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Physical Fitness Activities for Latter-Day Saint Missionaries

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PHYSICAL FITNESS ACTIVITIES FOR LATTER-DAY SAINT MISSIONARIES

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Robert R. Hughes

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Chapter 1

INTRODUCTION

Vannier and Foster (33:29) stated that the body and mind of man are impossible to separate. The inseparable components of total fitness are mental, emotional, social, and spiritual, as well as physical. Fitness then is a total phenomenon. Abundant and buoyant health gives one the drive to work, to play, and to live with zest.

On a world-wide church level, young men and women serving as missionaries do not have an organized plan or program of activities that would enhance their physical fitness while in the mission field. There are missionaries who do have a testimony of the importance of physical fitness; consequently, they will exercise, but the number is small. It is well understood by most people that the physical fitness of an individual influences his mental and spiritual capabilities. Elder John A. Widtsoe (35:56) of the Church of Jesus Christ of Latter-Day Saints stated:

> Complete living requires a sound body. The sound mind in the sound body is the first requisite of any person who desires to live happily and serve well. Every member of the Priesthood should keep himself in perfect physical health. There should be no pride in ill health. The person who keeps his body in good condition lengthens out his life in years, and, because he can do his work more effectively, increases the sum total of his service and enjoyments on earth. Even spiritual life is less vigorous and satisfying when the body is not in good condition.

STATEMENT OF THE PROBLEM

The problem of this study was to construct a physical fitness program designed specifically for the needs of full-time missionaries of the Church of Jesus Christ of Latter-Day Saints. An answer to the following subproblems was sought:

1. Determine the present levels of physical fitness among missionaries at the Brigham Young University Language Training Mission.

2. Determine specific activities that would enhance the physical fitness of missionaries.

3. Compile and publish a program of physical fitness activities for Latter-Day Saint missionaries to be used during their terms in the mission field.

HYPOTHESIS

For this study the null hypothesis was assumed. The hypothesis was that there would be no significant difference in the physical fitness level of missionaries who do not use a structured program and missionaries who do follow a regular scheduled and structured physical fitness program.

DELIMITATIONS

Experimentation and collection of data were done at Brigham Young University by the author. Participating in this study were those male missionaries attending the Language Training Mission during the Fall Semester of 1971.

Experimental tests were conducted upon the missionaries to determine their levels of physical fitness.

Those missionaries with excessive absences, injury, or other legitimate reasons such as physical deformity were excluded in an attempt to reduce the variables of the study.

Tests were administered twice: (a) at the beginning of a new cycle of incoming missionaries, and (b) the graduation of the same cycle of missionaries.

The pretest was officiated by five examiners; the post-test was officiated by only four.

JUSTIFICATION

The lack of research in the area of this problem and the attitudes of missionaries and leaders of the church missionary system stimulated interest and a desire for work in this area.

Information of this type could be helpful in determining whether a physical fitness program for missionaries on active duty would enhance their over-all missionary effectiveness.

DEFINITION OF TERMS

For the purpose of this study the following terms were defined:

Physical fitness.

A human being, whether he is an adult or a child, is physically fit when he (1) is free from disease, (2) does not have significant deviations from normal

> body functions or structure, (3) has sufficient strength, speed, agility, endurance, and skill to perform the maximum tasks of daily life without undue fatigue and can easily bounce back through rest when overly tired, (4) is mentally and emotionally adjusted, and (5) has high moral and spiritual concepts (36:114).

Full-time missionaries. Young single men or women usually between the ages of nineteen and twenty-four who are sent by the Church of Jesus Christ of Latter-Day Saints to propagate the teachings of the church to the free countries of the world for two years.

Church of Jesus Christ of Latter-Day Saints.

> An institution that was organized in 1830 under the direction of the Almighty. It is the only organization authorized by the Almighty to preach his gospel and administer the ordinances of salvation, the only church which has power to save and exalt men in the hereafter (22:128).

Brigham Young University Language Training Mission. A language school owned and operated by the Church of Jesus Christ of Latter-Day Saints whose objective is to teach in eight weeks to missionaries the basic six missionary language of the foreign country in which they will be laboring.

Physical fitness program. A booklet or pamphlet listing the activities and exercises that would enhance the physical fitness of full-time missionaries serving in the mission field.

Field of mission. A geographical area of the

world to which a missionary is assigned to preach the gospel and administer the ordinances of salvation.

Explosive strength. The ability to expend a maximum of energy in one or a series of explosive acts. It requires a mobilization of energy for a burst of effort, rather than continuous strain, stress, or repeated exertion of muscles.

Static strength. A maximum force which a subject can exert, for a brief period, where the force is exerted continuously up to this maximum. This strength factor can be exerted against objects (e.g., lifting heavy weights, pulling against a dynamometer).

Dynamic strength. The ability to exert muscular force repeatedly or continuously over time. It represents muscular endurance and emphasizes the resistance of the muscles to fatigue. The emphasis is on the power of the muscles to propel, support, or move the body repeatedly or to support it for prolonged periods.

Cardiovascular endurance. The capacity to continue maximum effort, requiring prolonged exertion over time.

Chapter 2

REVIEW OF RELATED LITERATURE

To facilitate the ease of understanding, the review of literature has been divided into three sections. Section one will review the history of physical fitness and exercise. Section two will review the knowledge and practice of physical fitness and exercise in our modern time. Section three will review the benefits that come from physical fitness and exercise.

HISTORY OF PHYSICAL FITNESS AND EXERCISE

Before recorded history man, through physical fitness, survived by hunting and gathering wild fruits. The first steps on the path to civilization began when tribes discovered the acts of polishing stones, building huts, and organizing communities. Shamans, or medicine men, held leadership, introduced ritual dances, and led communal hunting. These activities were useful in helping to maintain the physical fitness of the tribe (31:7).

The ancient Greeks emphasized physical fitness for war. In the thirteenth century, B. C., the individual city-states organized athletic events which included chariot racing, boxing, wrestling, running, and throwing the discus and javelin. These activities gave rise to the Olympics

in 776 B. C. (31:8).

In Sparta, the selecting of the fittest infants was given a helping hand by the government and those infants not meeting the required standards were thrown into the abyss. When the fittest infants grew to be boys, they were drilled for military success with the stern warning, "come back with your shield or on it" (3:8).

In Sparta and Athens the State assumed responsibility for the education of boys between seven and eighteen. The emphasis was placed more upon the physical than mental development. Plato recommended that the youth prior to eighteen years receive music and gymnastics and Aristotle placed his emphasis upon play, physical activities, stories, and morals to at least the age of fourteen (31:8).

During the middle ages, the fasting, contemplation, and ascetic life of the medieval monks restricted the enthusiasm and interest toward physical fitness. But with the birth of the renaissance, it was respectable to mention physical fitness again. Measures were even taken to preserve it in a functional sense. Luther (1483-1546) wrote of the moral values of physical education. Comenius (1592-1670) was bold enough to suggest thirty minutes of exercise for each one hour of study (31:9).

The subsequent course of physical education followed divergent national paths. The Germans pushed gymnastics with the emphasis upon apparatus work that was aimed

at developing the muscles. The Swedes favored free exercise and sought to perfect the rhythm of movement in the students. Denmark also had a keen interest in organized physical education and was the first nation to introduce compulsory physical education into schools (31:10).

During the present century, there has been limited social acceptance of voluntary activity in the adult. Low levels of national fitness have been of serious concern in both world wars. Many draftees were rejected because of poor physical development (31:11).

MODERN KNOWLEDGE AND PRACTICE OF PHYSICAL ACTIVITY AND EXERCISE

Today there is a vast amount of research and data that support the beliefs and practices that our forefathers had toward physical fitness and exercise.

Shryock (32:23) states that the heart works on the principle of a pump. The valuves in the heart, like the valves in any pump, can become ineffective. When this happens a backflow of blood is produced which puts extra work on the heart. To avoid this backflow and heart trouble, Shryock suggests that an individual: (a) take adequate rest, (b) exercise each day, (c) eat a proper diet, (d) avoid overweight, (e) avoid using tobacco, alcohol, and drugs, and (f) keep from worrying.

Physical exercise strenuous enough to make the breath come fast is a daily necessity for the proper

functioning of the heart; however, physiologists point out that physical activity does not cause blood supply to become more adequate but does cause the opening of accessory blood vessels to the heart, thus giving better body circulation (32:23).

Shephard (31:5) asks the question if there is a relationship between physical activity and cardiovascular health. Cardiovascular disease has reached epidemic proportions in the Western nations. The most common potential cause of death is an accident if the age is one to forty-four; some form of cardiovascular episode between forty-five and sixty, and cancer if over sixty.

Shephard (31:150) points out that the last fifty years have seen a big increase of deaths due to cardiovascular disease. Analysis of the death certificates has shown that most deaths were sudden deaths, particularly "coronary" attacks. Other blamed features of modern life are stresses and strains of the urban society, over nutrition, and the lack of exercise. Anxiety may play a direct role in coronary attacks since it increases the work of the heart and makes it more irritable.

According to Shephard (31:5), cardiovascular disease strikes man when he is most fruitful and productive such as the businessman and college professor. If the sobering total of deaths and those seriously incapacitated by non-fatal attacks were tabulated, the results would be enormous. There is a strong hint that the lack of endur-

ance fitness increases the risk of developing cardiovascular disease.

Tappen (10:90) conducted a study at the University of Michigan using 294 academic professors. It was found that 80 percent of these had an unusual amount of gastrointestinal disorders, diabetes, nervousness, tension, and cardiovascular disorders. Evidence showed that those who exercised regularly had far fewer of the above-mentioned disorders and were in much better states of mind.

Obesity is a problem that many individuals experience in their lifetimes. Shephard (31:105) states that the two simple measures of obesity are excess body weight and the thickness of the skin folds. Departures from the proper weight are due to an increase of body fat. The larger body mass has to be supported by shrinking cardiac and skeletal musculature, and there is solid evidence that excess weight is harmful to life expectancy. It also indicates a low level of habitual activity.

The average skinfold has a thickness of three to four millimeters if the tissues immediately under the skin are free from fat. The typical North American man's thickness is increased to eleven to fifteen millimeters while a woman's jumps to fourteen to twenty-two. Readings between thirty and forty millimeters are not uncommon in the abdominal region of both sexes. Such fat posits have no function unless a twenty-mile swim in icy waters is contemplated. They are just evidence of an over-nourished and

unfit population.

Morris and Crawford (31:152) stated that post-mortem studies suggested that normal amounts of exercise do not reduce the number of fatty, atherosclerotic placques in the walls of the coronary blood vessels. However, fibrous scarring of the heart muscle is less in active subjects. Eckstein (31:152) suggest that perhaps the exercise has developed an alternative vascular supply to areas of muscles when the artery has become narrowed and blocked. McDonald and Fullerton (31:152) stated that physical fitness and activity decrease the clotting tendency of blood.

Kraus (21:173) relates that from physiological facts, the age-old principle that physical activity and exercise are an integral part of the normal human life, and that a minimum of physical activity is necessary to maintain bodily and emotional health.

Schneider (30:16) points out that the benefits of muscular exercises performed within sound principles and extended over long periods of time cannot be over-estimated. Exercise is necessary for healthy existence and that it is actually a physiological need of a primitive kind which cannot be safely eliminated by civilization.

The need for regular physical exercise was pointed out by Michael (26:8) when it was shown that when exercise was discontinued, after ten weeks his subjects lost the conditioning they had attained during sixteen weeks of training.

In support of regular weekly exercise and physical activity, Picken (28:6) made the following observation:

> Effectiveness of physical activity and exercise depends upon how consistently you perform them. Twenty minutes a day six days a week for a total of two hours is far more beneficial than exercising for two hours at a time twice a week for a total of four hours.
>
> Concentrated activity cannot make up for lost time. In this sense exercise is like sleep. You can no more compensate for days of inactivity than you can make up for periods of insufficient rest by staying in bed seventy-two hours at a time.

Clark (3:57) stresses the importance of exercising early in life and continuing throughout life to participate in some degree by stating:

> Vigorous physical exercise should start in infancy and continue throughout the life of the individual, with the amount of exercise for each person dependent upon the individual's capacity but sufficient in intensity and extensify to assure a strong musculature capable of great endurance.

Kraus and Raab (21:5) published some interesting facts from a combined study that compared some sedentary subjects with some physically active subjects.

Sedentary Levels		Physically Active Levels
High	Neuro-Muscular Tension	Low
High	Absolute and Relative Weight	Low
High	Pulse Rate	Low
Low	Adreno-Cortical Reserve	High
Low	Muscular Strength	High
Low	Muscle Flexibility	High
Low	Vital Capacity (Breathing)	High
Low	Tiredness	High
Early	Aging	Late

Park (26:7-9) supports the above comparison by pointing out that to enjoy good health, the tissues of

the body should be in the tonic state. Physical fitness implies that the body can carry out bodily functions in a satisfactory way. As people move ahead in life, they produce energy in productive outlets. Actions of muscles imply tonicity or tension. When the demands become excessive, a stress factor may appear. It has been found in clinical practice that exercise is nature's sedative for the tense, harassed, and tired businessman. It appears that exercise strengthens the adaptive mechanism of the body. A physically fit individual seems to have a greater supply of adrenal reserve with an increased amount of steroids available to counter prolonged tension. Peebler (27:6) supports Kraus and Raab's study when he stated that if you are physically fit, your body has become a more efficient organism. You can perform more work at less bodily cost. You have better coordination, more endurance, strength, and even a healthier mental outlook.

Because of the threat of sedentariness that was besieging the nation's population, President Eisenhower established a National Committee for Youth Fitness in 1956. President Kennedy re-emphasized the importance of better physical fitness in the youth and adult populations. President Johnson and President Nixon have both continued this committee, which is dedicated toward upgrading the opportunities for young and old alike to live more complete lives through being physically fit (36:1).

BENEFITS DERIVED FROM PHYSICAL ACTIVITY AND EXERCISE

Cureton (9:266) states that the ability of man to keep his glands functioning properly determines more than anything else his endurance, vigor, disposition for exercise, and sexual ability. In working with human subjects it is strongly indicated that physical training influences the glandular functions. It cannot be said if this is due to a psychological effect in releasing tensions or not. It is probably due to improved circulation, higher metabolism, and better nutrition, all of which work together to permit the desired physiological adjustments to occur. Data show that rhythmic endurance exercise programs such as swimming, cycling, walking, jogging, and rhythmic conditioning calisthenics exercises cause marked improvement in the circulatory and respiratory functions and in several of the associated glandular functions.

A study was made by Celye (10:89) on two groups of rats. One group was unexercised and the other group was being exercised regularly. The untrained and unexercised rats developed ulcers, swollen glands, and heart disease, whereas the trained and exercised rats seemed to be relatively immune to the above difficulties even though exposed to the same types of stress and strains.

It is pointed out by Erickson (32:237) that stress disorders are on the increase. It is well known that physical education calms anxiety and helps relaxation. It is

very important for a boy to grow accustomed to regular physical exercise in order to keep himself in good form.

Kraus (21:148) in another study relates from his observations of children during and after active play, as well as those of parents, teachers, and psychiatrists who have observed the important transformations of the feelings which occur after exercise. He states that tension and fatigue tend to lessen, anxiety and depression are often diminished, and violent emotions such as hatred and anger are reduced. The alleviations following exercise are not the only changes observed by Kraus. When children, youths, and adults are exposed to regular exercise, their conduct becomes more sensible and purposeful. In many instances the powers of concentration increased. Kraus suggests that the above changes occur because of the fact that regular exercise tends to lessen the tensions of emotions built up in daily living and thus the mental equilibrium is re-established. Exercise serves a valuable junction since there is no acceptable satisfaction for many of our feelings.

Kraus (21:151) also explains the effect that physical activity has upon the personality of the individual. Through various testing and observation programs he states that proper interaction of various components form the personality. He suggests that inadequate physical activity, causing an emotional imbalance and tension through the curtailments of outlets, may be a direct factor in impairing

emotional and mental health.

Cureton (10:32) indicates that exercise can be an important means of relaxing from intense mental labor and that exercise is an excellent way to reduce worry and anxiety.

Ulrich (12:37) points out that whenever the homostatic balance of the body is upset, the human organism attempts to adjust in such a way that the balance is restored. Until the balance is restored, a state of "stress" exists.

Cureton (11:89) stated that research reveals that too much responsibility and/or competition--without being fit--is dangerous and actually killing too many. He also states that training is needed to bear such stresses.

The above information is supported by Bortz (26:8) when he stated that exercise, in clinical practice, is nature's sedative for the tense, harassed, and tired, for exercise strengthens the adaptive mechanism.

Park (26:176) stated that the association of chronic ailments, mild nasal running, and mental indisposition to bear stress has always impressed him. Such traits are inversely related to high energy capacity and endurance. Poor endurance on the treadmill was related to unsureness, conservatism, and imitativeness. Traits that were associated with young men who had poor endurance were: sophistication, anxiety, and mental fatigue. It has been shown in studies that the mature, confident, resourceful, and self-

sufficient personality traits go with better endurance on the treadmill. A good cardiovascular condition goes hand in hand with important personality traits.

Dowell (13:10) indicates that if man is to live a full life, an appropriate amount of physical activity must be mixed with mental activity and spiritual activity. Without the existence of spiritual activity, man's life would be void. Without mental activity, man would be dumb. Without physical activity, man would be a vegetable.

Harrison (3:14) further points out that all physiological activities contain mental elements and all mental elements are bound to organic functions. It is now generally accepted by scientists that body disturbances create psychic disturbances and psychic disturbances create body disturbances.

In a study which Appleton (21:150) compared the discharge rate of cadets who had to be dismissed from the military academy on account of psychiatric endorsements with the entrance physical aptitude, he found a relationship between emotional stability and physical fitness. He found that 7 percent of the top-ranking cadets had no psychiatric discharge and 7 percent of the bottom ones had 13 percent of the psychiatric discharges. The middle group moved at approximately 5 percent, significantly lower than the lower 7 percent. He also detected a strong correlation between the passing of physical fitness tests and academic performance, guaged by the ability of cadets to

complete their studies. Inability of cadets to meet academic requirements paralleled their lack of physical fitness.

Burger (1:157) stated that exercise would improve the productivity of the individual by improving the physical working capacity directly and thus reducing fatigue. Exercise would help indirectly by relieving the person of boredom and other psychological mechanisms. If such considerations are ignored, physical fatigue develops. Without the proper amount of exercise, the pulse rate, ventilation rate, deep body temperature, and lactic acid in the blood stream accumulates; consequently, the movements of the body become poorly coordinated and the quality and quantity of work deteriorates.

The efficiency of the muscular systems of the body is increased through muscular activity. By assisting the person to overcome the pull of gravity, the individual can conclude the activities of the day in a less fatigued state. Muscular fatigue creates a form of weariness which often results in discomfort. This fatigued state causes people to generally react in a manner that is often socially unacceptable and also renders him less capable of coping with the problems of daily living (12:46).

Concerning the areas of physical fitness, lactic acid, and fatigue, Falls (15:397) explained that aerobic means "with oxygen." Aerobic metabolism occurs in muscles where there is available an adequate supply of oxygen

and results in the complete utilization of the carbohydrates to produce carbon dioxide and heat.

Anerobic means "without oxygen." The performance of physical exercise wherein the oxygen cost per minute always exceeds the oxygen intake is known as anaerobic work. During severe anaerobic exercise, the energy for muscular contraction is derived anaerobically from a complex series of chemical reactions. During these chemical reactions, lactic acid is formed as the end product of anaerobic metabolism of glucose or glycogen. Lactic acid is adverse to muscular economy. The accumulation of lactic acid in the muscles and blood is the most common limiting factor of muscular activity.

Falls (15:39) further stated that where blood flow through the muscles is unable to supply oxygen fast enough for the energy demand, lactic acid and fatigue of the muscle result. This can happen in two ways: (a) if the blood flow through muscles is too slow to remove lactate as fast as it forms, it will accumulate in the muscles and inhibit further muscle contraction; (b) the other way is through the anaerobic process. This process causes muscle fatigue by exhausting the stores of glycogen in the muscles.

Karpovich (20:172) points out that the amount of lactate in the blood after identical types and amounts of work varies in the same individual. This level is related to the degree of physical fitness. In a post-exercise

study, men who were in the best physical condition had the lowest amount of lactate in the blood. Studies also showed that training causes a decline in the level of blood lactate for a standard amount of work.

Karpovich (20:238) also explains that the end product of the waste product theory of fatigue was suggested by the nineteenth-century German physiologist Rauke. Rauke found that certain substances formed during contraction depress or inhibit the power of muscle contraction. Among these products are lactic acid, carbon dioxide, and acid phosphate. The amount of these substances depends in part on the amount of oxygen supply to the muscles. Oxygen is required for the chemical processes within an organ. There is no simpler way of hastening fatigue than to subject the individual to a diminished oxygen supply.

Using a continuum of 0.0 to 14.0, 7.0 is neutral for the pH value. A pH of 7.0 is that of distilled water. Ricci (29:210) stated that cells can't tolerate wide fluctuations in pH. Beyond rather narrow pH limits, which vary among body fluids, biochemical activity ceases and the cells become necrotic. Blood pH varies from 7.58 to 7.0. During prolonged demanding work periods, blood pH falls gradually and effects a greater oxygen utilization by the tissues. Principal among the many factors that alter blood pH levels are such end products of metabolism as acid metabolites, lactic acid, and carbon dioxide.

The importance of muscular strength and cardio-

vascular endurance cannot be over-estimated because man's existence and effectiveness depends upon his muscles. Without the action of skeletal muscles, volitional movements of the body or any of its parts would be impossible. Muscles perform vital functions of the body. For example, the heart is the cardiac muscle and death occurs immediately when it ceases to contract. Without muscular contractions, breathing, digestion, and elimination would be impossible. Therefore, the proper condition of muscles, their strength, and endurance are essential to man (4:46).

Davis (12:39) points out that muscular activity improves and promotes the efficiency of the living organism and is essential for the proper functioning of the maintenance system of the body. The value of muscular activity in this regard is of profound importance in the life of the individual.

Cureton (10:14-15, 32), while discussing the benefits of exercise and what it will do for a person, lists twenty positive results that one can expect to gain from regular exercise. These benefits range from increased and efficient cardiovascular function to the prevention and reduction of what he called gravitational ptosis (sag).

Physicians are becoming increasingly aware of the fact that improvement in the postural tone of the skeletal muscles is one of the most important benefits of regular exercise. Many of the "minor ills" which from time to time afflict a large portion of the population are caused

by the faulty posture often seen in sedentary individuals. Such disorders as backache, constipation, eyestrain, chronic fatigue, varicose veins, enlargement of the prostrate gland, and many others have been shown to result in some cases from faulty posture and are often considerably improved or completely cured by correction of the posture (24:190-192).

Chapman (9:36) while discussing the question, "Why is exercise helpful?" says:

> The blood vessels are lined with smooth muscle fibers and, if these smooth muscles don't get exercise, they atrophy just like any other part of the body. Now, the only way you can exercise a blood vessel is to put a demand on the blood stream for oxygen. You do physical exercise, muscular tissues use up oxygen. Your heart has to beat faster to pump along a new supply of oxygen-carrying blood to meet the demand. As your heart increases its pumping action it pushes more blood through the system. The blood vessels expand to allow this more profuse circulation. Later they contract. And this expansion and contraction is, after all, exercise.

On the other hand, White (34:63) states that through the lack of regular exercise, thousands of microscopic blood vessels that carry oxygen and nutrients to the muscles, lungs, hearts, and other vital organs of the body slowly fall into disuse.

In conclusion, Cooper (6:101) makes the following contribution concerning the heart and its function:

> Ironically, the heart works faster and less efficiently when you give it little to do than it does when you make more demands on it. It is a remarkable engine. A conditioned man who exercises regularly will have a resting heart rate of about 60 beats per minute or less. A deconditioned man, who does not exercise, may have a resting rate of about 80 or more.

Just for the moment, suppose that you were at complete rest for a full 24 hours. A comparison might go something like this. Sixty per minute, times 60 minutes, equals 3600 beats per hour. Times 24 hours, equals 86,400 beats per day.

Eighty per minute, times 60 minutes, equals 4800 beats per hour. Times 24 hours, equals 115,200 beats per day.

So even at complete rest, a deconditioned man who does not exercise his heart forces it to beat nearly 30,000 times more every day of his life.

Chapter 3

PROCEDURE

The problem of this study was to construct a physical fitness program designed specifically for the needs of full-time missionaries of the Church of Jesus Christ of Latter-Day Saints. The following subproblems were considered:

1. Determine the present levels of physical fitness among missionaries at the Brigham Young University Language Training Mission.

2. Determine specific activities that will enhance the physical fitness of missionaries.

3. Compile and publish a program of physical fitness activities for Latter-Day Saint missionaries to be used during their terms in the mission field.

SELECTION OF EXPERIMENTAL AND CONTROL GROUPS

The population for this study included all 134 male missionaries entering the Language Training Mission on February 16, 1972. For control purposes the missionaries were divided into two groups. One group, the experimental group, had a recreation activity scheduled in the George Albert Smith Fieldhouse area on Monday, Wednesday, and Friday while the control group met on Tuesday, Thurs-

day, and Saturday. Participation was not mandatory but a sample of thirty-three participated in the experimental group and twenty participated in the control group.

SELECTION AND ADMINISTRATION OF STRENGTH MEASUREMENT

Fleishman's Basic Fitness Tests

Fleishman's Basic Fitness Tests were used because they were highly reliable in measuring strength of different parts of the body (16:24). The strength test was administered as follows:

Shuttle run. The shuttle run was used to measure explosive strength. This strength factor is distinguished from other strength factors in requiring mobilization of energy for a burst of effort, rather than continuous strain, stress, or repeated exertion of muscles. Two parallel lines, twenty yards apart, were marked off in the east gym of the George Albert Smith Fieldhouse. An observer was stationed at the finish line with a stop watch. Only one subject ran at a time. At the start he stood behind the starting line with one toe on the line. At the command, "Go," the subject ran to the opposite line twenty yards away and touched the floor on the far side of the line with either foot. He then returned to the starting line. The subject covered the one-way distance five times for a total of one hundred yards. On the last lap the subject went "all out" to cross the finish line stand-

ing up. The time that it took to cover the one hundred yards was recorded to the nearest tenth of a second (16:34).

Softball throw. The softball throw was also used to measure explosive strength. A twelve-inch standard softball was thrown from a white line marked on the grass. With a comfortable position as close to the mark as possible, the subject threw the ball as far as he could without moving his feet. He was not allowed any run-up, and was not allowed to shift the position of his feet during the throw. The subject was not required to keep his feel flat on the ground, but neither foot could leave the ground. The ball was thrown three times and the subject was scored according to his best throw. A 300-foot measuring tape was used to measure the best of three throws to the nearest foot (16:36).

Hand grip. A hand dynamometer was used to measure the static strength factor. This was the maximum force that a subject could exert for a brief period, where the force is exerted continuously up to this maximum. The dynamometer was placed in the palm of the subject's preferred hand. The dial was facing away from the palm. The larger half of the grip was in the meaty part of the palm, with the fingers curled over the smaller half of the grip. Part of the fingers between the second and third knuckles touched the grip, but the fingers did not curl far enough around to touch the dial and interfere with the pointer's

movement. The subject stood and held his hand down at his side, away from his body, palm facing his side. At the command, "Squeeze," the dynamometer was squeezed once, sharply and steadily as hard as the subject could. Each subject had three trials separated by at least a full minute of rest. The highest reading in pounds of the three squeezes was recorded (16:38).

Pullups. The pull-up test was used to measure the dynamic strength factor which is the ability to exert muscular force repeatedly or continuously over time. It represents muscular endurance and emphasizes the resistance of the muscles to fatigue. The common emphasis of tests measuring this factor was on the power that the muscles had to propel, support, or move the body repeatedly or to support it for prolonged periods. The subjects hung from a horizontal bar with the palms facing the body and did as many pull-ups as possible. From the hanging position, at the signal, "Start," the subject pulled himself up by the arms until he placed his chin over the bar. The subject then lowered his body to a fully extended position. He was instructed not to pause more than two seconds, either at the top or bottom of each cycle; otherwise he was told to stop. A penalty was assessed to the subject for not having the arms fully extended or chin over the bar. The number of pull-ups was counted aloud to the subject each time he lowered himself fully. One-half credit was given

for incorrect pull-ups. Kicking, twisting, or raising the legs was not allowed. When the subject started to sway, the examiner put his palm or forearm against the subject's legs. A subject was scored by recording the total number of times he pulled himself up correctly (16: 39).

SELECTION AND ADMINISTRATION OF ENDURANCE MEASUREMENT

Cooper's twelve-minute run, a measure of endurance, was conducted on the small track in the George Albert Smith Fieldhouse. Cooper found that the distance covered correlates with treadmill measurements of oxygen consumption (4:90) and aerobic capacity (6:29). The track was marked off into ten equal units. At the command, "Go," the subject ran and walked as far as he could in twelve minutes. The idea was to cover the greatest distance in those twelve minutes. A pistol was fired at the end of the twelve minutes and the subject stopped and found the closest marking indicating how far he had traveled of that lap. The examiner recorded the total number of laps and that number was converted into miles.

ADMINISTRATION OF THE TOOL

Pretest

Both the experimental and control groups were pretested using the shuttle run, softball throw, hand grip,

and pull-ups of Fleishman's Basic Fitness Tests and also Cooper's twelve-minute run. The pretest was administered February 22 and 23, 1972. The experimental group and control group were tested during their regularly scheduled recreation activity time in the George Albert Smith Fieldhouse and the lawn south of that building at Brigham Young University.

Experimental Group

The experimental group participated in a structured and organized physical fitness program which consisted of eight timed calisthenics. The eight calisthenics consisted of running in place, treadmill, high jump, four count burpee, shuffle step, sit-ups, push-ups, and chins. The group started each session by doing ten sets of running in place of ten-second duration with ten seconds of rest between each set. After the tenth set of running in place, the group was given a two-minute rest. After the two-minute rest, the experimental group exercised doing the remaining seven calisthenics by following the same procedure as running in place. The subjects were required to do only three sets of chins. This group met three times a week for seven weeks with twenty-five minutes of exercise each period. They were instructed and led by one examiner. Appendix C contains the details of the program.

Control Group

The control group participated in the normal free-

time recreation program that consisted of flag football, soccer, basketball, etc.

Post-test

A post-test was administered to thirty-two subjects in the experimental group and twenty in the control group on April 12 and 13, 1972. This was during their last week at the Language Training Mission. The experimental group was tested during a regularly scheduled physical fitness session. The control group was contacted by the Language Training Mission Presidency and a time was arranged for their post-test. The post-test, consisting of the shuttle run, softball throw, pull-ups, hand grip, and twelve-minute run, was administered in the same manner as the pretest to each group.

Statistical Analysis

An analysis of variance was used to test the data for significance. Sources of variations were the shuttle run, softball throw, hand grip, pull-ups, and twelve-minute run. The pretest and post-test data were analyzed comparing the experimental group against the control group. Significance was checked statistically at the .05 and .01 levels by using F ratios.

Chapter 4

ANALYSIS OF DATA

The purpose of this study was to construct a physical fitness program designed specifically for the needs of full-time missionaries of the Church of Jesus Christ of Latter-Day Saints. For this study an experimental group was selected which participated in a structured physical fitness program during the spring of 1972. A control group was selected which participated in no structured physical fitness program. Outside activities of each group were not controlled. A pretest and post-test were administered to each group to measure strength and endurance. Data were collected and then subjected to an analysis of variance to test for differences between the groups.

GENERAL INFORMATION

A questionnaire was designed and used to gather information concerning the physical fitness of the missionaries in the experimental and control groups. A presentation of that information is found in Tables 1, 2, 3, and 4.

Table 1 is a presentation of the age groups of the missionaries.

Table 1 revealed that in the control group nineteen or 95 percent of the missionaries were in the eighteen

Table 1

Age of Missionaries

Age	Control No.	%	Age	Experimental No.	%
18-21	19	95	18-21	32	100
22-25	1	5	22-25	0	0
26 and over	0	0	26 and over	0	0

to twenty-one age bracket. The twenty-two to twenty-five age bracket recorded one missionary, or 5 percent of the total. In the experimental group it was found that thirty-two missionaries or 100 percent of the group were in the eighteen to twenty-one age group.

Table 2 is a presentation of the residence of the missionaries for the past ten years.

Table 2

Residence

Residence	Control No.	%	Residence	Experimental No.	%
Rural farm	2	10	Rural farm	5	15.6
City under 10,000	2	10	City under 10,000	0	0
City of 10,000 to 50,000	6	30	City of 10,000 to 50,000	11	34.4
City of 50,000 to 250,000	3	15	City of 50,000 to 250,000	8	25
City over 250,000	7	35	City over 250,000	8	25

Table 2 showed that rural farms and cities under 10,000 population recorded two missionaries each for a total of 20 percent of the control group. Six missionaries came from cities with populations of 10,000 to 50,000; this equalled 30 percent of the total. Cities with populations of 50,000 to 250,000 showed three missionaries or 15 percent. Cities with populations over 250,000 equalled 35 percent or seven missionaries. The experimental group showed five missionaries or 15.6 percent living in a rural farm area and none of the missionaries from cities under 10,000 population. Eleven missionaries, or 34.4 percent, the largest percentage, came from cities with a population between 10,000 and 50,000. Cities of 50,000 to 250,000 and cities with populations over 250,000 each had eight missionaries for a total of 50 percent.

Table 3 is a presentation of the physical fitness assessment of the missionaries.

Table 3

Physical Fitness Assessment

Control			Experimental		
Rating	No.	%	Rating	No.	%
Excellent	3	15	Excellent	3	9.4
Good	12	60	Good	19	59.4
Fair	2	10	Fair	7	21.8
Poor	3	15	Poor	3	9.4

Table 3 showed that within the control group, three missionaries or 15 percent rated themselves in excellent condition, whereas the largest group, twelve missionaries or 60 percent, rated themselves in good condition. The ratings of fair and poor included two missionaries or 10 percent and three missionaries or 15 percent respectively. The experimental group rated themselves in the following categories: the excellent category had three missionaries or 9.4 percent; good had nineteen for 59.4 percent; the fair category had seven missionaries or 21.8 percent, and poor had three or 9.4 percent.

Table 4 is a presentation of the physical fitness programs of the missionaries.

Table 4

Personal Fitness Programs

Control			Experimental		
Response	No.	%	Response	No.	%
Yes	8	40	Yes	15	46.9
No	12	60	No	17	53.1
0-1 hour	1		0-1 hour	1	
1-3 hours	2		1-3 hours	11	
3-5 hours	2		3-5 hours	1	
Over 5 hours	3		Over 5 hours	2	

Table 4 is a response by the missionaries about their own physical fitness programs prior to their mission

calls. If they had a program, they responded to how many hours they spent each week. Of the control group, eight missionaries or 40 percent indicated that they had programs of physical fitness. Of the 40 percent, one missionary exercised from 0 to 1 hour a week; two missionaries exercised between 1 and 3 hours a week; two exercised between 3 and 5 hours; and three exercised over 5 hours each week. Sixty percent of the missionaries had no physical fitness programs.

Fifteen missionaries or 46.9 percent of the experimental group had physical fitness programs and 53.1 percent or seventeen missionaries had no programs of physical fitness. Of the fifteen that reported "yes," one missionary exercised between 0 and 1 hour; eleven exercised between 1 and 3 hours; one missionary exercised between 3 and 5 hours; and two exercised over 5 hours a week.

ANALYSIS OF DATA

The method of analysis in this study was a one-way analysis of variance on the differences between the experimental group scores and control group scores.

Table 5 is a presentation of the analysis of variance for all of the variables: shuttle run, softball throw, hand grip, pull-ups, and twelve-minute run. It was necessary to have an F ratio of 4.04 and 7.19 to be significant at the .05 and .01 levels.

An examination of the table revealed that a

Table 5

Analysis of Variance for Shuttle Run, Softball Throw, Hand Grip, Pull-ups, and Twelve-minute Run

Variable	Control Group (Gain/Loss)	Experimental Group (Gain/Loss)	Mean Difference	F Ratio $p < .01$	Significance $p < .01$
Shuttle run (seconds)	-0.2900	-0.0968	0.1932	1.4109	N. S.
Softball throw (feet)	3.1650	15.288	12.123	14.231	p = .01
Hand grip (pounds)	2.8824	2.0909	0.7915	0.50015	N. S.
Pull-ups	-1.5250	2.4531	-3.9781	70.147	p = .01
Twelve-minute run (miles)	0.11717	0.04848	0.06869	1.4011	N. S.

P = significance; N. S. = non-significance.

significant difference at the .01 level of confidence resulted between the control and experimental groups for the softball throw and pull-ups. The experimental and control groups showed no significant differences for the shuttle run, hand grip, and twelve-minute run.

For better interpretation of the scores made on the four strength tests, the scores were computed into percentiles. These percentiles came from norms that were based on data gathered from more than 20,000 students who were tested between 1960 and 1962 in more than forty-five cities throughout the United States. The percentile score tells the proportion of previously tested subjects, in a comparable age-sex category, that the subject had equalled or exceeded on that test (20:7). The percentile range was divided into nine levels of approximately equal standard score magnitude to facilitate further interpretation of percentile scores. The intervals and their designations can be found in Fleishman's Examiner's Manual for the Basic Fitness Tests.

Using the percentile intervals and fitness index from Table 6, presentation and interpretation of the scores that were made by the experimental and control groups on the four strength tests are given in Tables 7, 8, 9, and 10.

Table 7 is a presentation of Fleishman's shuttle run test that was administered to the control and experimental groups for both the pre- and post-tests.

Table 6

Percentile Equivalents and Fitness Index Points (20:8)

	Percentile Intervals	Contribution to Fitness Index
	97 and over	9
Very High	90 to 89	8
	80 to 89	7
High	65 to 79	6
Average	35 to 64	5
	20 to 34	4
Low	10 to 19	3
	4 to 9	2
Very Low	3 and below	1

Fitness Index Formula:

$$\frac{\text{Total index points scored on 4 tests}}{\text{Number of tests given}} \times 10$$

Table 7

Shuttle Run

	Control		Experimental	
	Pretest	Post-test	Pretest	Post-test
Mean (seconds)	19.22	18.93	19.07	18.98
Percentile	80	85	85	85
Fitness Index Points	7	7	7	7

The average time for the control group to run the hundred-yard shuttle was 19.22 seconds on the pretest and 18.93 seconds on the post-test. The average time on the pretest and post-test for the experimental group was 19.07 and 18.98 seconds, respectively. The control group improved by reducing its average time .29 of a second, whereas the experimental group reduced its time .09 of a second. The difference between .29 and .09 was not significant.

Table 8 is a presentation of Fleishman's softball throw test that was administered to the control and experimental groups for both the pre- and post-test.

Table 8

Softball Throw

	Control		Experimental	
	Pretest	Post-test	Pretest	Post-test
Mean (feet)	170.6	173.75	156.2	171.28
Percentile Fitness Index Points	60 5	60 5	40 5	60 5

The average distance that the control group threw the softball was 170.6 feet on the pretest and 173.75 feet on the post-test. This was compared to the experimental group's score of 156.2 feet on the pretest and 171.28 feet on the post-test. The experimental group improved by increasing its distance by 15.08 feet. The control group

improved also, but only by 3.15 feet. The difference between 15.08 and 3.15 was significant at the .01 level.

Table 9 is a presentation of Fleishman's hand grip test that was administered to the control and experimental groups for both the pre- and post-tests.

Table 9

Hand Grip

	Control		Experimental	
	Pretest	Post-test	Pretest	Post-test
Mean (pounds)	127	135	127	132
Percentile	78	85	78	85
Fitness Index Points	6	7	6	7

The control group increased its average grip strength by eight pounds, from 128 pounds on the pretest to 135 pounds on the post-test. The experimental group also improved by increasing its grip strength five pounds, from 127 pounds to 132 pounds. The improvement of the control group over the experimental group was not statistically significant.

Table 10 is a presentation of Fleishman's pull-up test as tested upon the experimental and control groups for both the pre- and post-tests.

The control group decreased in pull-ups from 9.6 on the pretest to 8.07 on the post-test. The experimental

Table 10

Pull-ups

	Control		Experimental	
	Pretest	Post-test	Pretest	Post-test
Mean (pull-ups)	9.6	8.07	9.14	11.76
Percentile	70	40	60	80
Fitness Index Points	6	5	5	7

group, however, increased from 9.14 pull-ups on the pretest to 11.76 pull-ups on the post-tests. The control group decreased 1.53 pull-ups and the experimental group increased 2.62 pull-ups. The improvement of the experimental group over the control was significant at the .01 level.

Table 11 is a presentation of Cooper's twelve-minute run as tested upon the experimental and control groups for both the pre- and post-tests.

Table 11

Twelve-minute Run

	Control		Experimental	
	Pretest	Post-test	Pretest	Post-test
Mean (distance in miles)	1.700	1.808	1.664	1.723

NOTE: Cooper's fitness index for the twelve-minute run is found in Appendix B. P = N.S.

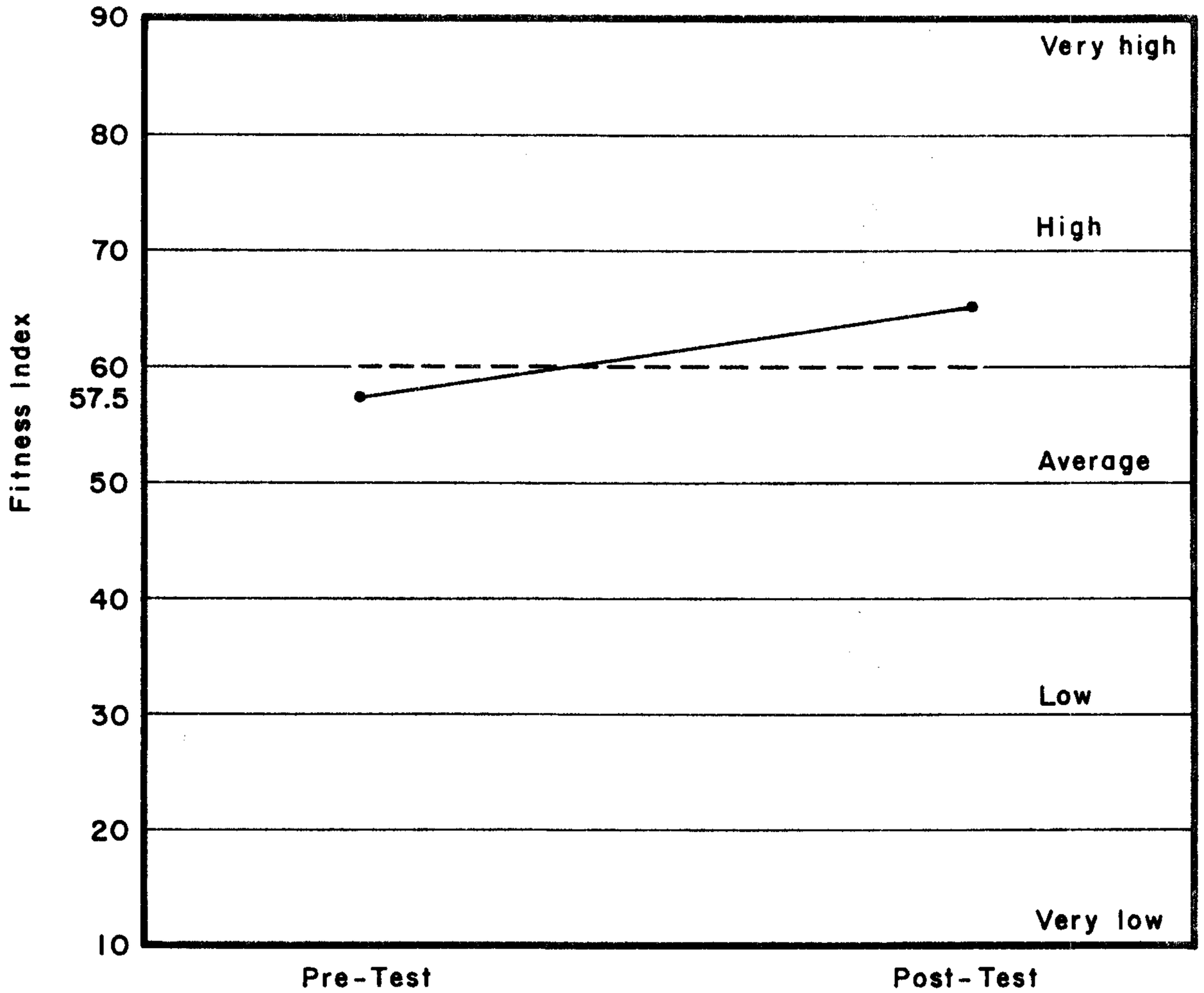
The twelve-minute run was not part of Fleishman's

strength tests; therefore it could not be converted to a percentile and fitness index.

The control group increased its distance from 1.700 miles in twelve minutes on the pretest to 1.808 miles on the post-test. The increased distance was .108 mile. The experimental group also improved, but only .059 mile, from 1.664 mile on the pretest to 1.723 mile on the post-test. The improvement of the control group over the experimental group was not significant as indicated by an examination of Table 5.

Figure 1 is a presentation of the group overall performance of the experimental and control groups on the four strength tests using the pretest and post-test fitness index points in Tables 7 through 10. From studying the graph it is evident that the experimental group improved from 57.5 on the pretest to 65 on the post-test, whereas the control group scored 60 on both the pre- and post-tests.

It was impossible to determine if the performance of the experimental group was statistically significant above the performance of the control group. For the purpose of determining the significance of the results in Figure 1, an analysis of variance was computed on the total score that each subject made on the four strength tests on the pre- and post-tests. A presentation of those results is found in Table 12.



—— Experimental group

--- Control group

Figure 1

Performance of Experimental and Control Groups on the Shuttle Run, Softball Throw, Pull-ups, and Hand Grip of Fleishman's Basic Fitness Tests

Table 12

Analysis of Variance on Fitness Index Score of Each Subject

	Control Group	Experimental Group
Pretest	59.6	58.4
Post-test	61.7	65.2
Average increase	2.13	6.75
F ratio	13.365	
Significance	p .01[a]	

[a]Significant at the .01 level of confidence.

TEST OF THE HYPOTHESIS

The hypothesis of this study was that there would be no significant difference between the physical fitness level of missionaries who trained under a structured fitness program and missionaries who did not follow a structured program.

The hypothesis was tested by administering a pre- and post-test, consisting of a shuttle run, softball throw, hand grip, pull-ups, and the twelve-minute run, to an experimental and a control group of missionaries from the Language Training Mission at Brigham Young University. For seven weeks, three times a week, the control group participated in the recreation activities of their choice. The experimental group also met three times a week for seven weeks. For twenty-five minutes each period, they

participated in exercises entitled "Timed Calisthenics." The following eight exercises constituted the timed calisthenics: running in place, treadmill, high jumper, four count burpee, shuffle step, sit-ups, push-ups, and chins. After the post-test was administered the results showed that at the .01 level of confidence the experimental group had a significant increase in physical fitness based upon the four factors. Both groups experienced no significant change for the twelve-minute run.

Considering the above results, the hypothesis was accepted that there was a difference between the physical fitness level of the experimental group and the control group.

Chapter 5

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

The purpose of this study was to construct a physical fitness program designed specifically for the needs of the full-time missionaries for the Church of Jesus Christ of Latter-Day Saints. The hypothesis of this study was that there would be no significant difference in the physical fitness level of missionaries who trained under a structured fitness program and missionaries who did not follow a structured program. Two groups, a control and an experimental group, were selected from the missionaries entering the Language Training Mission on February 16, 1972. The experimental group, consisting of thirty-two male subjects, participated in a structured physical fitness class for seven weeks. The control group, consisting of twenty male students, participated in no structured fitness class. During the test period the outside activities of both groups were not controlled. Each group took a pretest and a post-test consisting of four strength factor tests and Cooper's twelve-minute run. The data from these tests were collected and then analyzed by analysis of variance. The study was conducted during the spring semester

of 1972 at Brigham Young University, Provo, Utah.

FINDINGS

The statistical methods of analysis resulted in the following findings:

1. An analysis of variance showed no significant difference between the experimental and control groups for the following variables: shuttle run, hand grip, and twelve-minute run.

2. An analysis of variance showed a highly significant difference between the control group and experimental group for the following variables: softball throw and pull-ups at the .01 level of confidence.

3. An analysis of variance showed a significant difference at the .01 level of confidence between the control and experimental groups for the four strength factor tests.

CONCLUSIONS

Based on the findings of this study, the following conclusions were made:

1. The structured physical fitness program of this study participated in by the experimental group contributed to the overall strength of the subjects.

2. The structured physical fitness program of this study did not contribute to the development of endurance.

3. The structured program of this study contributed to the strength factors relative to the softball throw and the pull-ups.

RECOMMENDATIONS

Based on the findings and conclusions of this study the following recommendations were made:

1. Serious consideration should be given by the Church of Jesus Christ of Latter-Day Saints to developing and requiring a physical fitness program as presented in this study for all missionaries.

2. A follow-up study should be made utilizing a longer period of time and a greater number of subjects.

3. A physical fitness program should be developed that would increase the cardiovascular endurance of the missionaries.

4. A study should be conducted utilizing a pilot group of missionaries already serving throughout the world.

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APPENDICES

APPENDIX A

RAW DATA

Experimental Group

S	Pretest SR	ST	HG	PU	Run	FI*	Post-test SR	ST	HG	PU	Run	FI*
1	19.3	131	125.4	8.5	1.81	52.5	19.2	137	123.2	10.0	1.74	57.5
2	18.7	153	134.2	13.0	2.02	65.0	19.5	191	145.2	13.5	1.66	70.0
3	18.0	175	127.6	10.5	1.72	67.0	17.9	192	134.2	11.5	1.61	73.7
4	19.5	185	121.0	10.0	1.31	62.5	19.0	177	121.0	10.5	1.45	62.5
5	20.2	182	116.6	4.0	1.64	47.5	19.3	169	127.6	9.5	1.57	58.7
6	19.0	153	123.2	5.0	1.96	52.5	19.2	160	136.4	10.0	2.15	63.7
7	19.0	165	136.4	11.0	1.62	63.7	18.5	178	147.4	13.5	1.78	75.0
8	21.0	144	127.6	10.5	1.48	52.5	20.1	153	140.8	8.5	1.50	55.0
9	19.5	123	112.2	13.5	1.65	52.5	19.3	135	114.4	17.0	1.62	55.0
10	21.1	143	143.0	3.5	1.58	47.5	21.4	163	147.4	4.5	1.70	53.7
11	19.8	156	134.2	7.0	1.43	52.5	19.3	187	129.8	8.5	1.30	62.5
12	17.8	167	127.6	17.5	1.89	72.5	18.3	193	116.6	18.5	1.91	71.2
13	18.1	185	134.0	19.5	1.91	80.0	17.9	203	143.0	22.5	1.95	85.0
14	19.9	111	105.6	5.5	1.72	37.5	20.1	120	114.4	6.5	1.95	42.5
15	19.6	113	121.0	5.5	1.36	45.0	20.3	142	127.6	8.5	1.32	52.5
16	18.0	208	134.2	6.0	1.41	70.0	18.1	236	151.8	10.5	1.54	82.5
17	19.7	146	125.4	14.0	1.51	56.2	19.0	150	125.4	17.5	1.92	62.5
18	20.0	120	127.6	9.0	1.61	50.0	19.6	138	147.4	12.5	1.87	65.0
19	18.4	146	145.2	14.0	1.80	68.7	18.6	144	147.4	16.5	1.77	72.5
20	18.6	178	134.2	11.0	2.10	67.5	18.2	194	129.8	13.0	1.78	73.7
21	18.1	170	114.4	13.0	1.95	65.0	19.3	173	129.8	14.0	2.15	63.7
22	18.6	130	158.4	7.0	1.57	60.0	18.3	145	158.4	12.0	1.50	70.0
23	18.1	180	114.4	6.0	1.76	60.0	17.6	203	118.8	8.0	2.15	70.0
24	19.6	169	134.2	7.0	1.43	55.0	19.5	204	138.6	9.5	1.61	68.7
25	18.6	97	105.6	9.0	1.76	45.0	18.6	108	110.0	10.5	1.83	50.0

Experimental Group (continued)

S	Pretest SR	ST	HG	PU	Run	FI*	Post-test SR	ST	HG	PU	Run	FI*
26	19.0	178	136.4	10.0	1.76	66.2	18.7	206	125.4	15.5	1.64	75.0
27	19.1	167	121.0	1.5	1.80		18.6	191	123.2	0.0	0.0	
28	19.0	173	103.4	5.0	1.64	50.0	19.2	170	101.2	6.5	1.61	50.0
29	18.2	142	129.8	8.0	1.64	61.2	18.6	155	132.0	10.5	1.64	65.0
30	20.0	167	134.2	10.0	1.70	57.2	19.6	188	149.6	9.5	1.80	68.7
31	17.6	181	121.0	13.0	1.84	70.0	16.9	209	118.8	15.0	1.85	80.0
32	19.3	160	147.4	4.5	1.36	58.7	19.6	167	158.4	10.5	1.55	65.5

Control Group

1	18.7	171	0.0	11.5	0.00		18.3	187	143.0	10.5	0.00	
2	21.3	104	105.6	2.0	1.41	28.7	20.7	99	105.6	3.5	2.27	30.0
3	18.7	184	127.6	11.0	2.02	68.7	18.2	187	138.6	9.5	1.91	70.0
4	18.6	167	134.2	7.5	1.66	61.2	18.1	165	156.2	7.5	1.84	68.7
5	18.6	181	140.8	11.0	0.00	70.0	18.2	183	143.0	10.5	1.64	71.2
6	17.9	193	127.6	17.5	1.78	77.5	17.1	200	136.4	16.0	2.02	81.2
7	18.5	199	000.0	8.0	2.07		17.6	196	156.2	6.5	2.11	
8	17.7	164	000.0	11.0	1.66		18.0	159	132.0	4.0	2.02	
9	20.2	96	114.4	5.5	1.74	37.5	19.9	95	121.0	3.5	1.98	37.5
10	19.4	151	121.0	6.0	1.68	50.0	21.3	158	134.2	5.5	1.85	50.0
11	19.6	165	129.8	6.0	1.70	55.0	18.9	174	138.6	3.0	1.50	57.5
12	19.1	146	138.6	13.5	1.77	65.0	18.6	161	147.4	11.5	1.74	71.2
13	19.4	184	110.0	12.5	1.98	61.2	19.0	198	118.8	11.5	2.04	68.7
14	20.1	219	121.0	5.0	1.76	60.0	19.0	212	143.0	3.5	1.64	67.5
15	18.7	216	132.0	15.0	1.76	80.0	18.2	222	140.8	13.0	1.81	81.2

Control Group (continued)

S	Pretest SR	ST	HG	PU	Run	FI*	Post-test SR	ST	HG	PU	Run	FI*
16	19.4	178	145.2	12.5	1.74	67.5	19.6	161	149.6	10.5	1.80	65.0
17	19.8	159	134.2	6.0	1.30	52.5	19.6	180	134.2	5.0	1.45	57.5
18	21.2	208	127.6	1.5	1.36	52.5	20.4	219	125.4	1.5	1.44	55.0
19	18.2	147	127.6	22.0	1.59	71.2	19.0	148	127.6	19.0	1.64	65.0
20	19.3	180	125.4	7.0	1.62	55.0	18.9	171	110.0	6.0	1.66	52.5

*Fitness index score computed from strength factor tests.

S = Subject
SR = Shuttle Run
ST = Softball Throw
HG = Hand Grip
PU = Pull-ups
Run = Twelve-minute Run

APPENDIX B

COOPER'S FITNESS INDEX FOR TWELVE-MINUTE RUN

Fitness Category	Oxygen Consumption (ml/kg/min) (under 30 years)	Distance Covered (miles)
Excellent	51.6 +	1.75
Good	51.5 - 42.6	1.74 - 1.50
Fair	42.5 - 33.8	1.49 - 1.25
Poor	33.7 - 25.0	1.24 - 1.0
Very poor	Less than 25.0	Less than 1.0

APPENDIX C

PHYSICAL FITNESS PROGRAM

The physical fitness program consists of eight timed calisthenics. It is called timed calisthenics because the participant exercises for ten seconds and then rests for ten seconds. The participant is required to complete ten sets of this cycle for the first seven calisthenics. He is required to complete only three sets of exercise eight, which is pull-ups. After each exercise of ten sets, the participant rests for two minutes. The eight calisthenics are performed in the following way:

1. Running in place. The knees must be brought up in front raising the feet at least eight inches from the floor.

2. Treadmill. This exercise is also called the mountain climber. After positioning himself in the push-up position, the participant draws the right knee under his chest equal in distance to the extended arms. As the right leg extends, the left knee and leg follow the same motion and action as the right leg.

3. High jumper. From a standing position, the participant jumps vertically into the air and extends the arms by thrusting them straight above the head.

4. Four-count burpee. From a standing position, the participant bends the knees and places his hands directly in front of his feet. He then extends the legs behind him; this puts him into a push-up position. The

exercise is completed by bending knees and drawing both legs up under the body and then standing up to a position of attention.

5. Shuffle step. With the knees slightly bent, left foot fifteen inches in front of the right foot, and a downward pushing of the body weight upon both legs, the feet exchange positions with each other by a quick shuffle step that involves lifting both legs an inch or two off the ground.

6. Sit-ups. With the body in a supine position, knees slightly bent, and hands behind the head, the participant raises the trunk of the body from the ground and touches his elbows to the knees.

7. Push-ups. The proper position for a push-up includes a straight back, arms and hands under the shoulders, and feet twelve to fifteen inches apart. With the back straight, the body is lowered to the ground. The arms extend and push the body back to the starting position.

8. Pull-ups. The participant grips the bar with his hands. From the hanging position, he pulls himself up by his arms until he can place his chin over the bar. He then lowers his body to a fully extended position.

The participant will gain the most benefit from each

calisthenic by exercising as many times as possible during each ten-second period. It is recommended that he exercise daily, Monday through Saturday. To increase the resistance you can increase the time of the sets until you reach twenty seconds. But you always rest ten seconds between sets and two minutes between exercises.

VITA

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