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GUIDELINES FOR AEROBIC FITNESS TRAINING

IN THE U.S. ARMY

U S ARMY RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE

Natick, Massachusetts

6 August 1979

UNITED STATES ARMY
MEDICAL RESEARCH & DEVELOPMENT COMMAND

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Basic guidelines for the initiation of an aerobic training program are presented. The physiological principles involved in aerobic training regarding the heart, lung and work capacity are discussed. Before beginning a training program individuals over 35 years of age are advised to undergo medical screening for coronary risk factor assessment. The training program is designed so that individuals progress graduatlly in order to avoid unnecessary strain and injury. The goal of training is to build up to a regimen of running for 20-25 minutes

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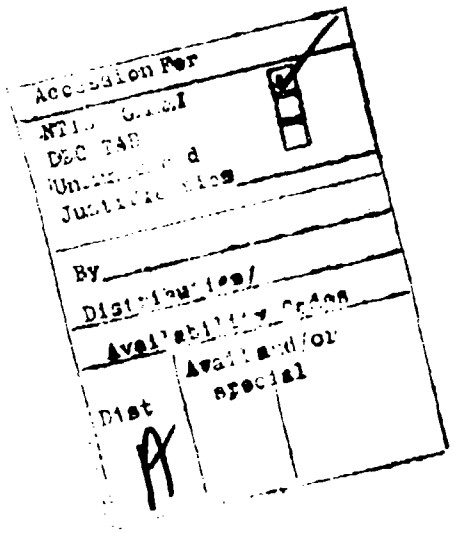
at least three times per week as a minimum. By achieving this minimum all individuals should be able to meet the minimum fitness requirements for most MOSs in the Army. Injury prevention and alternatives to running programs are also discussed.



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REPORT NO. T 5/79

(6) Guidelines for Aerobic Fitness Training

in the U.S. Army

(11) 6 Aug 79 (14) USARIEM-T-5/79

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1. Forward

AR 600-9 (The Army Physical Fitness and Weight Control Program) assigns to The Surgeon General the - - - "responsibility for evaluating medical aspects of the Army Physical Fitness Program - -." The Surgeon General in turn has delegated as the action agency the U.S. Army Research Institute of Environmental Medicine. Because of this responsibility and our research experience in physical fitness and training, this Institute is frequently contacted for advice on biomedical matters regarding physical fitness in the Army. The purpose of this publication is to bring together, for the unit commander or those conducting physical training, information which is not generally available in a single source or adapted to the military environment. It is an attempt to disseminate current scientifically and medically sound advice and thereby supplement such official publications as FM 21-20 (Physical Readiness Training).

Comments on this report or further inquiries should be directed to the Commander (ATTN: Director, Expercise Physiology Division), U.S. Army Research Institute of Environmental Medicine, Natick, MA 01760, AV 955-2800.

2. Introduction

Considerable change has occurred within the Army's physical readiness program over the past several years. Most pronounced is a new emphasis on aerobic (oxygen demanding) activities, particularly running. This new trend stems largely from the remarkable popularity that it has gained in the civilian community since the early 1970's. Army Commanders

soon adopted these examples from civilian life and applied it to their own situations. An excellent example of this was the "Pro-Life" Program originated by then MG Henry Emerson, CG, 2d Infantry Division, Korea, a program which included extensive aerobic running as the central theme. This type of program has now spread to where it is commonly found at Divisional Posts. "Run for Your Life", a program originated at the Army's Infantry School, Fort Benning, is another major example of an innovative approach of applying aerobic principles to the Army's environment.

This sudden and widespread implementation of running activities in the Army's fitness program has caused many questions to be raised and has led to a certain number of problems. How much running is necessary to achieve the desired goal? Can too much running be injurious? What footwear should be used by soldiers for running? What are medical safety considerations for older personnel? These are just a few of the questions being asked by new commanders or those responsible for their unit's physical training. Contributing significantly to this situation is the fact that there is virtually no instruction given in our service schools on the basic biological principles of exercise and physical training. Thus, the new officer or NCO who is confronted with the actual execution of their units fitness training must rely upon the limited written information that is available to him

or what he searches out for himself. The objective of this publication is to provide these basic principles of aerobic fitness and training, medical concerns and other relevant information as it pertains specifically to the Army user.

3. Background

Physical fitness, for the purposes of the Army, can be defined as those factors which determine one's ability to perform heavy physical work and contribute toward maintaining good health and appearance. These factors or components of fitness are:

a. Muscle strength

b. Anaerobic power (muscular endurance)

c. Aerobic power (cardiorespiratory fitness)

Other factors sometimes included, such as speed, agility, coordination and balance, are more properly classified as components of "motor fitness".

The components of physical fitness are based on the sources from which energy is derived for muscular activity. The first source that is most immediately available are phosphate chemical compounds (creatine phosphate and adenosine triphosphate), which are already stored in the muscle fibers. These, however, are very limited in supply and are consumed quickly for brief muscular work before being depleted. Non-repetitive pushing or lifting actions are examples of stored energy being used. This aspect of fitness is commonly referred to as muscular strength. One improves their muscle strength fitness by increasing the amount of muscle tissue and its stored energy content.

The next source of energy, in order of availability, is energy derived from anaerobic chemical processes. This energy producing pathway is characterized by a partial breakdown of foodstores (primarily carbohydrates) which requires no oxygen (thus anaerobic: non-oxygen demanding) in the chemical action. Thus, it is a source of muscular energy in circumstances where oxygen delivery has not yet met the demands, as at the beginning of intense exercise, or when the need for energy exceeds that made available by oxygen. A 100 yard sprint is an example of predominantly anaerobic activity.

The third source of energy is derived from aerobic processes. In contrast to the anaerobic component, carbohydrates and fats are completely broken down by chemical reactions which require oxygen (thus aerobic: oxygen demanding). This pathway is slower to yield energy since the oxygen has to be delivered from the outside air via the lungs and blood. However, it is much more efficient, i.e., it produces more useable energy for the same amount of foodstores burned. Walking and cross-country running are typical aerobic activities.

Other terms commonly used synonymously with aerobic fitness are stamina and cardiorespiratory or endurance fitness. We have chosen to use the term aerobic fitness since it represents specifically the energy producing component involved.

4. Physiology of aerobic fitness

Aerobic energy production is composed of the following steps:

a. Ventilation of the lungs with air.

b. Movement of oxygen from the lungs into the blood stream.

c. Delivery of oxygen laden blood by the pumping action of the heart.

d. Regulation of blood vessel size to distribute blood, e.g., away from inactive tissue to active muscle.

e. Movement of oxygen from blood to the muscle cells.

f. Breakdown of foodstores with oxygen to produce energy in the form of phosphate compounds.

An individual's aerobic fitness is therefore determined by the sum of the size or capacity and efficiency of all of these components of the aerobic cycle. Expanded use (training) of the cycle will expand one or more of these components and thus increase one's aerobic power capacity. In contrast, disease may reduce some components and thus decrease one's aerobic fitness.

Aerobic fitness is a function of 4 types of factors:

1. Genetic
2. Activity or training
3. Environment
4. Health

It is now generally believed that approximately 80% of one's aerobic potential is genetically determined, leaving only about 20% that can be modified by training. In order to achieve exceptionally high levels of aerobic fitness as seen in national or Olympic caliber athletes one must virtually inherit a high potential for aerobic fitness in addition to training hard to fully develop their capacity. Beyond one's inherited level, the only usual way to expand one's aerobic level is by continually loading or stressing the system, i.e., physical activity (training). By repetitively tasking the aerobic system beyond its previous level, one can cause it to expand. This is discussed

further in Section 7.

The genetic factor is expressed in the size and quality of the aerobic cycle components listed above. Thus, some individuals inherit a larger heart and blood flow capacity and a particular makeup of muscle fibers in the large skeletal muscles.

A number of factors may decrease aerobic fitness. Included in this list are:

a. Age

b. Anemia

c. Carbon monoxide from tobacco smoking or pollution

d. High altitude exposure (oxygen lack)

e. Illness or disease

Much of the decrease in fitness that is typically seen with increasing age is due to inactivity. Nevertheless even in athletes, a gradual decline is eventually seen, no doubt due to a gradual deterioration in the tissues of the lungs, heart, blood vessels and muscle.

Any condition which reduces the ability of blood to carry oxygen will also reduce ones aerobic fitness. Anemia is a condition of reduced oxygen carrying hemoglobin while carbon monoxide blocks hemoglobin from carrying oxygen.

Medical conditions which impair oxygen transport and therefore would reduce ones aerobic fitness would include emphysema, severe asthma, congestive heart failure and severe atherosclerosis.

In summary, a healthy individual's aerobic fitness is determined largely by genetic factors modified by training and environmental conditions.

5. Measurement of aerobic fitness

A test of aerobic fitness, in theory, would involve a measure of the body's capacity to transport oxygen to and utilization by the muscles. Such a measurement in fact, is well developed in laboratories and widely used as the standard for aerobic fitness. It is referred to as aerobic power, since it is measured as a rate: liters of oxygen transported per minute. The specific test is called maximal oxygen uptake. For the purposes of this report then these three terms will be used synonymously - aerobic fitness, aerobic power and maximal oxygen uptake ($\dot{V}O_2max$).

This laboratory reference measure consists of an individual exercising for short periods at increasing work intensities while measuring the body's oxygen consumption. The point at which the body can consume no further oxygen despite increased work intensities is referred to as his $\dot{V}O_2$ max. This is depicted in Figure 1.

The test can be carried out on a stationary cycle ergometer or preferably on a treadmill (Fig. 2). The individual being tested breathes through a mouthpiece so that his exhaled air can be measured for volume and analyzed for oxygen content and the oxygen consumption is computed.

Such a test is obviously only suited for a laboratory and, therefore, one must look elsewhere for methods to evaluate aerobic power in the

FIGURE 1. OXYGEN CONSUMPTION AT VARIOUS WORK INTENSITIES.

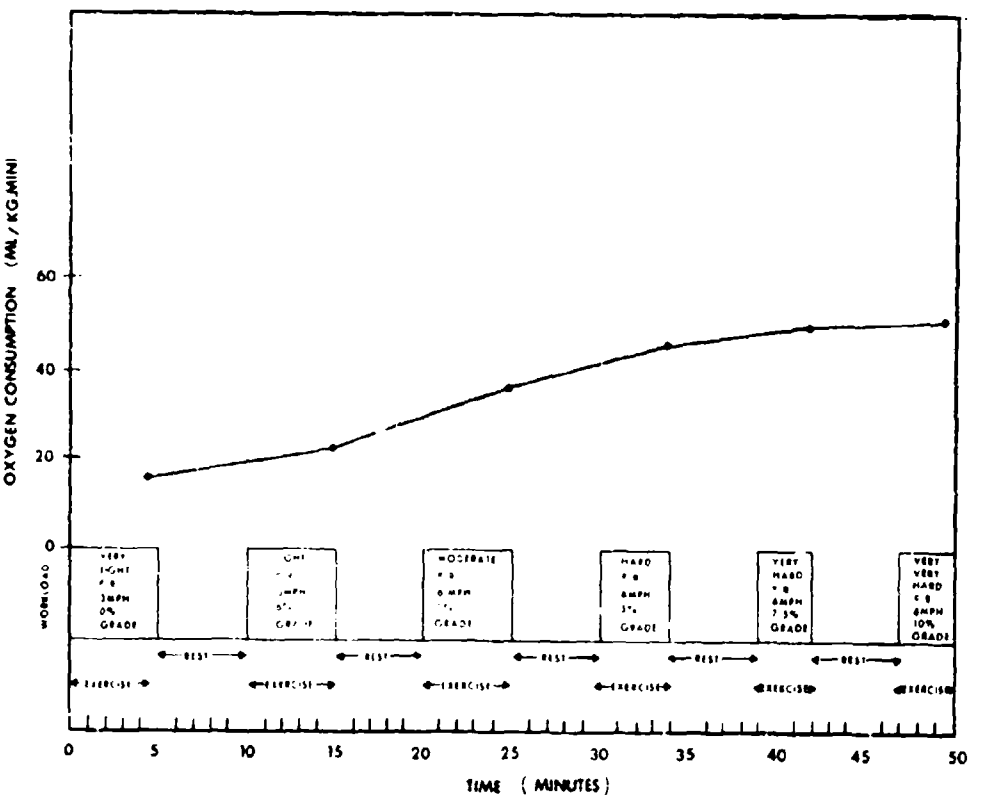
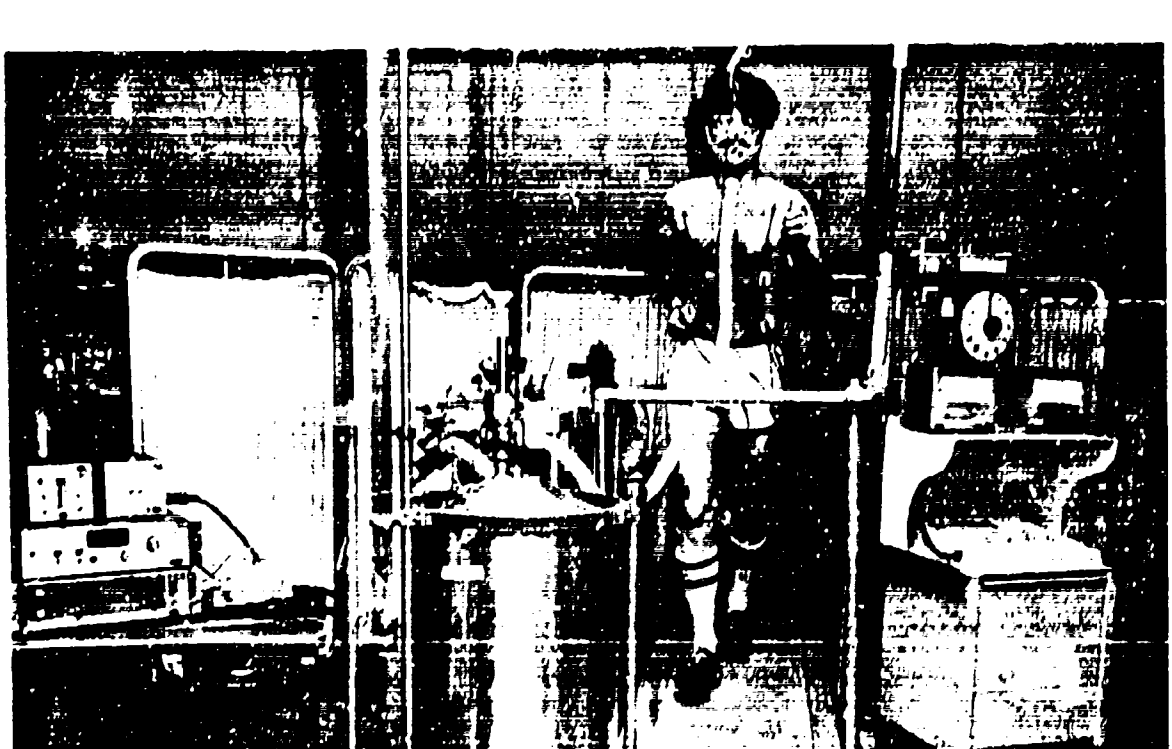


FIGURE 2. SUBJECT PERFORMING A MAXIMAL OXYGEN UPTAKE ($\dot{V}O_2$ MAX) TEST ON A TREADMILL.



field. Such "indirect" measures are generally of two types. The first utilizes physiological responses that follow closely to the increase in oxygen uptake as one exercises; examples of these are heart rate, blood pressure and ventilation. The most suitable is heart rate since it increases linearly with increasing work or oxygen consumption and reaches its maximum point near one's $\dot{V}O_2$ max. The absolute heart rate response, in fact, is largely a function of one's relative aerobic fitness (see Figure 3) and, therefore, is a popular predictor of aerobic power. Thus, the heart rate response at a moderate (less than $\dot{V}O_2$ max) work intensity can be applied against a norm and $\dot{V}O_2$ max estimated. Cycle ergometer (Fig. 4) and stepping exercise (Fig.5) are commonly used for this purpose. The disadvantage of these tests is that factors other than the relative fitness level, may modify the heart rate response, e.g., anxiety, ambient temperature.

The second type of indirect assessment of aerobic power involves performance tests. These must include performance tasks that are largely aerobic in nature. Most popular are the one or two mile run for time and the 12 or 15 minute run for distance. The disadvantage to these types of tests is that the subject must be motivated to perform maximally and have some ability to pace himself. The distance for time tests are traditionally used because of the ease in scoring. The one mile run is preferable for the less conditioned soldier while the two mile run is more purely aerobic and is preferable for the trained soldier.

FIGURE 3 COMPARISON OF HEART RATE AND OXYGEN CONSUMPTION IN A TRAINED AND UNTRAINED INDIVIDUAL.

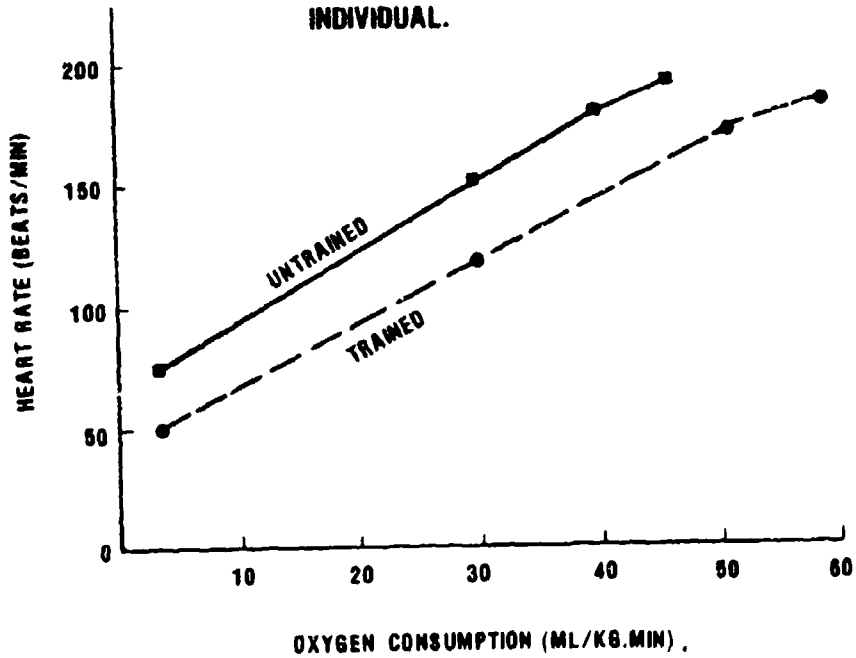
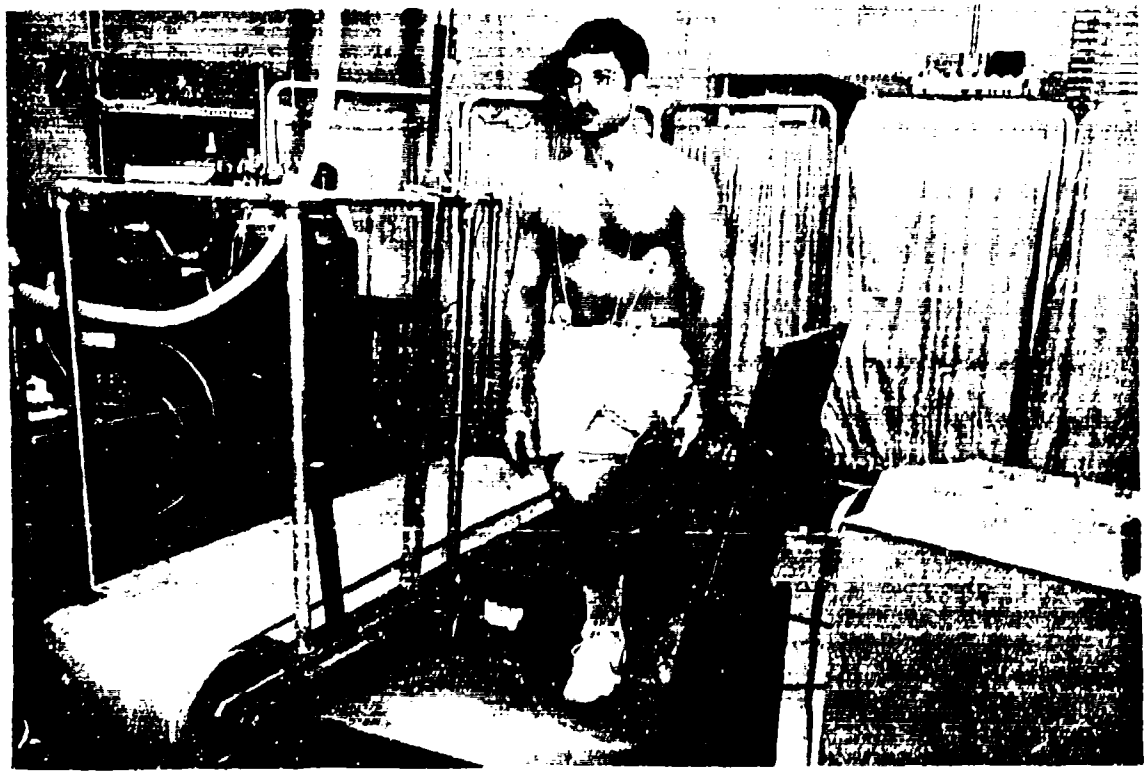


FIGURE 4. CYCLE ERGOMETER TEST FOR ESTIMATED $\dot{V}O_2$ MAX.

FIGURE 5. EXERCISE STEP TEST
TO PREDICT $\dot{V}O_2$ MAX.



6. Standards/Requirements

How much aerobic fitness is required or desirable for our Army? In the broad perspective, a level of fitness is required for the physical demands of a job, but is also believed to be desirable for better health, appearance and possibly morale and well-being. While the first (job demand) can be quantified, the latter reasons can not be. Thus, traditionally, fitness standards have been established by a process of "normative referencing" i.e., based on the achievement on fitness test scores of some upper percentile of the normal Army population. These norm references have been established separately for each gender, age group and type of unit assignment (combat or support) since these are factors which are known to influence fitness levels.

This system worked reasonably well from a practical standpoint until the recent expansion of women into jobs traditionally held only by men - many of which are physically demanding. This has resulted in a situation where MOS assignments are made irrespective of physical capability.

The solution for this problem appeared to be in establishing standards based on the one need that can be objectively determined, i.e., the fitness cost of the job (MOS) itself. If a MOS requires a certain level of fitness, that requirement remains the same irrespective of the gender or age of the soldier filling that position.

This approach has been adapted by the Department of the Army. The Training and Doctrine Command, the Infantry School and the Research Institute of Environmental Medicine are presently in the process of determining new minimum fitness standards for the Army, based solely on job requirements. In the future, every MOS will be placed into one of the following five groups or clusters according to a rating of its fitness demands.

Table 1

MOS Fitness Clusters

Cluster Designation	Demand for: Aerobic Power	Muscle Strength
Alpha	High	High
Bravo	Medium	High
Charlie	Low	High
Delta	Low	Medium
Echo (Baseline)	Low	Low

The placement of MOSs into clusters is being based on an examination of the physical task list of each MOS. This will be subsequently verified by actual measurements of aerobic cost (caloric energy expenditure) and strength (force or torque) required to perform the tasks. Thus, the initially estimated ratings of Low-Medium-High will be replaced with actual measured costs for the most demanding tasks within each cluster.

These energy and strength requirements will then be translated into equivalent physical fitness test event scores and training exercise intensities. Thus, in the future, there will be five fitness standards in the Army, one for each of the five job groupings, irrespective of gender or age. The Echo standard must be met, at a minimum, by every soldier by the end of basic training. If the soldier is assigned to a MOS within one of the four higher clusters, then he or she must eventually meet the higher standard for that cluster. These MOS standards are expected to be adopted by 1980.

It is important to note that these are the minimum standards required for each MOS cluster, based strictly on what is needed to physically perform the MOS. Individuals and unit commanders may wish to exceed these for such reasons as morale, espirit de corps, unit effectiveness, unit mission environmental factors, etc.

7. Basic principles of aerobic training

The purpose of an aerobic training program is to improve the capacity of the aerobic cycle components to deliver oxygen to the working muscles. Improvement is achieved by subjecting the body to a stress (e.g. running) and allowing it to recover. This stress should not be so severe that it takes 3-4 days to recover. It isn't necessary to become excessively fatigued and develop sore, aching muscles in order to train. A good thought to keep in mind is: train, don't strain.

A major problem with beginners in a training program is that they try to do too much, too soon. They become excessively fatigued, develop muscle soreness, become discouraged and drop out, or in the case of mandatory unit training - develop negative attitudes about training. To avoid these pitfalls, it is imperative that those who have not been exercising regularly start slowly. Improvement can be achieved without placing excessive stress on the body. It is very important to start slowly. It must be kept in mind that many individuals, expecially those in sedentary jobs, may not have exercised regularly for many years. The effects of years of inactivity will not be reversed by a few days or weeks of exercise. The training program should be started with a work load that is easily handled and the work load should be gradually increased in order to achieve a training effect. The reason for the slow start is to give the muscles and circulatory system a chance to adapt (adjust to a new environment or demand) to the exercise. Workouts should be at least three times per week with a 1-2 day rest between each workout.

8. Aerobic training methods/programs

The type of training program depends upon the facilities and equipment available and the interest of the individual. Cycling, swimming and cross-country skiing are all good, aerobic type exercises but they require special equipment or facilities. The most readily administered, least expensive and most efficient aerobic exercise is running. Because of its

wide popularity and year-round availability, the major discussion of this section will deal with the initiation and maintenance of a running program. Alternative forms of exercise will also be discussed for those who may be unable to participate in a running program.

Every exercise session should begin with a warm-up period of 5-10 minutes. The purpose of the warm-up is to loosen and stretch the muscles. This should be done slowly and gently, not with quick, jerky movements. A particular effort should be made to stretch the muscles in the back of the thigh (hamstrings) and the calf (gastrocnemius and soleus). There are two calisthenic exercises that are very good for this. The first one involves placing your feet about shoulder width apart and alternating the touching of your toes with the opposite hand, i.e., right hand to left foot and vice versa. This exercise stretches the hamstrings. For the second one, stand slightly more than arms length away from a wall, with feet apart ar toes pointed slightly in. Lean against the wall while keeping heels on the floor. Gradually lean closer and closer toward the wall. Repeat this about 10 times with each repetition lasting 5-10 seconds. This is a good exercise for treating and preventing "shin splints". These exercises should be supplemented with other calisthentics, e.g., bent leg sit-ups, push ups and other stretching exercises. Experiment to find the ones that are most appropriate for your situation and use them to fill up the warm-up period.

The exercise program itself, is divided into three phases: the preparatory phase, the conditioning phase, and the maintenance phase. Each

phase represents a different step in the progression towards a high level of aerobic fitness. The phase in which an individual begins should vary depending upon his present physical condition, activity and age. A young, healthy individual may be able to start with the conditioning phase. Someone who has been exercising regularly may actually be in the maintenance phase. However, individuals who have been sedentary, especially if they're over 35 years old, should begin with the preparatory phase.

PREPARATORY PHASE

The purpose of this phase is to develop the cardiorespiratory system and the muscles of the legs so that they are accustomed to exercise. The purpose is to build them up so they can handle the stress of the conditioning phase. In order to do this, begin by walking for 15-20 minutes, three times per week. Walk at a comfortable pace and remember not to overdo it. Continue at this level until there is no undue fatigue or muscle soreness the day after exercise. Once this point has been reached, increase the time to 20-25 minutes and walk at a faster pace. When a brisk walk for 20-25 minutes can be successfully handled, begin by alternating walking with jogging (slow run) for 20-25 minutes. Begin each session by walking and gradually increase the amount of time spent jogging. If one feels uncomfortable (breathless) while jogging, slow down and walk. Continue to alternate until jogging can be maintained for 10 minutes. When this can be done, the preparatory phase is completed.

CONDITIONING PHASE

The purpose of this phase is to begin the expansion of the physical

capacity of the cardiorespiratory system. This is done by increasing the amount of time spent running. Starting with the 10 minute running time that was achieved during the preparatory phase, gradually increase running time by one or two minutes until running is continuous for 20-25 minutes, at least three times per week.

During the conditioning phase, the frequency of exercise, i.e., the number of times per week, may be increased. However, it is not essential because a frequency of three times per week is an adequate training stimulus. During this phase, running speeds will probably become faster. By the end of this phase, a distance of about 2.5 miles in 25-30 minutes is a realistic goal. Many people will be able to do much more than that. Remember, during this phase, fitness capacity is increased by increasing running time (duration) and running speed (intensity). Follow the same guidelines that you did in the preparatory phase. Breathlessness is a sign that you are working too hard, so slow down. If fatigue and sore muscles occur the day after exercising, it's another indication that intensity is too great and should be adjusted accordingly. It's important to precede each session with a warm-up and follow the running by a short cool-down period (5 minute walk).

MAINTENANCE PHASE

Once all the effort of the preparatory and conditioning phase has been gone through, it is desirable to maintain the level of fitness achieved. This is the purpose of the maintenance program. Most exercise physiologists agree that a workout of 20-25 minutes, three times per week, will maintain good physical condition. Workouts should always be preceded by warm-up and followed by cool-down periods. During the maintenance

phase, it may be desirable to continue increasing the running time (duration) and frequency, for unit morale and esprit de corps. A realistic goal, initially, would be something like 30-45 minutes, 5 days per week. The only requirement for maintenance is a minimum of 20-25 minutes, 3 times per week. Anything beyond this should be worked up to gradually. By increasing the workouts slowly, you'll avoid injury due to excessive stress. However, by maintaining the minimum requirement, most individuals should be able to meet or exceed the aerobic power demands for their MOS, as described in Section 6. Individuals who have the desire and the capability to go beyond the minimum, should be encouraged in their efforts. The maintenance phase is meant to become part of one's life style or training routine. The benefits of an exercise program wear off rapidly once the program is discontinued. The maintenance phase is meant to go on indefinitely.

Table 2 summarizes the three phases by giving a guideline for the progression through each phase. Table 2 is not meant to be a schedule that should be strictly adhered to but a guideline for progression.

TABLE 2

GUIDELINE FOR EXERCISE

I. PREPARATORY PHASE

Level	Duration	Frequency	Method
1	15-20 minutes	3/wk	Walk
2	20-25 minutes	3/wk	Walk
3*	20-25 minutes	3/wk	Alternate Walk/Run

*Remain at Level 3 until a minimum of 10 minutes of continuous running.

II. CONDITIONING PHASE

Level	Duration	Frequency	Method
1	10-12 minutes	3/wk	Run
2	12-14 minutes	3/wk	Run
3	14-16 minutes	3-4/wk	Run
4	16-18 minutes	3-4/wk	Run
5	18-20 minutes	3-5/wk	Run
6	20-25 minutes	3-5/wk	Run

III. MAINTENANCE PHASE

Level	Duration	Frequency	Method
Minimum	20-25 minutes	3/wk	Run
Optional	20-45 minutes	3-7/wk	Run

When using the table as a guide, stay at one level until the capability of proceeding to the next has been achieved. Increase gradually, by spending at least one workout at each level to make sure it can be handled without difficulty. If the desire exists to increase beyond the minimum level of the maintenance phase, increase gradually. It may take months to reach the desired level, but there is much less likelihood of injury if it is done slowly.

There are factors that prohibit an individual or group from participating in a running program. Therefore, certain activities may be used as supplements and/or alternatives to running. Swimming, cycling and cross-country skiing are excellent endurance exercises and are adequate substitutes for a running program. The problems with these sports is that they require special equipment and facilities which are not universally available. However, when available, the same general guidelines still hold true for these activities. Start slow and progress gradually.

Rope skipping is another good exercise which involves a large muscle mass. However, it is of such high intensity that it is difficult to keep it up for more than a few minutes. Some runners use it as a substitute for running during inclement weather. Once again, start slowly and progress gradually.

Handball and the racquet sports (tennis, squash and racquet ball) involve activity bursts of high intensity and short duration. Activities of this type do not provide the same degree of aerobic training as

exercises of long duration at lower intensities. Because it increases endurance, running would probably help improve one's performance in these sports, but the reverse is not necessarily true. However, these sports do provide some aerobic benefits and are excellent supplements to an aerobic training program. If played on a daily basis, they could even be an adequate substitute for minimal aerobic training.

9. Medical considerations

No one should begin an exercise program unless they are in good health. It is also a good idea for anyone who has had a sedentary life style for the past few years to check with a physician before beginning a training program. It is imperative that anyone over 35 years of age have a physical exam before beginning an exercise program. There are risks involved for sedentary individuals over 35 years of age. Individuals who have elevated coronary risk factors should exercise only under the supervision of trained medical personnel.

Extensive research has documented the relationship between the risk factors of elevated blood fat content (cholesterol, triglycerides), high blood pressure, smoking, family heart disease, obesity, abnormal electrocardiogram and the eventual development of coronary heart disease. Evidence also suggests that exercise can play an important role in reducing these risk factors. However, improper exercise in a high risk population could be dangerous. It is unwarranted to assume that someone is not at high risk simply because they are in the military. In a study designed to evaluate these risk factors in military personnel (officers and NCOs)

over 35 years of age, an increased prevalence of risk factors was noted among the NCO sample. However, to speculate that the officers had a lower risk of coronary heart disease is unwarranted. In general, this study of the military showed them to be no different from the United States adult male population. A study of the faculty and staff at the U.S. Military Academy at West Point showed that this group was at a higher level of fitness than a similar aged civilian population. However, there were elevated risk factors in these men and this suggests the need for careful medical evaluation even in a fit military population before initiating an intensive physical training regimen. In fact, several studies have reported elevated risk factors in military populations under the age of 35. Therefore, not only those over 35 years of age, but also individuals under 35 with elevated risk factors should have a complete medical examination before beginning an intensive training program. According to the American Heart Association and the American College of Sports Medicine, the physical exam for high risk individuals and anyone over 35 years should include an electrocardiogram monitored exercise tolerance test.

Table 3 summarizes the coronary risk factors. Individuals who are about to begin an exercise program should be made aware of these risk factors. If an individual has two or more of these characteristics, he should be advised to consult a physician before beginning an exercise training program.

TABLE 3

Coronary Risk Factors

1. Hypertension (Blood pressure above 140/90).
2. Family history of heart disease (one parent with heart disease).
3. Smoking.
4. Cholesterol (Blood levels above 280 mg%).
5. Triglycerides (Blood levels above 135 mg%).
6. Diabetes.
7. Obesity (more than 20% overweight).
8. Inactive life style.

No one who has existing coronary artery disease, a history of myocardial infarction (heart attack) or any other serious medical problem should begin an exercise program unless it is under the supervision of trained medical personnel.

10. Special considerations: gender, age and unit training

When conducting a training program, special consideration should be given to individuals based upon their age and sex. It has been shown that an individual's aerobic power declines with age. Therefore, it is unrealistic to expect the average 35 year old NCO to be able to keep pace with a 20 year old right out of basic training. The same relationship holds true when comparing men and women. On the average, women run at a much slower pace than men and have a lower aerobic capacity. There are many exceptions to these generalizations. Many older individuals and females have high aerobic capacities and are excellent runners because of their training background and/or their heredity. However, when the unit trainer

starts a training program, he may have to make certain adjustments unless he has a homogeneous group. Most military units are made up of individuals of different sexes, different ages, different capabilities, and different job demands. No single training regimen is going to be helpful to all these people. For instance, if a platoon is composed of members of both sexes who range in age from 18-45 years of age, it is unlikely that running in formation at one pace will benefit all individuals. If the pace is slow enough to accommodate the slowest individual in the group, it will probably not be an adequate training stimulus for the more fit individuals. On the other hand, a pace that will train the fit individual will undoubtedly be too strenuous for the unfit. There are several ways to get around this problem. One is to have everyone exercise on an individual basis and thus place responsibility for carrying out the program on the individual. Periodic testing for improvement could be used to see that the program is actually being carried out. Another alternative, if exercise as a unit is desired, is to divide people into groups based on their present level of fitness. Fitness can be determined by the annual Army PT Test, a mile or 1.5 mile run or any other appropriate physical fitness test. Such a procedure places people in groups based upon their ability thus enabling them to train at a level that will provide them with a training stimulus. The groups would then simply follow the training guideline in the same manner an individual would follow it. The group would progress slowly by gradually increasing the duration and intensity of the exercise. Individuals would workout three times per week in a group and those individuals who want to workout more frequently could do it on the other

days. If an individual shows rapid improvement he (she) could be moved to a more advanced group or if an individual has difficulty training with one group, they could be placed in a slower group. The number of groups would depend upon the range of capabilities within the unit. Three or four groups should be sufficient for a platoon or company sized unit. In order to retain interest in the program, awards can be given after an individual has run a fixed number of miles (e.g., 50, 100, etc., as in the Run for Your Life Program). Races can also be run periodically with awards for fastest male and female in various age groups and for most improved runners. Unit competitions could be held to promote interest and troop morale. No matter how the program is run, the important point to remember is that in order for the maximum number of people to derive the most benefit from the program, some consideration must be given to differences in individual capability.

11. Injury prevention

The most serious problem that is encountered as a result of an exercise program is precipitation of cardiovascular disease (heart attack). Therefore, if anyone develops chest pain or any other abnormal signs, i.e., unusual sweating or breathlessness, dizziness, faintness, etc., the individual should stop exercising, sit down and rest, and be taken to the appropriate medical facility.

Another serious problem which can result from exercise is heat exhaustion or heat stroke. There is no need for these injuries to ever occur. Exercise on extremely hot days should take place either

early in the morning or late in the afternoon in order to avoid the hottest parts of the day. Exercise programs should be cancelled or curtailed on very hot, humid days in order to avoid heat injury. Even in the morning or late afternoon, extreme caution is advisable and plenty of water should be available to participants. The guidelines which are contained in TB Med 175 should be strictly adhered to.

The most common problems encountered in a running program will be foot, ankle, knee and leg injuries. Although it is very difficult to totally eliminate such injuries, a great deal can be done to keep them to a minimum. First of all, many of these can be prevented by using proper footwear. Combat boots, tennis shoes, basketball shoes or sneakers are not optimum for running. Running shoes are available commercially in a wide range of prices and styles. If possible, individuals should be encouraged to acquire adequate running shoes. The more serious runner who is running above the minimum level would be wise to invest the money in a good pair of running shoes. Shoes must fit properly and it is recommended that they have multi-layered flexible soles with adequate arch and heel support. Nylon uppers are usually the most comfortable.

The type of surface which is run on will determine the injury rate among runners. Soft surfaces are best for injury prevention and whenever possible running should be done on parade fields, dirt paths or park trails. Running on pavement or concrete is acceptable but a larger injury rate is to be expected.

Clothing should be comfortable and loose fitting. A T-shirt and gym shorts are sufficient in pleasant weather. In cold weather, additional clothing may be added according to preference. Fatigues, a sweatsuit, a jogging suit, or even Army issue long underwear all work satisfactorily. In very cold weather, ski hats and gloves are necessary. Rubberized or plastic suits must never be worn. These can cause excessive sweating because they prevent evaporation and can lead to dehydration and dangerous elevations in body temperature. Proper warm-up and cool down periods with adequate stretching exercises will also help prevent injuries. Warm-up exercises are an important part of any injury prevention program. Several of the suggested readings provide a number of exercises which can be added to those listed earlier in this text. Individuals who have problems with their knees may wish to add leg exercises which specifically strengthen the quadriceps (thigh muscles). It has been demonstrated that strengthening these muscles will help prevent knee injuries. Examples of such exercises are leg lifts, knee bends with weights (squats) and many of the grass drills.

Summary (Abstract)

Basic guidelines for the initiation of an aerobic training program are presented. The physiological principles involved in aerobic training regarding the heart, lung and work capacity are discussed. Before beginning a training program individuals over 35 years of age are advised to undergo medical screening for coronary risk factor assessment. The training program is designed so that individuals progress gradually in order to avoid unnecessary strain and injury. The goal of training is to build up to a regimen of running for 20-25 minutes at least three times per week as a minimum. By achieving this minimum all individuals should be able to meet the minimum fitness requirements for most MOSs in the Army. Injury prevention and alternatives to running programs are also discussed.

Suggested Readings

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