a dynamometer involves a different neuromotor pattern from that controlling the muscles during movement.

It has been proven conclusively by several investigators that isotonics contribute greatly to improved vertical-jumping ability. Chue (13) reports a mean gain of 7.2 cm. for an experimental group, while a required physical education class increased only 3.9 cm. Capen (14) showed greater increases in a weight-training group than in a control group. Grattos (18) also showed a significant increase in a weight-training group over a "free jumping" group. Weed's (22) experimental weight-training group of six college basketball players increased a mean of six inches over an eighteen-week period. During the first six weeks, their mean increase was 2.2 inches. Even though both of his groups increased in vertical-jumping ability, Smith (20) showed a greater increase, significant at the .01 level, in his experimental group than in his control group. Hoffman (4) showed a three-inch increase in vertical-jumping ability due to an isotonic training program involving legs, shoulders, arms, and hands.

When isotonics and isometrics were compared, conflicting outcomes have resulted. Berger and Rapp (9) showed that an isotonic program was more effective than an isometric program in improving the vertical jump and that a significant increase in isometric strength does not necessarily guarantee an increase in vertical-jumping ability. In a study of the relationship of power to static and dynamic strength, Berger and Henderson (10)

found that both types of strength are related to leg power, but that neither one is more related than the other. In contrasting the effects of isometric and isotonic training on the vertical jump, Hannett (19) found a mean increase of 3.3 inches for his isometric group, 2.6 inches for his isotonic group and 1.4 inches for his control group. Improvements within each group were significant at the .05 level.

In his attempt to find the components which contributed most to the vertical jump, Bangerter (17) found that all five of his groups, including the control group, gained "strength" beyond the .05 level of significance and three of the five gained beyond the .01 level. These three groups were the hip extensor muscles, the knee extensor muscles, and the plantar flexor, knee and hip extensor muscles. However, these three groups which improved beyond the .01 level were not significantly different from each other.

Smith (20) showed a significant increase (.01 level) in vertical-jumping ability over an eight-week training period. However, the game rebounding performances, also included in the study, were not significantly improved.

CHAPTER III

METHODS OF RESEARCH

It was the desire of the writer to test the Exer-Genie under controlled conditions. A comparison was made of the training effects of three programs of exercise on vertical-jumping ability.

Subjects

The subjects were selected from four required physical education classes at Ainsworth High School (Flint, Michigan). Of the sixty Caucasian subjects who started the study, none were involved in interscholastic athletics, and all were considered normally healthy individuals. Due to class absenteeism, the final number of participants was only thirty-six. All subjects were given two days of instruction in the proper way to do the assigned exercises and to execute the vertical jump. Written instructions then were put on the wall adjacent to each place of exercise. Each individual was pre-tested on the vertical jump (three jumps were given and the average height was recorded as the score) and placed, by matching, into one of the four groups.

Experimental Procedures

The following general procedures were adopted:

1. Each subject had the same amount of mental and physical instruction on the correct execution of the vertical jump and the training exercises. It is generally agreed by experimenters that best results with the vertical-jump tests are obtained after the techniques of the jump have been taught and the subjects have practiced its execution. Under these conditions, reliability coefficients have been reported at .85 by McCloy and by Coleman (2).

2. The vertical-jump test consisted of chalking the fingertips, standing with the jumping arm parallel to the jumping board, and reaching for maximum height. The subject then proceeded to jump, touching the board with chalked fingertips at the height of his jump. The distance between the two chalk marks was measured to the nearest half-inch (2).

3. Each subject was pre-tested and then tested every Monday of the six-week training program. In each test, the subject took three jumps with the average height of the three being recorded. All vertical-jump tests preceded the work-out and class activity of the day.

4. A one-minute warm up, consisting of running-in-place at three-quarter speed, preceded each work out. A similar run, plus five practice vertical jumps, preceded each vertical-jump test.

5. Each experimental group participated in three training exercises each day with the control group having a pre-arranged set of calisthenics.

6. Subjects of each experimental group worked in pairs for most exercises.

7. The specific exercises used by the three experimental groups were kinesiologyically similar. This was to insure that the muscles most used in the vertical jump would be exercised by all three experimental groups.

8. All training programs were conducted during the regularly scheduled physical education hour.

9. The subjects were encouraged to be regular both in school attendance and in participation in this study. Those who missed more than three days of the six weeks' program, for any reason, were not included in the final analysis. The study concluded with nine sets (four subjects per set) of matched subjects.

10. Individual, weekly, vertical-jumping performances were recorded and are listed in Appendix B.

11. The study started September 7, 1967, and ended October 23, 1967.

Exercise Programs

A muscle will develop in size and strength only when it is overloaded (21). Therefore, in this study the leg extensor muscles were required to exert force against greater resistance than they normally do. An

attempt was made to work the movements involved in the vertical jump into a group of exercises. These exercises were chosen, after reading the literature by Hook (5) and Massey (6). Following is a brief description of each group of exercises. A more thorough explanation of the individual exercises is given in Appendix C.

Exercises for Group I

This training program included the three isometric exercises shown in Figures 1, 2, and 3. These exercises were designed to strengthen the legs and were matched with exercises used by the other experimental groups. Each contraction began and ended slowly (9). A ten-second duration was used for each contraction. A rest period then was taken, lasting from ten to twenty seconds, depending on the exercise.

Exercises for Group II

This training program included the three isotonic exercises shown in Figures 4, 5, and 6. They were performed with a partner of approximately the same weight. The partner supplied the resistance in two of the three exercises. Here, too, the exercises were matched with those used by the other experimental groups.

Exercises for Group III

This training program consisted of the three exercises with the Exer-Genie, shown in Figures 7, 8, and 9.

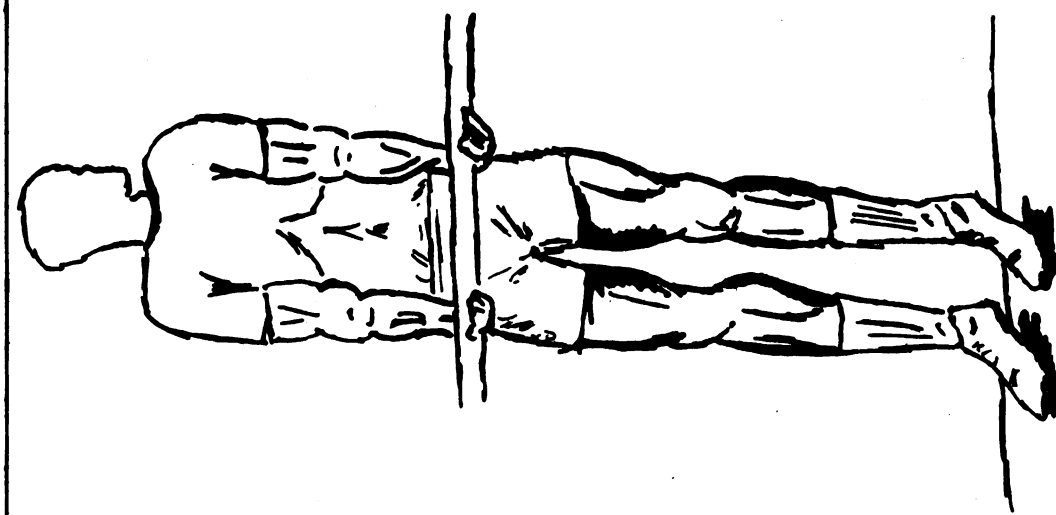


Figure 1.--Ankle plantar flexion.

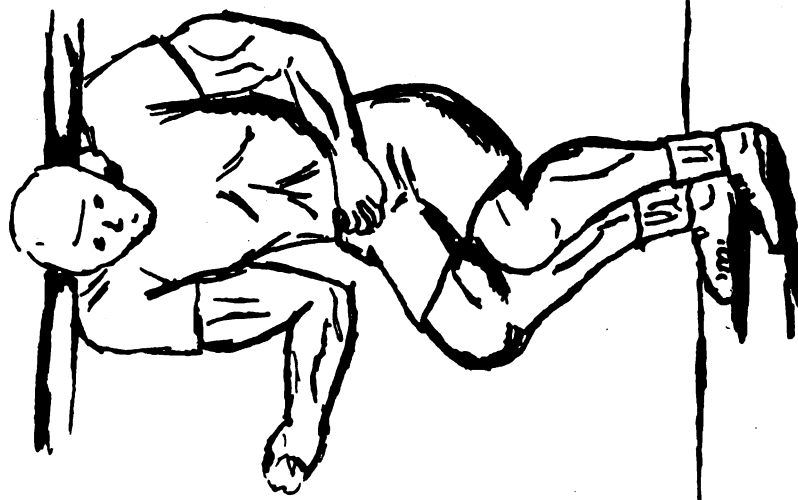


Figure 2.--Leg Press.

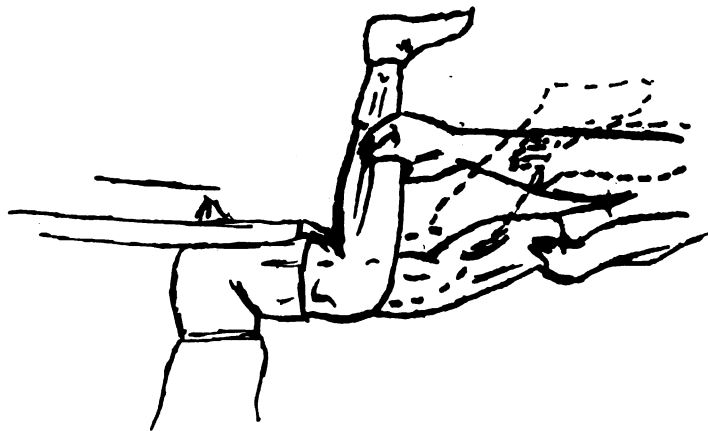


Figure 3.--Knee-extension.

GROUP I

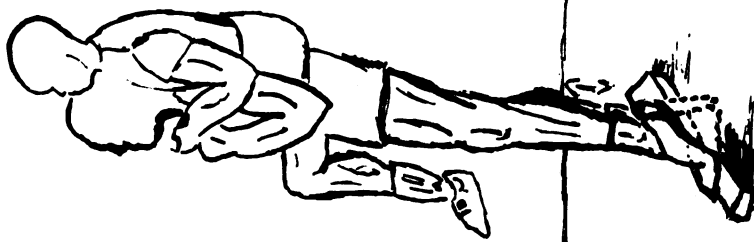


Figure 4.--Calf-raise.

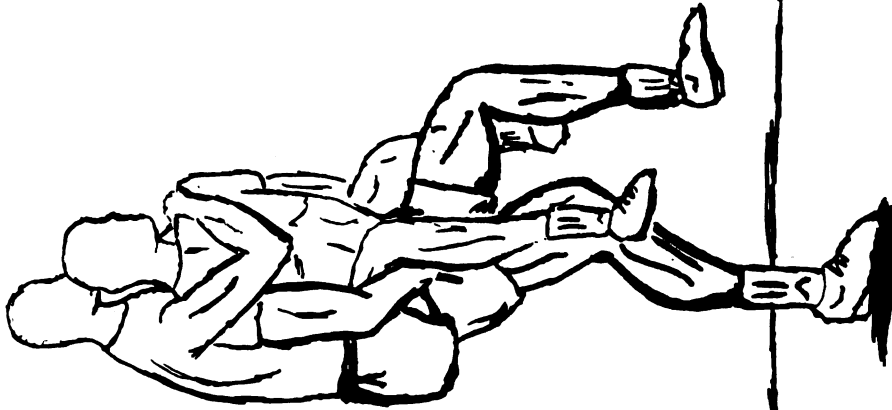


Figure 5.--Three-quarter walking squat.

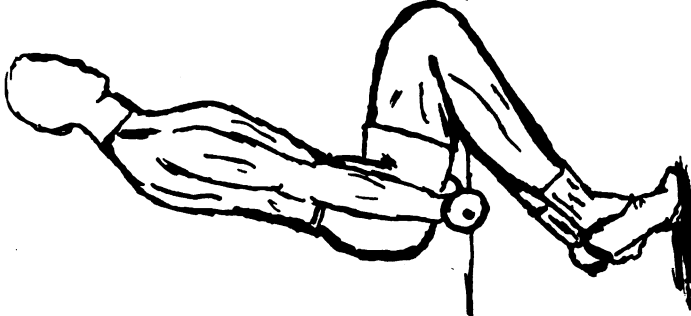


Figure 6.--Jump squat with weight.

GROUP II

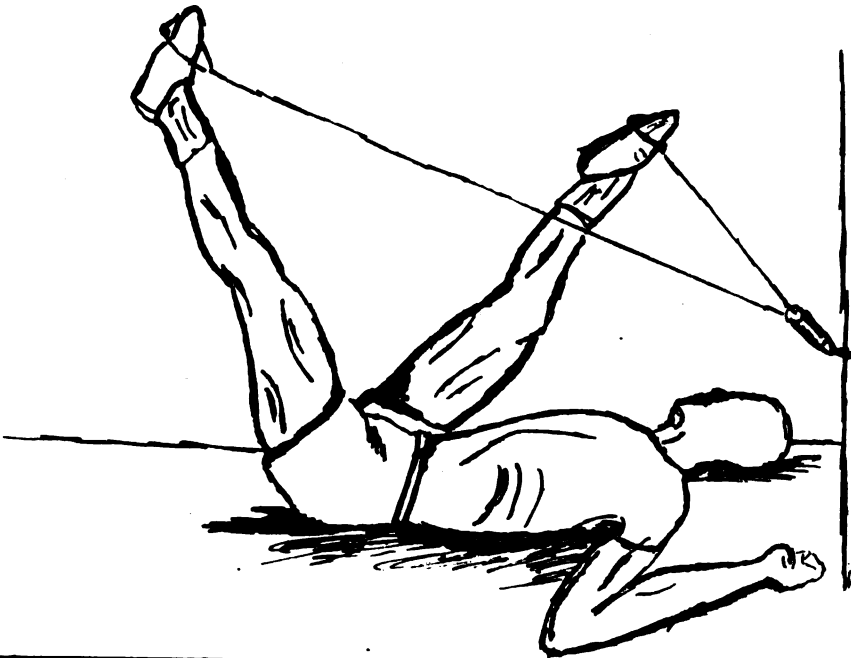


Figure 7.--Straight leg
bicycle.

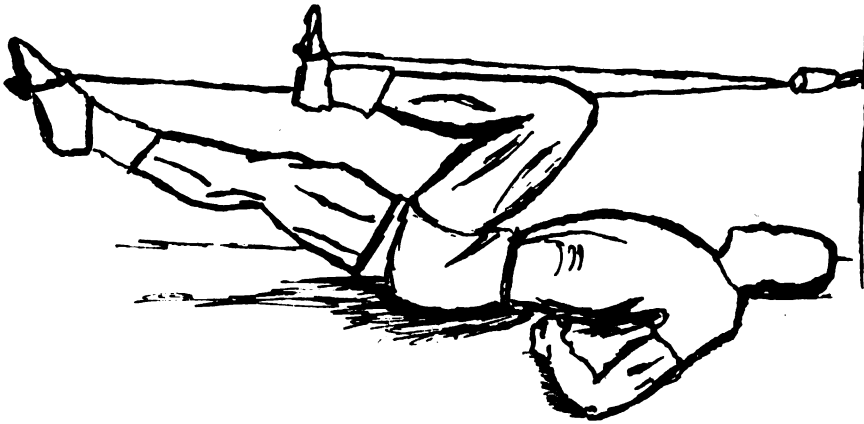


Figure 8.--Bent leg
bicycle.

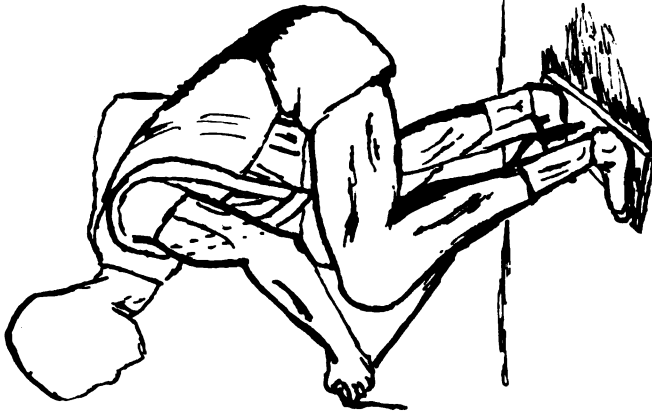


Figure 9.--Leg Press.

GROUP III

Each exercise started with a ten-second isometric contraction to tire the muscles being used. Then, against a predetermined amount of resistance, the muscles were contracted as quickly as possible, through their range of motion. Each exercise was designed to imitate, as closely as possible, an exercise used by each of the other groups.

Exercises for Group IV

The control group participated in regular physical education activities with the three experimental groups. Their only other conditioning was a set of calisthenics, executed daily, and the vertical-jump tests taken each Monday of the six-week training period. They participated in the weekly tests to minimize any effects other than those due to the training programs.

Equipment Used

With the exception of the Exer-Genie, all of the equipment used in this research project was very inexpensive and of the do-it-yourself variety. The economy factor, in the duplication of this equipment, enhances its desirability. Many schools cannot afford elaborate weight machines or, for that matter, several sets of weights and standards. The cost of the equipment for the three experimental groups was \$94.85.

Three Exer-Genies accounted for \$89.85 of the total amount. See Appendix D for the cost analysis.

Statistical Analysis

The analysis of co-variance of randomized blocks (3) was used to detect any group differences which might have been caused by the different treatments. Freidman's two-way analysis of variance by ranks (7) was also used for testing the null hypothesis that the samples had been drawn from the same population.

CHAPTER IV

RESULTS AND ANALYSIS OF DATA

Analysis of Data

The statistics used for the data analysis were the analysis of co-variance of randomized blocks (3) and Freidman's two-way analysis of variance of ranks (7). The performance in the final vertical jump was dependent upon, and somewhat determined by, the initial jump at the beginning of the experiment as well as upon the differential treatments involved in the study. The use of analysis of co-variance made possible an adjustment, or correction, for these initial differences. The primary concern was to detect any difference caused by the treatments. Freidman's two-way analysis of variance by ranks was used for testing the null hypothesis that the different matched samples were drawn from the same population.

Some authors point out that care should be exercised when interpreting an analysis of co-variance, if the concomitant (initial vertical-jump score) variable is influenced by the treatments. If the concomitant variable can be measured before the experiment is performed, this difficulty can be avoided (3). That procedure was followed in this study.

Results of Data

The initial and final mean values and mean changes for the four groups are shown in Table 1. The analysis of co-variance, as shown in Table 2, yielded an $F = 1.92$, which was lower than the 2.34 needed for significance at the .10 level. Table 3 shows the ranks, within sets, of the nine matched sets of subjects. Freidman's two-way analysis of variance by ranks, yielded an $Xr^2 = 5.10$. This was not significant at the .10 level. The critical region for this statistic was any value equal to or greater than 6.25.

Although the results of this study would seem to indicate the existence of a training effect, the differences observed between the control group and the three experimental groups were not statistically significant at the .10 level. Because alpha was set at .10, the power of the analysis of co-variance could not be calculated from Guenther (3). However, it is the writer's opinion that if a formula were available, it would yield a low power, thereby creating a good chance of incurring a type II statistical error. Because of this possibility, the writer wishes to reserve judgment for further study at this time.

TABLE 1.--Initial and final mean values and mean changes
for the four groups (in inches).

	Initial Means	Final Means	Mean Changes
Group I	15.0	16.5	1.5
Group II	15.3	16.2	0.9
Group III	15.0	16.7	1.7
Group IV	15.2	15.8	0.6

TABLE 2.--Analysis of co-variance for randomized blocks design

Source	SS _x	SP	SS _y	SS' _y	d.f.	MS' _y	F
Blocks							
	SS _{xb}	SP _b	SS _{yb}				
	276.1	255.2	241.5				
	SS _{xtr}	SP _{tr}	SS _{ytr}	SS' _{ytr}	r-1	MS' _{ytr}	$\frac{MS'_{yTr}}{MS'_{YE}}$
Treatments							
	-.1	-1.1	4.5	5.1	3.0	1.5	1.92
Error							
	SS _{xe}	SP _e	SS _{ye}	SS' _{ye}	(n-1)(r-1)-1	MS' _{ye}	
	5.1	-.9	18.2	18.04	23.0	.78	
Total							
	SS _{xt}	SP _t	SS _{yt}	SS' _{y(tr+e)}			
	281.1	253.2	264.2	23.5			

TABLE 3.--Final ranks, within sets, of nine matched sets under four conditions (Freidman's test).

Subject	Group I	Group II	Group III	Group IV
1	1	2.5	4	2.5
2	3	4	1	2
3	2	3	4	1
4	3.5	2	1	3.5
5	1.5	3	4	1.5
6	4	2	3	1
7	3	1.5	4	1.5
8	3.5	1	3.5	2
9	3	1	4	2
Rj	24.5	20.5	28.5	17.0

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to compare the effects of an Exer-Genie training program with those obtained from kinesiologicaly similar isometric and isotonic programs. The vertical jump was used as the criterion for making this comparison.

Sixty Ainsworth High School (Flint, Michigan) physical education students were pre-tested on the vertical jump. These boys then were matched into sets of four, according to jumping ability, and randomly assigned within sets to four treatment groups. The programs were conducted during each school day for a period of six weeks. Absenteeism reduced the final sample to nine sets of four or a total of thirty-six subjects.

The three experimental groups performed three exercises each training period with a variation of repetitions, sets, and rest time. Group I, the isometric group, performed a maximal knee-extension at 90°, 135°, and 165°, an ankle plantar flexion, and a leg press. Group II, the isotonic group, performed a jump squat, a calf-raise, and a three-quarter walking squat. Group III, the Exer-Genie

group, performed a bent-leg bicycle, a straight-leg bicycle, and a leg press. Group IV, the control group, participated in a short period of general calisthenics.

Each Monday, after a one-minute, stationary run at three-quarter speed, all subjects were tested on their vertical-jumping ability. Each subject was given three jumps with the average height of the three jumps being recorded. The data then was analyzed by analysis of covariance of randomized blocks and Freidman's two-way analysis of variance by ranks. Significance at the .10 level was not evident in either of these tests.

Conclusions

Even though statistical significance was not evident at the .10 level, the results indicated the possible existence of a realistically important training effect. Because of this, and the presence of a high β , the writer reserves judgment until further work can be completed.

Recommendations

Upon conclusion of this study, the following considerations are recommended:

1. Rerun the study, but add more weight to the isotonic exercises used by Group II and more resistance to the Exer-Genie exercises used by Group III.
2. Increase the number of subjects to be included in the final analysis.

3. In pre-season training programs, attempt this study using varsity basketball players.

4. Conduct the study for a period of twelve weeks, instead of the six-week period which was used.

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APPENDICES

APPENDIX A

INDIVIDUAL GAINS AND/OR LOSSES IN
VERTICAL JUMPING ABILITY
(in inches)

APPENDIX A

INDIVIDUAL GAINS AND/OR LOSSES IN VERTICAL JUMPING ABILITY (in inches)

Isometric Group

Subject	Standing Reach	<u>Jumping Reach</u>		Jump Difference
		Start	Finish	
J. Jarvis	96.0	11.0	12.5	1.5
W. Crosno	79.5	13.0	14.5	1.5
D. Pienozek	84.5	13.5	14.5	1.0
D. Caylor	86.5	14.0	16.0	2.0
R. Long	82.0	15.0	15.0	0.0
J. Anderson	78.0	15.0	18.5	3.5
D. Hulburt	85.5	15.5	16.0	.5
M. Orme	88.5	17.5	19.0	1.5
J. Simon	89.5	20.5	22.5	2.0
MEAN	85.55	15.0	16.5	1.5

Appendix A Cont.

Isotonic Group

Subject	Standing Reach	<u>Jumping Reach</u>		Jump Difference
		Start	Finish	
T. Conway	85.0	12.0	13.0	1.0
J. Peterson	93.0	12.5	15.5	3.0
J. Kinnemon	82.0	14.0	15.5	1.5
P. Wolfe	87.0	14.0	15.5	1.5
R. Davis	90.5	15.0	16.0	1.0
G. Shamel	90.5	15.5	16.5	1.0
C. Hawks	78.0	15.5	15.5	0.0
D. VanSipe	97.0	17.0	17.5	.5
D. Yow	84.5	22.0	21.0	-1.0
MEAN	87.5	15.3	16.2	.9

Exer-Genie Group

D. Dace	91.5	11.0	14.0	3.0
D. Yocum	89.5	12.5	12.5	0.0
M. Olmstead	88.5	13.0	15.5	2.5
D. Newsom	76.0	14.0	15.0	1.0
D. Horvath	95.0	14.5	17.0	2.5
R. Burns	80.0	15.0	17.5	2.5
E. French	87.5	15.5	17.0	1.5
E. Berke	89.5	17.0	19.0	2.0
B. Kirby	97.0	22.5	23.0	.5
MEAN	88.27	15.0	16.7	1.7

Appendix A Cont.

Control Group

Subject	Standing Reach	<u>Jumping Reach</u>		Jump Difference
		Start	Finish	
D. Grable	88.0	11.5	13.0	1.5
J. Potvin	87.0	13.5	13.5	0.0
G. Pigg	92.5	13.5	13.0	-.5
H. Hepburn	84.0	14.0	16.0	2.0
D. Stetz	93.5	15.0	15.0	0.0
D. Davis	85.5	15.5	15.5	0.0
R. Green	78.0	15.5	15.5	0.0
D. Morgenthalen	78.0	16.5	18.5	2.0
D. Wolford	91.5	21.5	22.0	.5
MEAN	86.44	15.2	15.8	.6

APPENDIX B

INDIVIDUAL WEEKLY VERTICAL
JUMPING PERFORMANCE
(inches)

APPENDIX B

INDIVIDUAL WEEKLY VERTICAL JUMPING PERFORMANCE (inches)

Isometric Group

Subject	Pre-Test	1	2	3	4	5	6
Jarvis	11.0	10.0	11.5	11.0	11.0	11.5	12.5
Crosno	13.0	12.0	13.0	14.0	14.0	14.5	14.5
Pienozek	13.5	15.5	14.5	14.5	14.5	15.5	14.5
Caylor	14.0	15.0	16.0	14.5	14.0	15.0	16.0
Long	15.0	15.0	14.5	16.5	15.5	16.6	15.0
Anderson	15.0	16.0	16.0	17.0	17.5	17.5	18.5
Hulburt	15.5	16.5	14.5	16.0	16.0	17.0	16.0
Orme	17.5	17.0	17.0	17.0	17.5	17.5	19.0
Simon	20.5	22.0	21.0	22.0	21.5	21.0	22.5

Isotonic Group

Conway	12.0	12.5	13.0	13.0	13.0	14.0	13.0
Peterson	12.5	12.0	14.5	15.0	14.5	15.5	15.5
Kinnemon	14.0	14.0	13.0	14.0	14.0	14.0	15.0
Wolfe	14.0	14.5	15.0	16.0	15.5	15.5	15.5
Davis	15.0	14.5	15.5	16.0	16.5	16.0	16.0
Shamel	15.5	16.5	16.5	17.5	17.0	17.0	16.5
Hawks	15.5	15.5	16.0	16.0	16.0	16.0	15.5
VanSipe	17.0	17.5	18.0	17.5	18.0	17.0	17.5
Yow	22.0	23.0	21.0	22.0	22.0	22.0	21.5

Appendix B Cont.

Exer-Genie Group

Subject	Pre-Test	1	2	3	4	5	6
Dace	11.0	12.0	12.5	13.0	13.0	13.0	14.0
Yocum	12.5	11.5	12.0	11.5	11.5	13.0	12.5
Olmstead	13.0	14.5	14.0	14.0	14.5	15.0	15.5
Newsom	14.0	13.0	13.5	14.0	14.5	14.0	15.0
Horvath	14.5	15.0	15.5	15.5	15.5	16.0	17.0
Burns	15.0	15.0	16.0	16.5	16.0	16.5	17.5
French	15.5	15.5	16.5	16.5	16.0	17.0	17.0
Berke	17.0	18.5	17.5	19.5	20.0	19.0	19.0
Kirby	22.5	21.5	22.0	22.5	23.5	23.5	23.0

Control Group

Grable	11.5	11.5	12.0	13.0	12.5	13.0	13.0
Potvin	13.5	14.5	14.0	15.0	13.5	13.5	13.5
Pigg	13.5	13.0	12.5	13.0	12.5	12.5	13.0
Hepburn	14.0	15.5	15.0	15.5	15.5	15.5	16.0
Stetz	15.0	14.5	14.5	15.0	14.0	15.5	15.0
Davis	15.5	16.0	15.5	16.5	17.0	16.5	15.5
Green	15.5	14.5	15.5	15.0	16.0	16.0	15.5
Morganthalen	16.5	16.5	16.5	16.0	17.0	17.0	18.5
Wohlford	21.5	20.0	21.0	21.5	22.0	21.0	22.0

APPENDIX C

DESCRIPTION OF THE EXERCISES

FOR THE FOUR GROUPS

APPENDIX C

DESCRIPTION OF THE EXERCISES FOR THE FOUR GROUPS

Group I. Exercises for the Isometric Group

Exercise A. Knee-extension.--The partner offered only enough resistance to maintain the desired angle. The exercise consisted of one set of three repetitions. The duration of each repetition was ten seconds. A ten-second rest was provided between repetitions. This exercise was performed once at each of the three angles: 90°, 135°, and 165°.

Exercise B. Ankle plantar flexion.--This exercise consisted of one set of three repetitions. The duration of each repetition was ten seconds. A ten-second rest was provided between repetitions. An isometric bar at hand level permitted the subject to grasp the bar and use this as his resistance. The resistance started after the subject had come to a half calf-raise on his toes.

Exercise C. Leg Press.--This exercise consisted of one set of three repetitions. The duration of each repetition was ten seconds. A twenty second rest was provided between repetitions. Resistance came from an isometric bar, located above the shoulders. The bar was fully padded to eliminate pain or injury to the shoulder area.

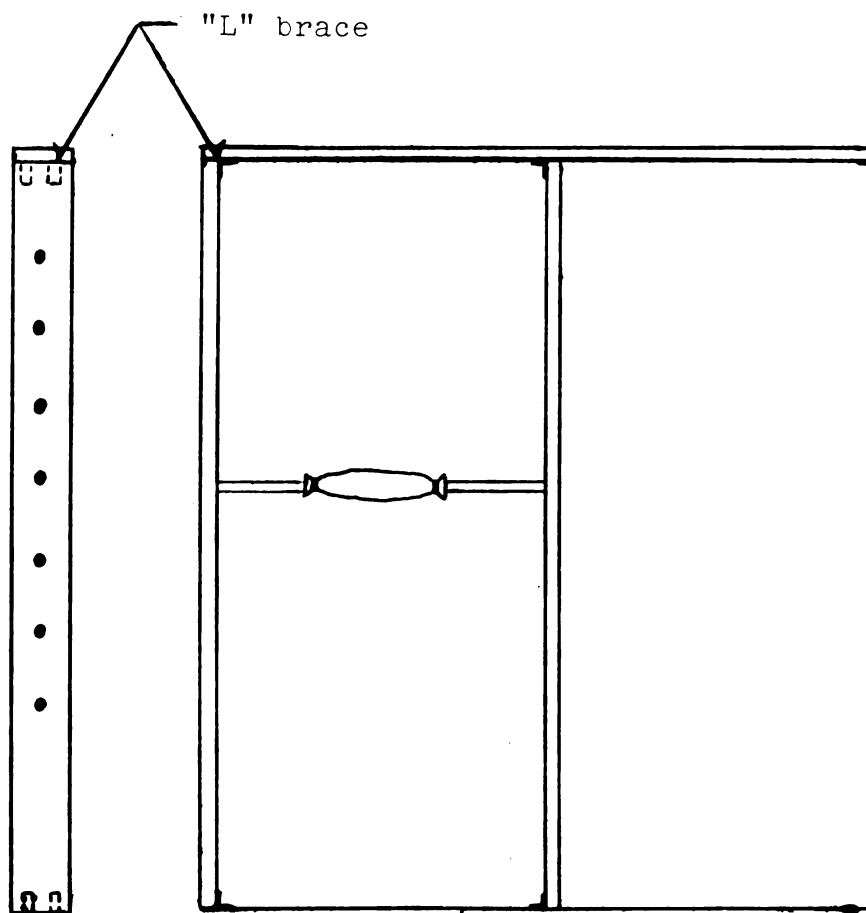


Figure 10.--Isometric Bar.

Group II. Exercises for the Isotonic Group

Exercise A. Jump squat.--The participant held a ten-pound weight in each hand, bent the knees at approximately a 90° angle, and then sprang upward as high as possible. Three sets of eight repetitions, with emphasis on continual motion and quickness of spring, was required.

Exercise B. Calf-raise.--The calf-raise was executed with toes on a 2 x 6 inch board, in three sets of fifteen repetitions. The first set was executed with the feet turned in; in the second set, the feet were turned out; and in the third set, the feet were pointed straight forward. The subject's partner supplied the resistance.

Exercise C. Three-quarter walking squat.--Three sets of eight repetitions were used, with emphasis on drive upward. The resistance was supplied by a fellow participant, of approximately the same weight.

Group III. Exercises for the Exer-Genie Group

Exercise A. Bent leg bicycle.--This bicycle exercise was performed at a 90° angle and included one set of three repetitions with a twenty-pound resistance. The exercise was started with a 10 second isometric hold after which the muscles moved through their range of motion.

Exercise B. Straight leg bicycle.--This bicycle exercise had one set of three repetitions with a twenty-pound resistance. Toes were pointed downward, (as a swimmer's toes are pointed). The 10 second hold was, again, evident in this exercise. The muscles then continued through their range of motion.

Exercise C. Leg press.--One set of three repetitions at fifty pounds resistance was used. Knees were at an approximate 90° angle to begin the contraction. The isometric hold occurred at this angle and lasted for 10 seconds. The muscles then moved through their range of motion at the pre-set resistance.

Group IV. Calisthenics for the Control Group

The calisthenics included the following exercises:

- A. One-minute, three-quarter speed run-in-place
- B. Fifty jumping jacks
- C. Fifteen leg lifters
- D. Fifteen toe touchers
- E. Fifteen squat thrusts
- F. Fifteen push-ups
- G. Five sprints of 28 yards each

APPENDIX D

TOTAL COSTS OF THE EQUIPMENT USED IN THE
THREE EXPERIMENTAL GROUPS

APPENDIX D

TOTAL COSTS OF THE EQUIPMENT USED IN THE THREE EXPERIMENTAL GROUPS

Vertical Jump Test

The jump board, used in all the jump tests, was constructed from a piece of discarded 2 x 5 foot, half-inch plywood. After a coat of paint, the board was marked with half-inch measurements, from six feet to ten feet, six inches. No cost was involved for the construction of the vertical-jump board.

Isometric Exercises

Three boards, which were six feet long (2 x 6 inch), were purchased for \$2.80. Corner braces and screws came to \$2.20. The three-quarter inch, five foot long steel rod was discarded by the metal shop. The padding, covering the steel rod, was left over foam rubber from old football equipment. The total cost was \$5.00 for the Isometric bar.

Isotonic Exercises

A ten foot long board (2 x 6 ft.), four ten-pound weights, and four small pieces of rope were the only pieces of equipment needed. No expense was involved.

Exer-Genie Exercises

Three Exer-Genies, belonging to Ainsworth High School (Flint, Michigan), were used for these exercises. The total cost of the three exer-genies was \$89.85.

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