

A COMPARATIVE EVALUATION OF THE
EFFECTIVENESS OF THREE CONDITIONING PROGRAMS

by

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9984

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Physical Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1972

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CHAPTER 1

INTRODUCTION

The way of life for many people in today's world of advanced technology lends itself to fewer working hours, and more hours of leisure. The human products of this technology, such as young college women, are discovering themselves physically unfit even at minimum standards. The importance of frequent and regular exercise in modern living should not be minimized.

PURPOSE

The purpose of this study was four-fold:

1. To design three different conditioning programs; one specific to flexibility, one specific to general muscular fitness, and one specific to strength.
2. To test each of the three groups for hip flexibility, trunk flexibility, back strength, leg strength, body fat, and general muscular fitness prior to and immediately following participation in the conditioning programs.
3. To compare pre- and post-conditioning scores of all tests.
4. To evaluate test scores in order to determine the effectiveness of the three conditioning programs.

LIMITATIONS

Subjects who participated in this study were divided into Groups 1, 2, and 3 according to their enrollment in one of three sections of Basic Fitness and Conditioning classes at Kansas State University

1. Closed class sections limited the number of students able to participate in the study.
2. Comparison and evaluation of testing was limited to participants who completed pre-conditioning test, programs of exercise, and post-conditioning testing to eliminate contaminated results.
3. Each of the three groups met for formal instruction of their exercise program twice weekly during the study. This will limit the improvements and gains made by the limited number of exercise meetings.
4. Because testing apparatus was not calibrated before testing, some degree of error will be present in pre- and post-conditioning testing scores.

Definition of Terms

Flexibility:	The ability to move a joint or muscle through its entire range of movement.
Isometric:	A type of muscular contraction resulting from the exertion of force against an immovable object. (static contraction) Tension increases while the muscle length remains the same.
Isotonic:	A type of muscular contraction resulting from the exertion of force against a movable object. (dynamic contraction) Tension is constant while the length of the muscles change.
Passive exercise:	Exercise in which length of the muscle is increased by slow stretching.
Dynamic exercise:	Exercise in which length of the muscle is increased by bouncing pressure.
Skinfold caliper:	An instrument designed to measure body fat.
Strength:	The external force exerted by a muscle or muscle group.

CHAPTER 2

REVIEW OF LITERATURE

Although much research has been done in the past concerning fitness and physical conditioning, until recent years little research had been done relating specifically to women subjects. This is evident in the following review of literature for this report. In 1968 Conger and Wessel (1) investigated the differences between groups varying in activity levels. Thirty-five college women volunteered for the study and were placed in groups termed "most active" and "least active" according to their responses on an activity history questionnaire. After testing and statistical analysis, results revealed significant differences at the .05 level between means of weight, fat free body weight, trunk extension flexibility with the most active group having higher values. The least active group had significantly more shoulder extension flexibility, shoulder inward rotation flexibility, and ankle flexion flexibility. Although means were not different statistically, higher mean values were recorded for the most active subjects in the majority of strength measures. Lack of standardized strength measures and lack of standardized flexibility measures for women were made more evident after this study. The purpose of a study by Banister (2) was to investigate current fitness training programs. His subjects 14 to 16 year old boys were placed into three fitness programs according to scores recorded on three indices. The three fitness programs included one interval circuit training with endurance training, one of conventional circuit training with game activities, and one with games alone. His results revealed that gains were

made by all groups but that interval circuit training produced the greatest gains. In a study by McGraw and Burnham (3) research was done to compare the effectiveness of three resistive exercise programs in increasing muscular strength and endurance. The three methods were: 1. isotonic, 2. isometric, and 3. speed. Analysis revealed significant difference in gains of leg strength. There was no real difference between isotonic and isometric program results. They both increased leg strength. Results did show that speed exercises were best for developing leg strength. Bender, Kelly, Person, and Kaplar (4) did a study to determine the effectiveness of isometric contraction and isotonic movement for strength development as related to the strength level of the individual prior to participation in the exercise program at the United States Military Academy at West Point. Of the three groups tested, it was found that those persons who were initially lower in strength gained more force with the exercise of stool stepping, whereas those who were initially higher in strength gained more force with isometrics. Rupiper (5) in 1960 did a study of college male students enrolled in Physical Education classes. They were given the Kraus-Weber test of minimum muscular fitness. Mean height, weight, and age was determined. The mean age difference between the pass and fail groups was significantly beyond the .05 level. The pass group was 12.58 months older than the fail group. The majority of failures (60%) were attributed to flexibility tests. If a student failed any one of the items this constituted failure of the entire test. Results of this test gave no indication that failures on the Kraus-Weber items by these subjects were associated with height or weight, however, age of the subjects was a significant factor. Hilsendager, Strow, and Ackerman (6) did a study at Temple University, Philadelphia on eighty-three subjects, the purpose of which was to determine

whether exercises designed specifically to develop strength and speed were as effective for improving agility as exercises designed specifically to develop agility. After pre-conditioning testing, a six week program, and post-conditioning testing, results led to the conclusion that agility can best be developed in programs designed specifically for that purpose indicating that a unique factor of agility does exist. In a study by Barney and Bangerter (7), eight male subjects were divided into three groups. Each of the three groups used a variation of progressive resistance exercises for eight weeks. Pre- and post-training strength measurements were taken. Results indicated that all three training programs produced significant strength gains.

In 1956, Thompson, Bushick, and Goldman (8) did a study of skinfold changes in college males during regular activity training season. It was concluded by this study that body fatness, particularly subcutaneous, can be altered by strenuous training. Also in 1956, in a study by McCue (9), measurements were taken on 130 college women enrolled in physical education activity classes to determine twelve measure of flexibility. Conditioning took place followed by testing. Results indicated by this study revealed that people with a history of exercise habits were more flexible than less active participants. Hip flexion for underweight subjects was significantly higher. Of the lower quartile of subjects tested, a significant increase of flexibility was felt with mild exercise in only three weeks.

The need for more research in conditioning for women is evident. Standard testing procedures for determining strength and flexibility are not available for women. Until such standards are researched and made known, research in the area of conditioning for women will remain substandard.

CHAPTER 3

PROCEDURE

The general purpose of this study was to compare and evaluate the effectiveness of three fitness and conditioning programs. These three programs were designed and carried out with purposes specific to each of three groups. Group 1 was the flexibility group whose program was designed to increase hip flexibility, to increase trunk flexibility, and to reduce body fat. Group 2 was the general muscular fitness group. This program was designed to increase hip flexibility, to increase trunk flexibility, to increase back strength, to increase leg strength, to increase general muscular fitness, and to reduce body fat. Group 3 was the strength group. Their program was designed to increase back strength, to increase leg strength, and to reduce body fat.

Selection of Subjects

Participating subjects consisted of sixty-five college freshmen and sophomore women enrolled in three sections of Basic Fitness and Conditioning class at Kansas State University. Ages of the subjects ranged from seventeen to twenty years. Seventeen subjects were in flexibility Group 1. Twenty-six subjects were in general muscular fitness Group 2, and twenty-two subjects were in strength Group 3. Participation by all subjects in this study was required by the instructor of the fitness and conditioning classes as all subjects were selected for this study upon enrollment in the class. The exact testing procedures are outlined in the following section of this chapter.

Tests

Six tests were administered with the assistance of trained technicians. Tests included measures of hip flexibility, trunk flexibility, back strength, leg strength, percentage of body fat, and general muscular fitness.

Hip Flexibility: Hip flexibility was determined by Wells' Sit and Reach Test. (10) Each subject was instructed to sit on the floor with knees together and feet flat against the side of a wooden box. The box had a ruler attached at its edge starting with number six. From this position the subject reached forward, passively, along the ruler scale. Reaching distance was read and recorded. A five inch ruler was held at the edge of the box to record reaching distance of less than six inches. (Fig. 1)

Trunk Flexibility: Trunk flexibility was determined by the use of Fleischman's Static Upper Trunk and Shoulder Flexibility Test. (11) Subjects were instructed to stand an arm's length, with a fist, from the wall with toes touching a line on the floor. The subject then extended the other arm to the side at shoulder height with palm down. Keeping the feet still, the subject twisted the trunk clockwise, (if right-handed), or counter-clockwise, (if left-handed). Each subject was encouraged to twist and reach as far as possible on the wall scale. While holding for two seconds, the score was read and recorded. (Fig. 2)

Back Strength: Back strength was measured by a back and leg dynamometer. Subjects were instructed to stand on the dynamometer base with feet parallel about six inches apart. In this position the subject stood with knees locked and head erect. Bending forward slightly, with shoulders rounded, the subject grasped the bar using a mixed grip. Each subject was

then instructed to lift straight up and roll the shoulders back to an erect position. The amount of force exerted was then read from the dynamometer dial and recorded. (Fig. 3)

Leg Strength: To determine leg strength, each subject was instructed to assume the same position used to determine back strength with these exceptions: The head and shoulders were held erect with the back straight. The subject bended at the knees while maintaining the aforementioned body position. Proceeding to lift straight up, the subject attempted to push off the base exerting force with the legs. The amount of force exerted was read from the dynamometer dial and recorded. (Fig. 4)

Body Fat: Percentage of body fat was determined with a Lange skinfold caliper. Two skinfold measurements were taken, one at the midpoint of the tricep and one just above the iliac crest. Both measurements were taken on the right side of the body. (12) The two caliper readings were then plotted on Paul's nomogram to determine percentage of body fat. (13) (Fig. 5)

General Muscular Fitness: General muscular fitness was measured by the Kraus-Weber Test, a six item test developed to measure minimum muscular fitness. (14) These test items are graded on a pass or fail basis. The six items are:

Test No. 1: Strength of the abdominal plus psoas muscles. The subject is lying in a supine position with hands clasped behind the neck. The examiner holds the feet down. The test is to perform one situp. (Fig. 6)

Test No. 2: Strength of the abdominals without the help of the psoas muscle. The subject is in the same position as item number one except the knees are bent and the heels are close to the buttocks. The test is to perform one situp. (Fig. 7)

Test No. 3: Strength of the psoas and lower abdominal muscles. The subject lies supine with hands behind the neck. Legs are fully extended with the heels held ten inches off the floor. The test is to hold this position for ten seconds. (Fig. 8)

Test No. 4: Strength of the upper back muscles. The subject lies prone with hands clasped behind the neck. A partner holds the feet down. The test is for the subject to raise the head, shoulders, and chest, holding them without touching the floor for ten seconds. (Fig. 9)

Test No. 5: Strength of the lower back. The subject maintains the same position as test No. 4 except a partner holds the upper trunk down. The test is for the subject to raise the legs off the floor and hold the knees straight for ten seconds. (Fig. 10)

Test No. 6: Length of the back and hamstring muscles. The subject stands erect in bare feet with hands at the sides and feet together. The test is for the subject to lean down slowly and touch the floor with the fingertips. This position is to be held for ten seconds. (Fig. 11)

Leg Lower: The leg lower test is included as a test of general muscular fitness and relates specifically to posture. This test is administered in three steps: 1. The subject lies supine with legs together and arms outstretched to form right angles to the body. 2. The subject then raises the legs vertically to the floor keeping the knees straight. 3. The subject proceeds from this point to lower the legs slowly to ten inches off the floor while touching the lower back to the floor. The test is failed if the tester is able to slide a hand, palm down, under the lower back of the subject. (Fig. 12)

Design

Pre-Conditioning Testing: Pre-conditioning testing of all subjects took place in Ahearn Gymnasium on January 24 and 26, 1972. Groups 1, 2, and 3 were tested during their regular class meeting hours, 7:30 A.M., 8:30 A.M., and 2:30 P.M., respectively. No warming up exercises were allowed prior to testing. Maximal effort was encouraged of each subject by the author and assistants before and during testing.

Exercise Programs

Group 1: The flexibility group of 17 subjects met twice weekly for formal exercise instruction. Their program consisted primarily of a series of passive stretching, bending, and running exercises. It also included a limited number of isotonic exercises in which the subjects lifted a portion of their own body weight. Isometric contractions were utilized in a few posture repair exercises.

Group 2: The general muscular fitness group of 26 subjects met twice weekly for formal exercise instruction. The exercise program for Group 2 was designed with contributions from both Groups 1 and 3. Their program involved both passive and dynamic bending and stretching, jumping, running, and isotonic and isometric strength exercises.

Group 3: The strength group of 22 subjects also met twice weekly for formal exercise instruction. Their exercise program consisted primarily of isometric and isotonic strength exercises for the back and legs. It also included exercises for endurance, running, and posture repair.

Post-Conditioning Testing: Post-Conditioning testing of all subjects took place in Ahearn Gymnasium on May 1 and 3 of 1972. All three groups were tested during their regular class meeting hours as with the pre-conditioning

testing. As before, no warming up exercises were allowed prior to testing. Again maximal effort was encouraged of each subject by the author and assistants before and during testing.

Statistical Treatment

Pre- and post-conditioning testing scores were recorded on a data sheet (Appendix A) along with height, weight, bust, waist, and hip measurements. Through the use of a computer, analysis of variance, group means, and t tests were calculated. Percent improvement scores for all tests were also calculated.

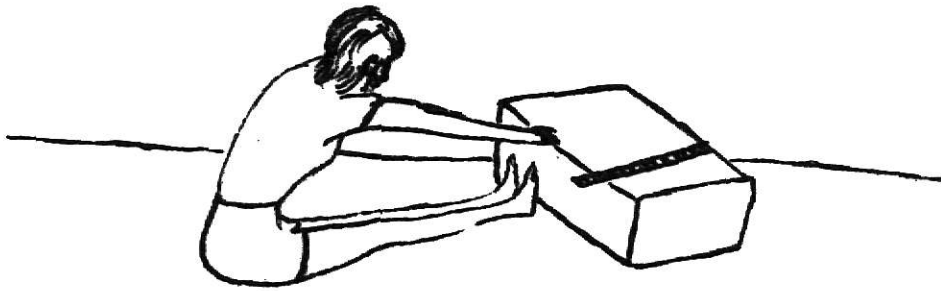


Fig. 1 Hip Flexibility



Fig. 2 Trunk Flexibility

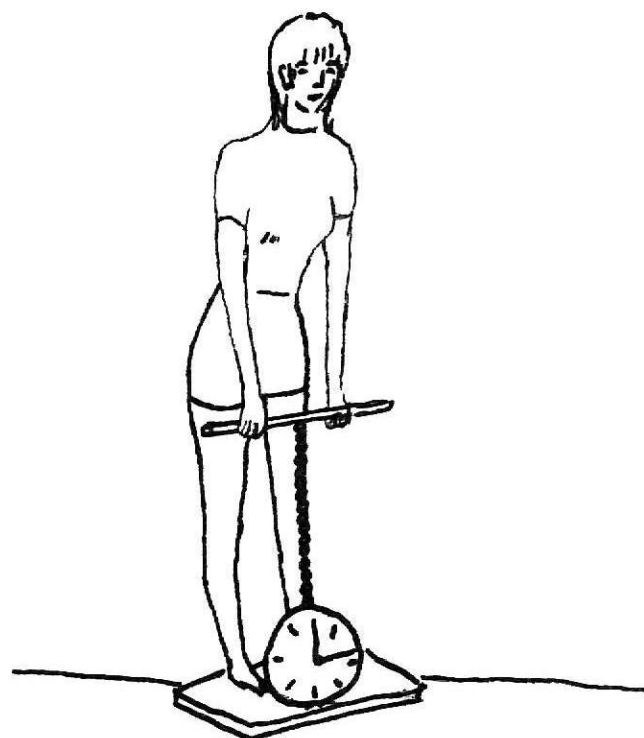


Fig. 3 Back Strength

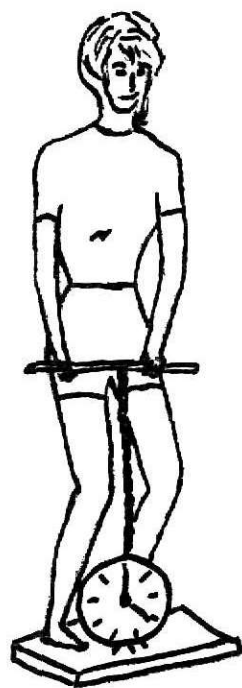


Fig. 4 Leg Strength

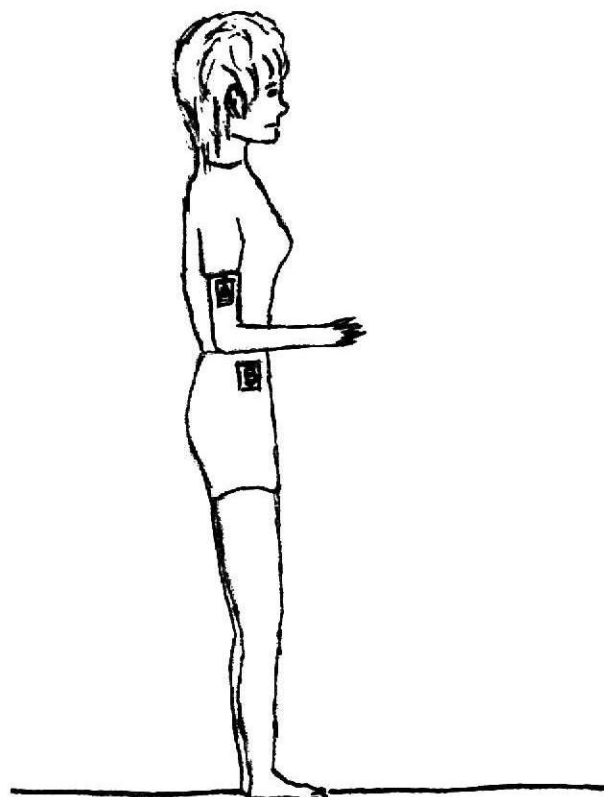


Fig. 5 Body Fat

A. Tricep

B. Iliac

KRAUS-WEBER TEST OF MINIMUM MUSCULAR FITNESS

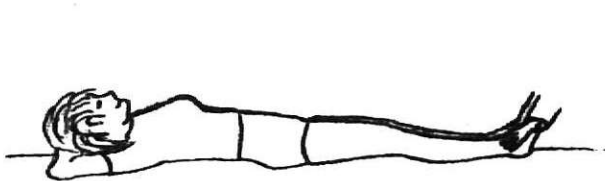


Fig. 6 Abdominal Plus

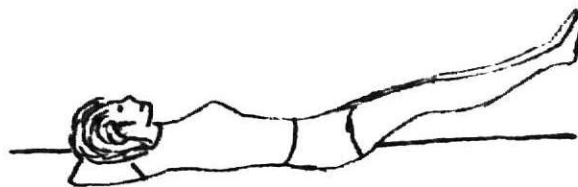


Fig. 8 Psoas-lower abdominal

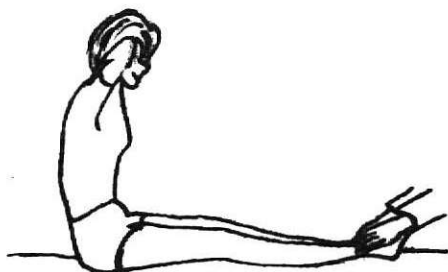


Fig. 7 Abdominal Minus



Fig. 9 Upper Back

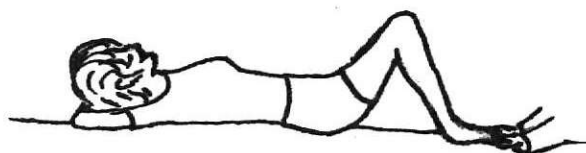


Fig. 10 Lower Back

Fig. 11 Length of back and
hamstring muscles

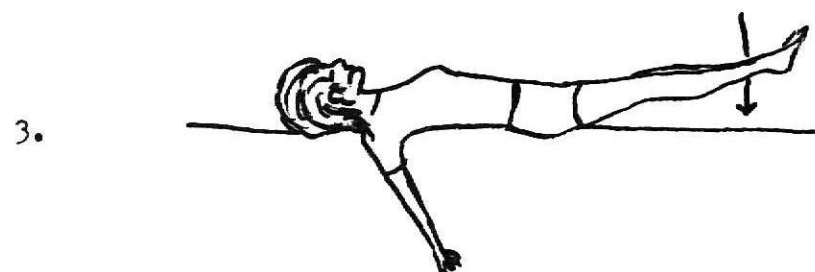
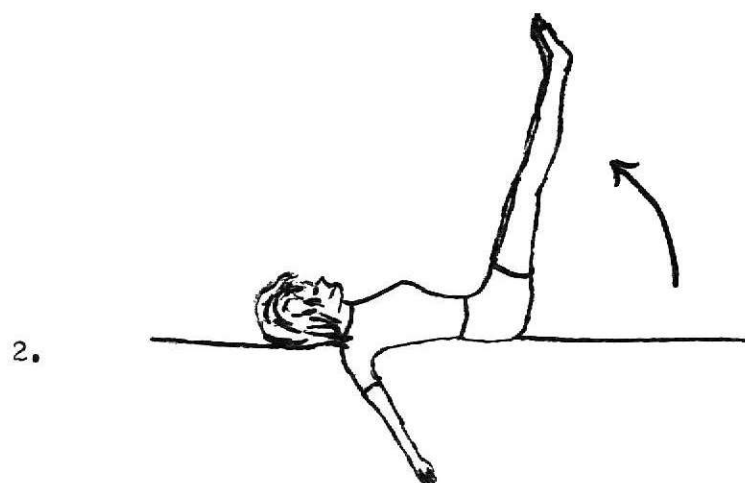
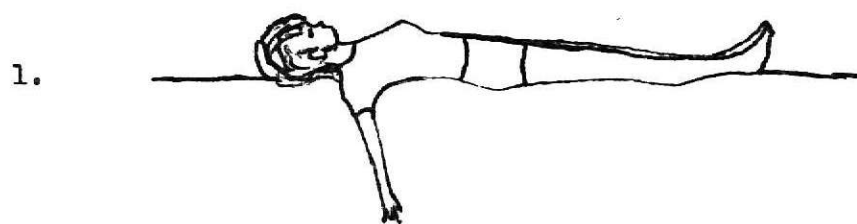


Fig. 12 Leg lower

CHAPTER 4

RESULTS

In the following section of this report tables are presented for each fitness factor tested. An improvement table is presented to show group averages and percent improvement. This table is followed by a pre-conditioning analysis of variance table used to establish group homogeneity. Post-conditioning analysis of variance follows to present significant group changes brought about by the conditioning programs. Paired t tests are presented to indicate significant differences between pre- and post-conditioning.

Results of all testing reflected significant improvement with the exception of hip flexibility and percent body fat for Group 3. Scores are presented in the following tables.

Hip Flexibility

SUBJECT	HIP FLEXIBILITY IN INCHES			
	AVERAGE PRE-TEST	AVERAGE POST-TEST	AVERAGE IMPROVEMENT	PERCENT IMPROVEMENT
GROUP 1	8.47	12.15	3.68	43.4
GROUP 2	8.50	11.46	2.96	34.8
GROUP 3	10.54	12.45	1.91	18.1

Table 1. Hip Flexibility Improvement

Analysis of variance for hip flexibility in pre-conditioned subjects revealed significant difference between the three groups at the .05 level as shown in Table 2.

Pre-Conditioning Hip Flexibility	DF	SS	MS	F Ratio
Exercise	2	73.964	36.982	1.465*
Error	62	1565.066	25.243	
Total	64	1639.031		

* Significant at the .05 level

Table 2. Pre-Conditioning Hip Flexibility Analysis of Variance

Analysis of variance for hip flexibility in post-conditioned subjects revealed no significant difference between the three groups at the .05 level. These figures are shown in Table 3.

Post-Conditioning Hip Flexibility	DF	SS	MS	F Ratio
Exercise	2	1290.062	645.031	1.931
Error	62	20708.500	334.008	
Total	64	21998.562		

Table 3. Post-Conditioning Hip Flexibility Analysis of Variance

The paired t test for hip flexibility revealed significant difference between pre- and post-condition as shown in Table 4.

Test	Mean	t
Pre-Conditioning Hip Flexibility	9.446	2.20*
Post-Conditioning Hip Flexibility	11.984	

* Significant at the .05 level

Table 4. Hip Flexibility Student t test

Trunk Flexibility

SUBJECT	TRUNK FLEXIBILITY IN INCHES			
	AVERAGE PRE-TEST	AVERAGE POST-TEST	AVERAGE IMPROVEMENT	PERCENT IMPROVEMENT
GROUP 1	15.41	23.65	8.24	53.5
GROUP 2	17.42	24.19	6.77	38.9
GROUP 3	15.14	21.77	6.63	43.8

Table 5. Trunk Flexibility Improvement

Analysis of variance for trunk flexibility in pre-conditioned subjects revealed no significant difference between the three groups at the .05 level as shown in Table 6.

Pre-Conditioning Trunk Flexibility	DF	SS	MS	F Ratio
Exercise	2	73.964	36.982	1.465
Error	62	1565.066	25.243	
Total	64	1639.031		

Table 6. Pre-Conditioning Trunk Flexibility Analysis of Variance

Analysis of variance for trunk flexibility in post-conditioned subjects revealed no significant difference between the three groups at the .05 level. These figures are shown in Table 7.

Post-Conditioning Trunk Flexibility	DF	SS	MS	F Ratio
Exercise	2	70.878	35.439	2.234
Error	62	983.207	15.858	
Total	64	1054.085		

Table 7. Post-Conditioning Trunk Flexibility Analysis of Variance

The paired t test for trunk flexibility revealed significant difference between pre- and post-conditioning as shown in Table 8.

Test	Mean	t
Pre-Conditioning Trunk Flexibility	16.123	8.85*
Post-Conditioning Trunk Flexibility	23.242	

* Significant at the .05 level

Table 8. Trunk Flexibility Student t test

Back Strength

Table 9 indicates back strength in pounds, however, actual testing was recorded in kilograms. Conversion of these figures was done by multiplying test scores by 2.2.

BACK STRENGTH IN POUNDS				
SUBJECT	AVERAGE PRE-TEST	AVERAGE POST-TEST	AVERAGE IMPROVEMENT	PERCENT IMPROVEMENT
GROUP 1	200.84	223.84	23.00	11.5
GROUP 2	194.87	226.93	32.06	16.5
GROUP 3	195.99	207.70	11.71	6.0

Table 9. Back Strength Improvement

Analysis of variance for back strength in pre-conditioned subjects revealed no significant difference between the three groups at the .05 level as shown in Table 10.

Pre-Conditioning Back Strength	DF	SS	MS	F Ratio
Exercise	2	93.812	46.906	0.201
Error	62	14468.062	233.355	
Total	64	14561.875		

Table 10. Pre-Conditioning Back Strength Analysis of Variance

Analysis of variance for back strength in post-conditioned subjects revealed no significant difference between the three groups at the .05 level. These figures are shown in Table 11.

Post-Conditioning Back Strength	DF	SS	MS	F Ratio
Exercise	2	979.062	489.531	2.009
Error	62	15105.062	243.630	
Total	64	16084.000		

Table 11. Post-Conditioning Back Strength Analysis of Variance

The paired t test for back strength revealed significant differences between pre- and post-conditioning as shown in Table 12.

Test	Mean	t
Pre-Conditioning Back Strength	89.692	3.71*
Post-Conditioning Back Strength	99.753	

* Significant at the .05 level

Table 12. Back Strength Student t test

Leg Strength

Table 13 indicates leg strength of the respective groups. Actual testing was recorded in kilograms but was converted to pounds, as were back strength scores, by multiplying the test score by 2.2.

LEG STRENGTH IN POUNDS				
SUBJECTS	AVERAGE PRE-TEST	AVERAGE POST-TEST	AVERAGE IMPROVEMENT	PERCENT IMPROVEMENT
GROUP 1	220.39	265.29	44.80	20.4
GROUP 2	201.98	266.79	64.81	32.9
GROUP 3	203.50	262.90	59.40	29.2

Table 13. Leg Strength Improvement

Analysis of variance for leg strength in pre-conditioned subjects revealed no significant difference between the three groups at the .05 level as shown in Table 14.

Pre-Conditioning Leg Strength	DF	SS	MS	F Ratio
Exercise	2	206.812	103.406	1.401
Error	62	15948.875	257.239	
Total	64	16155.687		

Table 14. Pre-Conditioning Leg Strength Analysis of Variance

Analysis of variance for leg strength in post-conditioned subjects revealed no significant difference between the three groups at the .05 level. These figures are shown in Table 15.

Post-Conditioning Leg Strength	DF	SS	MS	F Ratio
Exercise	2	39.437	19.718	1.1413
Error	62	29598.875	477.401	
Total	64	29638.312		

Table 15. Post-Conditioning Leg Strength Analysis of Variance

The paired t test for leg strength revealed significant differences between pre- and post-conditioning as shown in Table 16.

Test	Mean	t
Pre-Conditioning Leg Strength	97.400	6.96*
Post-Conditioning Leg Strength	120.476	

* Significant at the .05 level

Table 16. Leg Strength Student t Test

Body Fat

Percentage of body fat, calculated with the use of Paul's nomogram, is shown in Table 17.

SUBJECT	PERCENT BODY FAT		
	AVERAGE PRE-FAT	AVERAGE POST-FAT	AVERAGE IMPROVEMENT
GROUP 1	24.11	21.75	2.36
GROUP 2	23.25	21.51	1.74
GROUP 3	22.38	22.70	-.32

Table 17. Body Fat Improvements

Analysis of variance for body fat in pre-conditioned subjects revealed no significant difference between the three groups at the .05 level as shown in Table 18.

Pre-Conditioning Body Fat	DF	SS	MS	F Ratio
Exercise	2	788.000	390.000	1.21542
Error	62	113398.000	1829.000	
Total	64	114186.000		

Table 18. Pre-Conditioning Body Fat Analysis of Variance

Analysis of variance for body fat in post-conditioned subjects revealed significant difference between the three groups at the .05 level. These figures are shown in Table 19.

Post-Conditioning Body Fat	DF	SS	MS	F Ratio
Exercise	2	1938.000	969.000	1.65105*
Error	62	92279.000	1488.370	
Total	64	94217.000		

* Significant at the .05 level

Table 19. Post-Conditioning Body Fat Analysis of Variance

The paired t test for body fat revealed significant differences between pre- and post-conditioning as shown in Table 20.

Test	Mean	t
Pre-Conditioning Body Fat	23.538	
Post-Conditioning Body Fat	21.984	2.20*

* Significant at the .05 level

Table 20. Body Fat Student t Test

Kraus-Weber test item scores are indicated in Table 21 by group percentages of failures in pre-conditioning testing and percent improvement for said items. Test item number two, abdominal minus, was the only item that did not realize one hundred percent passing by all subjects in post-conditioning testing. A 3.8 percent failure of this item was evident for Group 2, general muscular fitness.

SUBJECT	PERCENT PRE-TEST FAILURE KRAUS-WEBER ITEMS						PERCENT IMPROVEMENT KRAUS-WEBER ITEMS					
	1	2	3	4	5	6	1	2	3	4	5	6
GROUP 1	0	0	0	0	0	0	-	-	-	-	-	-
GROUP 2	0	7.6	3.8	0	3.8	0	-	3.8	3.8	-	3.8	-
GROUP 3	0	0	0	4.5	0	13.6	-	-	-	4.5	-	13.6

Table 21. Kraus-Weber Test Item Improvements

The leg lower test scores are recorded in Table 22. Positive improvement was recorded for all three groups. Percent improvement of Groups 1, 2, and 3 were 17.4, 57.4, and 59.1, respectively.

SUBJECT	LEG LOWER TEST		
	PRE-TEST FAILURE	POST-TEST FAILURE	PERCENT IMPROVEMENT
GROUP 1	58.5	41.1	17.4
GROUP 2	88.4	30.7	57.6
GROUP 3	86.3	27.2	59.1

Table 22. Leg Lower Test Improvements

DISCUSSION

Hip Flexibility

As indicated in Table 1 through 4, hip flexibility improved in subjects after exercise, however, these improvements were variable. Table 2 shows that the groups were not homogeneous at the onset of conditioning. Group 3 was significantly more flexible than Groups 1 and 2 prior to conditioning. Groups 1 and 2, after flexibility conditioning, attained nearly the same degree of hip flexibility as Group 3. This may have been due to program design as Groups 1 and 2 participated in hip flexibility exercises while Group 3 did no hip flexibility exercises.

Trunk Flexibility

Tables 5 through 8 reveal results of trunk flexibility testing. All groups were homogeneous at the onset of conditioning and all groups improved. It is interesting to note that Group 3, prior to conditioning, held the smallest score in trunk flexibility but improved almost 5 percent more than Group 2, the general muscular fitness group, whose program included many trunk flexibility exercises. Group 3 did no trunk flexibility exercises. As expected, the flexibility group, Group 1, achieved the highest percentage of improvement, although not significant. Their program was concentrated with flexibility exercises.

Back Strength

Back strength scores, in Tables 9 through 12 reveal surprising outcomes of the three conditioning groups. Group 3, who conditioned for back strength achieved the least percent improvement from their program, 6 percent, while Group 2, a combination of the remaining programs yielded the highest percent improvement of 16.5 percent. This may indicate that the strength program design was not adequate for improving back strength and that flexibility exercises can contribute to back strength when combined with strength exercises. Group 1 achieved almost twice as much back strength improvement as Group 3, therefore supporting the statement that flexibility exercises may contribute to back strength improvement. The lack of statistically significant differences between groups, however, limits generalizations which can be made on strength gains for different exercise groups.

Leg Strength

Tables 13 through 16 show results of leg strength testing for all subjects. Prior to conditioning the three groups were homogeneous and conditioning brought about significant changes for all three groups. It can be noted in leg strength post-conditioning scores that Group 2, as in back strength post-conditioning scores, held the greatest percentage of leg strength gain. This group held the lowest score in pre-conditioning testing and the highest score at the end of the conditioning program, again suggesting that a combination program of flexibility and strength exercises may be more valuable for increasing leg strength. Since the flexibility group had the lowest improvement score, one could suggest that hip and trunk flexibility exercises will not bring about large leg strength improvements.

Body Fat

Results of body fat post-conditioning testing indicate that flexibility exercises contribute more to body fat losses than strength exercises. Testing scores can be reviewed in Tables 17 through 20. Group 1 had the greatest reduction of body fat while Group 3 gained .32 percent body fat. The combined program of Group 2 resulted in significant group loss of 1.74 percent body fat. The nature of program design may be a significant factor of this outcome.

Kraus-Weber Test

All programs can be considered as positive programs regarding gains in general muscular fitness according to the Kraus-Weber post-conditioning test results shown in Table 21. Group 1 passed all items prior to and following conditioning indicating their possession of minimum general muscular fitness before conditioning began. Group 2 improved to pass all subjects on all items after conditioning with the exception of 3.8 percent of the subjects on item 2, abdominal minus. Group 3 passed all items after participation in the strength program suggesting that strength exercises too do contribute to general muscular fitness.

Leg Lower Test

The leg lower post-conditioning test results shown in Table 22, indicate that flexibility exercises are not as effective as strength exercises in improving general muscular fitness in relation to posture control. The combination program of Group 2 yielded nearly as large percent improvement as the strength group indicating that a combination of flexibility and strength exercises offer significant improvements for lower back posture control.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

The purpose of this study was to compare and evaluate the effectiveness of three conditioning programs for improving hip flexibility, trunk flexibility, back strength, leg strength, percent body fat, and general muscular fitness.

Freshmen and sophomore college women at Kansas State University enrolled in three Basic Fitness and Conditioning classes were subjects of the study. Groups were assigned as 1, flexibility; 2, general muscular fitness; and 3, strength. Exercise programs were carried out with purposes specific to each of the three groups.

Pre-conditioning testing was done to determine scores of all subjects for hip and trunk flexibility, back and leg strength, percent body fat, and general muscular fitness. Post-conditioning testing was done, likewise, following completion of the three conditioning programs.

Results were analyzed by a computer to determine percent improvements, pre-conditioning analysis of variance, post-conditioning analysis of variance, and t tests. Statistical analysis revealed homogeneous grouping for all tests prior to conditioning with the exception of hip flexibility for Group 3. Statistical analysis further revealed significant improvements in all tests for all groups in post-conditioning testing with the exception of percent body fat for Group 3.

CONCLUSIONS

The following conclusions were made based on statistical results of this study:

1. Twice weekly participation in any one or a combination of all three of the conditioning programs in this study will result in significant improvements of hip and trunk flexibility, back and leg strength, body fat, and general muscular fitness.

2. To produce specific fitness differences in subjects, exercise programs should be carefully designed to produce those differences.

RECOMMENDATIONS

As author of this study and report, I recommend that further studies be made in the area of exercise programs such as:

1. Specific exercises should be stressed when a specific outcome is wanted.

2. Posture repair exercises should be included in all conditioning programs.

3. Conditioning programs for reduction of body fat should include concentrated flexibility exercising.

FOOTNOTES

¹Patricia A. Conger and Janet Wessel, "Physical Performance and Body Form as Related to Physical Activity of Women," Research Quarterly 39:908-914, 1968.

²E. W. Brewster, "A Comparison of Fitness Training Methods in a School Program," Research Quarterly, 36:387-392.

³Lynn McGraw and Stan Burnham, "Resistive Exercise in the Development of Muscular Strength and Endurance," Research Quarterly, 37:79-88, 1966.

⁴Jay A. Bender, Francis J. Kelly, Joe K. Person, and Harold M. Kaplar, "Analysis of the Comparative Advantages of Unlike Exercise in Relation to Prior Individual Strength Level," Research Quarterly, 39:443-448, 1968.

⁵Omer J. Rupper, "Status of Male College Students on Kraus-Weber Tests," Research Quarterly, 32:419, 1962.

⁶Donald R. Hilsendager, Malcolm H. Strow, and Kenneth Ackerman, "Comparison of Speed, Strength, and Agility," Research Quarterly, 40:71-75, 1969.

⁷Vernon Barney and Blauer Bangerter, "Comparison of Three Programs of Progressive Resistance Exercise," Research Quarterly, 32:138-146, 1961.

⁸C. W. Thompson and others, "Changes in Body Fat, Estimated From Skinfold Measurements of College Basketball and Hockey Players During a Season," Research Quarterly, 27:418-430, 1956.

⁹Betty Foster McCue, "Flexibility Measurements of College Women," Research Quarterly, 24:316-324, 1953.

¹⁰Donald Mathews, Measurement in Physical Education (Philadelphia: W. B. Saunders Company, 1963), p. 107.

¹¹E. A. Fleischman, The Structure and Measurement of Physical Fitness (Englewood Cliffs, N. J.: Prentice-Hall, 1964), p. 162.

¹²Charles B. Corbin and others, Concepts in Physical Education (Dubuque: Wm. C. Brown Company Publishers, 1970), p. 168.

¹³Ibid., p. 170.

¹⁴Harrison H. Clarke, Application of Measurement to Health and Physical Education (Englewood Cliffs, N. J.: Prentice-Hall, 1967), p. 174.

BIBLIOGRAPHY

- Banister, E. W. "A Comparison of Fitness Training Methods in a School Program," Research Quarterly, 36:387-392, December, 1965.
- Barney, Vernon and Blauer Bangerter. "Comparison of Three Programs of Progressive Resistance Exercise," Research Quarterly, 32:138-146, May, 1961.
- Bender, Jay A., and others. "Analysis of the Comparative Advantages of Unlike Exercise in Relation to Prior Individual Strength Level," Research Quarterly, 39:443-448, October, 1968.
- Clarke, Harrison H. Application of Measurement to Health and Physical Education. Englewood Cliffs, N. J.: Prentice-Hall, 1967.
- Conger, Patricia A., and Janet Wessel. "Physical Performance and Body Form as Related to Physical Activity of Women," Research Quarterly, 39:908-914, December, 1968.
- Corbin, Charles B., and others. Concepts in Physical Education. Dubuque: Wm. C. Brown Company Publishers, 1970.
- Fleischman, E. A. The Structure and Measurement of Physical Fitness. Englewood Cliffs, N. J.: Prentice-Hall, 1964.
- Hilsendager, Donald R., Malcolm H. Strow, and Kenneth Ackerman. "Comparison of Speed, Strength and Agility," Research Quarterly, 40:71-75, March, 1969.
- Mathews, Donald. Measurement in Physical Education. Philadelphia: W. B. Saunders Company, 1963.
- McCue, Betty Foster. "Flexibility Measurements of College Women," Research Quarterly, 24:316-324, September, 1953.
- McGraw, Lynn, and Stan Burnham. "Resistive Exercise in the Development of Muscular Strength and Endurance," Research Quarterly, 37:79-88, March, 1966.
- Rupiper, Omer J. "Status of Male College Students on Kraus-Weber Tests," Research Quarterly, 32:419, October, 1961.
- Thompson, C. W., E. R. Buskirk, and R. F. Goldman. "Changes in Body Fat, Estimated from Skinfold Measurements of College Basketball and Hockey Players During a Season," Research Quarterly, 27:418-430, December, 1956.

APPENDIX

APPENDIX A

FITNESS & CONDITIONING DATA SHEET

Name: _____	Pre-Date _____
Hour: _____	Post-Date _____
Group: _____	

PRE-CONDITIONING

Age: _____

Height: _____

Weight: _____

Bust: _____

Waist: _____

Hips: _____

R. Wrist: _____

POST-CONDITIONING

Weight: _____

Bust: _____

Waist: _____

Hips: _____

R. Wrist: _____

PRE-CONDITIONING

Hip Flexibility: _____

Trunk Flexibility: _____

Leg Strength: _____

Back Strength: _____

Abdominal Plus: _____

Abdominal Minus: _____

Psoas: _____

Upper Back: _____

Back Hamstrings: _____

Leg Lower: _____

Lower Back: _____

POST-CONDITIONING

Hip Flexibility: _____

Trunk Flexibility: _____

Leg Strength: _____

Back Strength: _____

Abdominal Plus: _____

Abdominal Minus: _____

Psoas: _____

Upper Back: _____

Back Hamstrings: _____

Leg Lower: _____

Lower Back: _____

Skinfold: IL TR $\frac{\%}{\%}$	Skinfold: IL TR $\frac{\%}{\%}$
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A COMPARATIVE EVALUATION OF THE
EFFECTIVENESS OF THREE CONDITIONING PROGRAMS

by

MARTIA RUTH WIELAND

B. A., Kansas Wesleyan, 1971

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Physical Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1972

ABSTRACT

A COMPARATIVE EVALUATION OF THE EFFECTIVENESS OF THREE CONDITIONING PROGRAMS

Martia R. Wieland, B. A., Kansas Wesleyan University

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