

THE USE OF AEROBIC RUNNING IN THE
REDUCTION OF ANXIETY

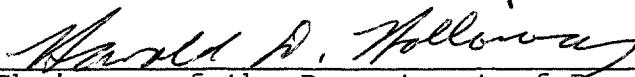
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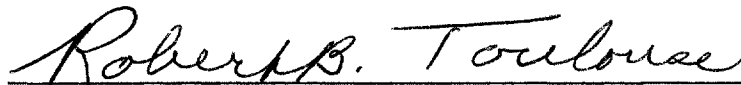
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This investigation was concerned with the potential effectiveness of an aerobic running program in the reduction of anxiety. Anxiety was defined in this investigation as a subject's score on the Taylor Manifest Anxiety Scale (TMAS). It was hypothesized that an aerobic running group, upon completion of the aerobic program, would achieve a significant reduction in anxiety. In addition, it was hypothesized that the aerobic running group would show significantly more anxiety reduction than three traditional exercise groups.

Ninety-two male students enrolled in four types of physical education activities served as subjects for the investigation. The types of exercise activities represented were as follows: Group I, volleyball; Group II, baseball; Group III, weight-lifting; Group IV, aerobic running. Prior to initiating the exercise programs, each of the four groups was administered a pre-test TMAS, which for the purpose of this investigation was titled "Attitude Survey".

Following completion of their respective programs, each group was administered a post-test TMAS. The data for each subject consisted of a pre-test TMAS score and a post-test TMAS score. The post-test TMAS mean of the aerobic running

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group, when compared to the pre-test TMAS mean, indicated a significant reduction in anxiety. In addition, the post-test TMAS revealed a significantly reduced mean change for the aerobic running group when compared with the volleyball, baseball, and weight-lifting groups. These results offered support for the hypothesis regarding the potential efficacy of an aerobic running program in the reduction of anxiety.

THE USE OF AEROBIC RUNNING IN THE
REDUCTION OF ANXIETY

THESIS

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Geoffrey H. Allen, B. A.

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THE USE OF AEROBIC RUNNING IN THE
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Introduction

Although the medical profession had long recognized the value of exercise in maintaining a healthy body and as therapy for an unhealthy one, the intriguing questions of how much, how long, and what kinds of exercise best benefit overall health remained ambiguous until Dr. Kenneth H. Cooper's development of "Aerobics", a new, and relatively revolutionary, exercise program. The program was unique because, for the first time in the recorded history of athletic activity, the effects of exercise were systematically determined, and normative data was provided.

In 1963, Dr. Cooper, a skilled exercise physiologist, began doing research on the effects of exercise for the United States Air Force. His goal was to scientifically measure the benefits of relevant forms of popular activity. Dr. Cooper's research was augmented by having at his disposal the most modern and sophisticated testing equipment in the field of exercise physiology. In addition, through the availability of Air Force personnel, he had an unlimited supply of subjects.

The best type of fitness is "endurance fitness" (Cooper, 1963; Falls, Wallis and Logan: Roby, 1970). Endurance

fitness, or working capacity, implies the ability to do prolonged work without undue fatigue. This kind of fitness focuses on the health of the heart, lungs, and entire cardiovascular system, in contrast to fitness which emphasizes muscular strength or agility. The key to "endurance fitness" is oxygen (Cooper, 1963; Roby, 1970). During any activity, oxygen is the burning agent that combines with the food stuffs in the body to produce energy. How efficiently oxygen can be delivered to the various parts of the body during an activity is a reflection of the functioning of the heart, lungs, and cardio-vascular systems, and, as such, is the best indicator of one's endurance fitness, or general health. It is the improvement of these systems toward which all exercise should be directed (Cooper, 1963). After testing thousands of subjects, Cooper was able to specify the energy cost to the body, for each exercise evaluated, in terms of millimeters of oxygen necessary to be processed in a certain amount of time. These amounts were then translated into exercise norms and "points". The greater the amount of oxygen processing required by a given exercise, the higher the point value awarded. After four years of research, Cooper was able to determine that the minimum number of points an individual should earn per week, in order to maintain physical fitness, is thirty. This amount enables the person to reach and maintain the "training effect" (Cooper, 1967). The training effect is the primary goal of endurance

exercise and refers to the beneficial changes that are produced in the body by following Dr. Cooper's point system and by obtaining sufficient amounts of the proper kinds of exercise. The highlights of the training effect are (1) the lungs are conditioned to process more air with less effort, (2) the heart grows stronger, thereby reducing the number of strokes necessary for pumping a sufficient amount of blood supply for the body, (3) the number and size of the blood vessels are increased along with the increase of the total blood volume, and (4) the tone of the muscles and blood vessels is improved and blood pressure is reduced (Cooper, 1967, 1968; Boyer and Kasch, 1970). Cooper determined that exercises that contribute maximally to increasing one's aerobic capacity are activities such as running, swimming, and cycling.

Individuals contemplating embarking on any of Dr. Cooper's aerobic programs should first be given a thorough physical examination. After securing medical clearance, an individual may determine his approximate present level of fitness by taking the "twelve minute test". This test measures the person's present aerobic capacity, categorizes him in a Cooper-specified fitness category, and recommends the proper conditioning program to be followed in beginning his aerobic program.

People who have not had a physical examination, or who have not been exercising regularly, are advised to begin

their aerobic program at the appropriate "age-adjusted" Starter Program of the Chart Pack section in his book, The New Aerobics (Cooper, 1967). The starter programs allow the individual to gradually increase his aerobic capacity until, eventually, he is earning the required thirty points per week.

Aerobics practiced according to Cooper's charts and rules can raise the general physical fitness level of an entire population and can have a significant preventive effect on some of the nation's major health problems (Cooper, 1968). Aerobics can be an effective counter measure to the nation's number one killer: heart disease (Cooper, 1968). An aerobic program lessens one's chances of prematurely developing coronary heart disease or related vascular ailments by strengthening the heart and opening up more blood vessels in the muscle tissues. In particular, an aerobic running program efficaciously aids in the recovery of coronary patients by benefitting them both physically and psychologically (Cambell, 1968; Cooper, 1969).

For years exercise enthusiasts have claimed that physical activity can alter the state of man's mind. According to Time Magazine (1968), a great deal of evidence has now been accumulated that supports the contention that lack of exercise can cause negative psychological repercussions to the individual. It has been shown that poor physical condition due to lack of exercise may often be directly or indirectly

influential in the elevation of anxiety and depression (Layman, 1957).

Increased anxiety was suggested as being one of the psychological effects of exercise deprivation. In a recent investigation (Baekland, 1970), the sleep of fourteen normal undergraduates accustomed to exercise was studied during nights following periods of exercise and during nights following periods of exercise deprivation. A change in sleep patterns, indicating increased anxiety, was observed over the exercise deprivation period. As judged by the verbal reports of the participating subjects as well as by the effects on their sleep, the one month period of exercise deprivation was a psychologically stressful experience. The most salient change in subjects' sleep patterns occurring during the exercise deprivation period was a significant increase in Rapid Eye Movement (REM) density. Baekland relates this increase in REM density to anxiety because subjects who reported increased day and night restlessness had greater increases in REM density during sleep than those who did not.

Watson (1938), based on years of experience, stated that with the majority of people more can be done toward a good emotional adjustment though building up physical "well being", than can be achieved by psychotherapy. Dudley (1967) states that a regular program of exercise is quite necessary for human well-being amid the tensions of contemporary

society. Because exercise gives the participant a sense of doing something virtuous, sensible, and good about his condition, there are psychological as well as physiological benefits (Time Essay, 1968).

Recent investigations have produced appreciable data concerning a relationship between exercise and emotional stress. The theory that repeat exercise "conditions" the stress adaptation mechanisms was strengthened by Michael's (1957) findings that the adrenocortical activity along with the autonomic nervous system are involved in adjusting to stress. The evidence suggests that adaptation to exercise produces a degree of protection against emotional stress. The increased adrenal activity resulting from repeated exercise causes an increased reserve of steroids available to counter a stress. A lack of activity was reported to reduce the ability to withstand stress, as if the reaction to a mental or physical shock is a learned process.

Tanner (1964) declared that the relation of physical activity to mental health should not be overlooked. Pleasurable exercises relieve tension. Muscular efforts are probably one of the best antidotes for emotional stress.

McPherson, Pavio, Yuhez, Rechnitzer, Pickard, and Lefeo (1967) studied some of the psychological effects and changes occurring over a twenty-four week exercise program among normal and post infarct males. Their experiment involved a 2 x 2 factorial design with experimental conditions

(exercise vs. control) and subject types (cardiac vs. normal) as variables.

Eighteen males with symptomatic acute myocardial infarctions were randomly assigned to either the exercise or control group. Nine sedentary males volunteered to participate as a nonexercising normal control group. The fourth group was designated as the normal exercise group and had volunteered after being recruited from a beginning adult men's fitness class. Tests used in this study were the Semantic Differential Inventory, Cattell Sixteen Personality Factor Questionnaire, and a twenty item Manifest Anxiety Scale. Anxiety and tension were among the mood states that the experimenters measured in order to assess changes as a function of exercise.

The two exercise groups engaged in a similar program of gradual exercises two evenings per week for twenty-four weeks. The cardiac controls met one evening per week for swimming instructions, followed by a twenty to thirty minute recreational swim. The normal controls followed their usual sedentary routines throughout the twenty-four week period. At the end of the twenty-four week period, the psychological tests were readministered to all subjects. The results were then analyzed by appropriate analysis of variance and T tests. Separate analyses were done for each of the individual scales of the Semantic Differential.

After twenty-four weeks on their respective programs, the cardiac exercisers, normal exercisers, and cardiac controls experienced a reduction in manifest anxiety scores ($p < .01$). In contrast, the nonexercising normal controls experienced an increase in manifest anxiety over the twenty-four week period ($p < .01$). This evidence was corroborated by the mood changes reported on the carefree-anxious semantic differential scale. After their respective programs, the cardiac groups were more carefree than they had been before the exercise programs began ($p < .05$), whereas the nonexercising normal controls regarded themselves as more anxious. McPherson et al. (1967) suggested that tenable causes for the cardiac control group's apparent reduced manifest anxiety was that they did not represent an adequate control group by virtue of their exercise participation in swimming instructions and recreation one evening per week. In addition, the authors of the study attributed some significance to the exercise programs in the reduction of anxiety and to the increase in self confidence reported by both cardiac control and cardiac exercise groups. Because the study was completed during mid-winter, it was suggested that the increase in manifest anxiety experienced by the nonexercising normal controls was influenced to a degree by their extreme inactivity during the period.

Further, of particular note, was the significant increase in manifest anxiety experienced by the nonexercising normal

control group, while a significant reduction in manifest anxiety was experienced by the normal exercise group succeeding their respective twenty-four week exercise programs. Tests prior to the exercise programs revealed no significant differences in personality characteristics between the non-exercise normal control group and the normal exercise group.

According to Dr. Cooper (1969), running is the most productive exercise activity in terms of its aerobic benefits. In addition, a number of psychological benefits purportedly accrue to individuals who maintain an aerobic running program. The loss or reduction of anxiety is a prime psychological benefit that often seems to occur as a result of aerobic running. Anxious, tense people become more relaxed. It is not known which benefit occurs first, the relaxation because of the physical changes in the body, or the physical changes due to the learned ability to relax (Cooper, 1969). According to Dudley (1967), aerobic running forces exertion, eases tension, and is a natural relaxant.

Dr. Cooper (1969) reports that aerobic running has been immensely therapeutic in treating many emotionally disturbed individuals, heavy drinkers, and insomniacs. Heavy drinkers find that running provides a constructive substitute for relieving tension that previously necessitated a drink. Insomniacs state that they are helped by aerobic running because it relaxes their anxiety and induces a healthy fatigue.

In the present investigation, it was hypothesized that following treatment, there would be a significant reduction on a post-test TMAS mean obtained by the aerobic running group as compared to its pre-test TMAS mean. In addition, it was hypothesized that there would be a significant reduction in mean change at the .05 level on the post-test TMAS obtained by the aerobic running group as compared to the volleyball, baseball, and weight lifting groups.

Method

Instrument

The instrument used in this study was the Taylor Manifest Anxiety Scale (TMAS) (Taylor, 1953).

Subjects

The population from which the subjects were drawn consisted of ninety-two male students enrolled in four types of physical education activities at North Texas State University in the spring semester of 1973. The chairman of the North Texas State University Physical Education Department designated the classes of physical education that were available to represent the four exercise activities required in the study. Prior to commencement of their respective programs, the pre-test TMAS was administered to the subjects comprising the four types of activities under the innocuous title of "Attitude Survey". Upon completion of seven weeks

of treatment activity, all subjects in each of the four exercise groups were administered a post-test TMAS.

Procedure

At the beginning of the spring semester, 1973, prior to commencement of their regular activities, a pre-test TMAS was administered to the subjects enrolled in the four types of activities in a duplicate manner. Immediately prior to the pre-test administration of the TMAS, the experimenter was introduced to the subjects by the physical education instructor as a graduate student who was conducting research on attitudes. The respective group instructors had not been informed as to the true nature of the investigation. The TMAS, under the mock title of "Attitude Survey", was passed out to each student along with an answer sheet. All subjects were verbally instructed to read the directions on the answer sheet carefully before answering the "Attitude Survey". Written directions appeared on the answer sheet as follows:

Directions: Respond to the following items (true or false) in regard to your most recent feelings. (Remember this is not a test and there are NO right or wrong answers.)

The verbal and written instructions were identical for the pre-test and post-test TMAS administrations.

Group I: Volleyball. The volleyball group met for three sessions per week in the men's gymnasium. Each session was approximately thirty minutes in length and was supervised

by an instructor. Prior to the commencement of the activity in each session, two group members were assigned and directed by the instructor to select team members for the period. Following the team selection, the two teams would proceed to engage in a twenty-five minute game.

Volleyball is classified as an aerobic exercise and, according to Dr. Cooper's point system, members of the volleyball group earned an approximate total of six to eight aerobic points per week for performing their respective activity. At the completion of the seven weeks of activity, the subjects were administered the post-test TMAS.

Group II: Baseball. The baseball group met on one of the North Texas State University baseball fields for three sessions each week. Each session was approximately thirty minutes in length and was supervised by an instructor. At the onset of the first week of activity, the subjects were randomly assigned by the baseball instructor to one of two teams. The teams appeared to be of comparable ability and were left unaltered to oppose one another at each session for the duration of the seven weeks of activity.

Baseball does not classify as an aerobic exercise. Consequently, the subjects in the baseball group earned no aerobic points whatsoever during the entire supervised baseball sessions. At the completion of the seven weeks of activity, the subjects were administered the post-test TMAS.

Group III: Weight-Lifting. The weight-lifting group met three sessions per week in the weight room of the men's gymnasium. Each session was approximately thirty minutes in length. Subjects were supervised by two instructors and were free to carry out individual weight programs. Instructors encouraged all subjects to exercise their major muscle groups thoroughly with the development of strength as the primary goal.

Although weight-lifting can significantly contribute to improved skeletal muscles, it does not make sufficient demands on the oxygen consumption process and cannot be classified as an aerobic exercise. Consequently, subjects in the weight lifting group failed to earn any aerobic points during their supervised weight-lifting sessions.

At the completion of the seven-week period, the weight-lifting group was administered the post-test TMAS.

Group IV: Aerobic Running. The aerobic running group met on the North Texas State University track twice weekly for two fifty-minute sessions. Each subject was required to undertake Dr. Cooper's "Twelve Minute Test" at the group's first regular activity session. Results of this test enabled the instructors to approximate the subjects' present aerobic capacity and determine their placement in the appropriate conditioning program. As a group, the subjects predominantly qualified for category IV on Cooper's physical fitness categories and, consequently, were eligible for participation

in Conditioning Program IV and V. These advanced programs allow participants to begin earning the desired goal of thirty points per week from the onset.

In each of the following sessions, subjects were required to run a timed, supervised distance of one and one-half miles. Upon completion of the run, and following a short rest period, all subjects were directed to spend an additional twenty to twenty-five minutes involved in individual running of not less than a distance of one and one-half miles. Although this latter individual running period was supervised, subjects' exact running times and distances were not charted. On the basis of the instructors' tabulations of the distances run and time required to complete each run, the majority of the subjects in the aerobic running group were earning a weekly total of thirty to thirty-six aerobic points.

At the completion of the seven-week period, the aerobic running group was administered the post-test TMAS.

Results

Pre-test and post-test TMAS scores for each subject are presented in Table 1. In addition, the pre-test and post-test means of each group are included. The data listed in each of the four group columns includes each subject's pre- and post-test TMAS raw scores and their difference score. It should be noted that the aerobic running group was unique in obtaining a sizeable mean difference.

Table 1

Pre-Test and Post-Test Raw Scores on the TMAS for Each Subject

Subject No.	Group I*			Group II			Group III			Group IV		
	Pre	Post	Dif.	Pre	Post	Dif.	Pre	Post	Dif.	Pre	Post	Dif.
1	11	16	5	5	9	4	9	7	-2	9	6	-3
2	9	9	0	13	15	2	19	16	-3	12	3	-9
3	13	16	3	18	14	-4	11	7	-4	17	4	-3
4	13	7	-6	12	8	-4	26	28	2	27	27	0
5	17	20	3	11	17	6	3	0	-3	19	8	-11
6	10	10	0	11	9	-2	13	14	1	23	24	1
7	18	20	2	15	29	14	3	4	1	22	15	-7
8	25	22	-3	1	10	9	13	11	-2	8	6	-2
9	32	38	6	15	12	-3	11	13	2	14	7	-7
10	10	8	-2	28	29	1	13	10	-3	7	6	-1
11	16	16	0	13	8	-5	12	16	4	9	4	-5
12	25	21	-4	16	18	2	13	9	-4	12	14	2
13	14	19	5	6	6	0	12	16	-2	12	7	-5
14	18	25	7	4	1	-3	7	12	5	12	10	-2
15	34	31	-3	18	15	-3	7	9	2	20	10	-10
16				11	13	2	10	10	0	14	10	-4
17							12	10	-2	17	13	-4
18							15	12	-3	3	3	0
19							8	7	-1	3	1	-2
20							8	18	10	7	8	1
21							28	28	0	8	5	-3
22							16	17	1	11	11	0
23							19	23	4	9	7	-2
24							21	20	-1	14	11	-3
25							7	11	4	14	9	-5
26							7	10	3	16	18	2
27							10	6	-4	18	16	-2
28							12	9	-3	11	6	-5
29							14	4	-10	8	8	0
30							20	21	1	8	8	0
31										5	3	-2
Means												
Pre-Test	17.66			12.31			12.63			12.16		
Post-Test	18.53			13.31			12.40			9.06		
Difference	.87			1.00			- .23			-3.09		

*Group I, Volleyball; Group II, Baseball; Group III, Weight-Lifting; Group IV, Aerobic Running

Table 2 presents the percentage of subjects in each of the four exercise groups whose post-test TMAS scores indicated a reduction, increase, or no change in anxiety.

Table 2

Summary of Percentage of Subjects Reducing, Increasing, or Remaining Unchanged on Post-Test TMAS

Post-Test Anxiety	Volleyball Group	Baseball Group	Weight-Lifting Group	Aerobic Group
Reduction	33.33	43.75	50.00	74.20
Increase	46.62	50.00	43.39	13.90
Unchanged	20.00	6.25	6.66	13.90

It should be noted that approximately 75 per cent of the subjects in the aerobic running program achieved a reduction on their post-test TMAS scores.

An analysis of variance procedure was next utilized to assess the presence of any significant differences among the mean changes of the post-test TMAS scores obtained by the four groups. Table 3 lists the results of the analysis of variance procedure, indicating that there was a significant difference among the four groups at better than the .01 level.

Table 3
Summary of Analysis of Variance Mean Changes

Source	SS	df	MS	F
Between Groups	274.33	3	91.44	6.24*
Within Groups	1278.41	88	14.65	
Total	1563.74	91		

* $p < .01$ level

The Newman Keuls Test was employed to make specific contrasts among the four groups. The results of this procedure are listed in Table 4.

Table 4
Results of Newman Keuls Test

Shapes	b_4	b_3	b_1	b_2
Ordered Means	7.0932	10.9667	11.8667	12.000
Differences Between Pairs		3.0365*	3.9635* .9000	4.0968* 1.0333 .1333
S B = .8418		2.815 2.3697	3.38 2.8453	3.715 3.1273

* $p < .05$ level

As indicated in Table 4, there was a significant difference at the .05 level between the mean change of the post-test TMAS obtained by the aerobic running group and the volleyball, baseball, and weight-lifting groups.

The hypothesis that there would be a significant reduction on a post-test TMAS mean obtained by an aerobic running group was supported. In addition, the hypothesis that the aerobic running group would show a significant mean change on a post-test TMAS following treatment, when compared to the mean changes of a volleyball, baseball, and weight-lifting group post-test TMAS, was supported.

Discussion

Results of earlier investigation have suggested the importance of exercise for the psychological well-being of the individual. The purpose of the present investigation was to test the efficaciousness of an aerobic running program in the reduction of general anxiety.

All subjects were administered a pre-test TMAS prior to their respective treatment programs and a post-test TMAS upon completion of their seven-week exercise period. The four exercise groups' treatment differed in the type of exercise activity in which each participated during the ensuing seven-week period. Results of the study showed that the aerobic running group, following treatment, achieved a significant reduction in anxiety scores. Furthermore, the

aerobic running group proved to be significantly more effective in the amelioration of anxiety when compared to three traditional exercise groups. The results of this investigation supported the use of an aerobic running program as an efficient, efficacious treatment procedure for the reduction of general anxiety.

The aerobic running group in this investigation differed from Dr. Cooper's (1968) suggested aerobic running routines in one noteworthy procedure. The importance of the regularity of exercise was stressed by Cooper and he advised individuals engaged in aerobic programs to exercise at least four times per week in order to reach and maintain the training effect. The results of this study suggest that either individuals can achieve significant reduction of anxiety without reaching the training effect--that the subjects had, in fact, reached the training effect through exercising on additional days other than their scheduled sessions--or that the subjects had reached the training effect prior to their seven-week exercise program.

The general implications of this study are that the pragmatic application of an aerobic running program might prove to be of considerable therapeutic import to behavior clinicians. Clients suffering from anxiety based disorders might be maximally treated by a program of therapy in conjunction with an individualized aerobic program.

Studies have shown there exists a high positive correlation (.92) between the TMAS and scale 7 of the Minnesota Multiphasic Personality Inventory (MMPI) (Good and Branter, 1961). Scale 7 measures the similarity of the client to psychiatric patients who are troubled by phobias or compulsive behavior. It seems tenable that clients' scores on scale 7 might significantly decrease after an aerobic running program, as did anxiety scores on the present study.

The results of the present investigation suggest that further research of the effects of aerobic running on anxiety would be warranted. Research should focus on the effects such variables as age, sex, the length of the aerobic running program, aerobic points to be earned per week, and number of exercise sessions per week have on the level of general anxiety. In addition, the effects of an aerobic running program on such independent variables as depression, frustration tolerance, agitation, hostility, and the aging process would seem to be of considerable interest for future investigation.

Research has been carried out revealing a relationship between sound physical health and sound psychological health. Studies have indicated that aerobic running is the most expedient exercise contributing to an individual's overall physical fitness. The present investigation suggests that individuals are psychologically benefitted in the form of reduced anxiety following an aerobic running program.

Future investigatory programs should be aimed toward a delineation of additional types of psychological problems for which an aerobic running procedure may be germane and efficacious.

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