

PHYSICAL EDUCATION IN THE ARMED FORCES: PHYSICAL FITNESS

BY

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INTRODUCTION

In today's world, major global concerns of human beings are related to levels of fitness for health, occupational needs (work), qualitative life; productivity, wealth and well informed (educated) citizenry. Human race in modern times strives to maintain high life expectancy especially through wise use of advanced medical knowledge based on research including related resources in pharmacology. Reduced life expectancy index in many countries threatens the very existence of human beings.

The demands of the armed forces may become very stressful and life threatening unless the soldier is adequately fit and healthy to meet those specific physical and physiological needs. Fitness in this paper is treated in its wide context where fitness encompasses the physical, mental, spiritual and socio-emotional dimensions of the human being (total fitness).

World Health Organisation (WHO) recognises that fitness and health hinge on more aspects than the absence of disease. Wellness of the individual, family, community and corporate market driven consumptive national must of necessity be involved in health and fitness programmes for improved quality lifestyle in the 21st century. HIV-AIDS, a health and fitness related ailment threatens the very existence of many nations of the world, particularly in the Southern African region as elsewhere in the world, unhealthy, unfit soldiers will not be able to meet the demands made on them as they carry out their duties and missions in an effort to sustain national and world peace every where.

In this paper attempts have been made to include the aims and objectives of building healthy/fit nations with capacity to prepare people to meet challenges of occupation and general lifestyle particularly in the armed forces today and for the future for productivity and socio-economic benefits. These result from a lifestyle of balanced fitness by creating a less stressful environment. These also assure longevity through exercise and healthy/fit living which could make a difference for present and future generations of the world.

The paper as requested, focuses on issues of general fitness and its components, job skill performance of the worker (soldier), health aspects of fitness and physical fitness tests/condition tests.

GENERAL PHYSICAL FITNESS AND ITS COMPONENTS

Science of Exercise

"The rate of a persons heart beat and the time required for the rate to return to normal upon cessation of exercise, are partly determined by a persons physical conditions. A physically well-conditioned person will also be less affected by a given amount of exercise than a poorly conditioned person. The fitter you are, the faster your pulse rate will return to normal after exercises. Many fitness tests have been developed which are based on a subjects pulse rate recovery after exercises for example the Harvard step test" Towned, M. Stewart (1984), Mathematics in sport book.

“All parts of the body which have a function if used in moderation and exercised in labours in which each is accustomed, become thereby healthy, well developed and age more slowly; but if unused and left idle they become liable to disease, defective in growth and age quickly”. **Hippocrates**

Mark Twain pronouncement ” The only exercise I get is being a pallbearer for my more active friends” was humorous but it is an established fact that many people including scientists, writers and philosophers have celebrated the benefits of regular exercise for a long time. Great strides were made in the twentieth century in understanding what actually happens to the body during exercise and physical activity and also how it contributes to physical fitness and health.

Definition of Terms:

PHYSICAL ACTIVITY – Any bodily movement produced by the skeletal muscles resulting in energy expenditure that can be measured in kilocalories. Such activities can be categorised into:

- Occupational
- Recreational
- Sports
- Conditioning and
- Household activities

EXERCISE – Is part of physical Activity but is distinct because it is planned, structured, and repetitive.

PHYSICAL FITNESS – Is a combination of attributes associated with the development of **physical skills**, such as speed and agility or **health-related** issues such as strength, flexibility, endurance and body composition. Details of how physical activity and exercise can be effectively combined to enhance health related fitness would be focussed on as mentioned in The standard Alumni Association in conjunction with the Stanford Centre for Research in Disease prevention which was published as the Stanford Health and Exercise Hand book (1987).

Before addressing the components of physical fitness I wish to first discuss the benefits of Exercise. So many extravagant claims have been made for exercise claims have been made for exercise in recent years making many people take exercise with misplaced expectations. Many people have exercised without attaining their expected aims such as change in their personality or improving their thinking process.

However, there is ample evidence backed by studies of the general population showing that more active people have a lower risk of heart attacks even when mode of exercise consisted of such a activities as gardening, stair climbing, brisk walking or active games and sports. In the process of exercising, the body undergoes a number of changes designed to help the muscle work more efficiently, increase their capacity and reduce fatigue. Thus exercise has a beneficial effect on the nervous system, the cardiovascular system, and the bones, in addition to improving the rate of metabolism of fats and carbohydrates.

Nevertheless “ fitness “ should not be confused with health. Fitness comes from increased physical activity cannot “cure” diabetes or hypertension and cannot promise to prevent disease. However, it can provide significant health benefits in a number of areas which affect body and mind.

Eight Benefits of Exercise

1. It improves cardiovascular health
2. It is a key to weight control
3. It improves blood fat and cholesterol profiles
4. It lowers blood sugar
5. It helps lower blood pressure
6. It maintains and increases bones density
7. It provides psychological benefits
8. It holds back time.

Weight control.

The ability to control body weight is one of the most obvious benefits of exercise. Many people today find it hard to control their weight without exercise because of changes in diet for example eating junk food.

Maintenance of Lean Muscle Mass

Without good muscles, every physical action becomes more of an effort. People whose muscles are allowed to deteriorate with age will be less equipped to care for themselves as they get older than those whose muscles mass has been maintained by regular exercise. For the military personnel, it is critical to maintain muscle strength through regular exercise for self-reliance and quality of life. Soldiers who acquire and maintain a good proportion of muscles mass will find it easier to control their weight, given that muscle requires more calories for its normal maintenance than does fat. In simple terms, this means at the same body weight, one can eat more without gaining weight if one has a larger muscle mass.

Bone Density

Exercise can play an important role in prevention of osteoporosis. Any activity that applies force to bone will help build or maintain it. Studies have shown that runners, tennis players and weight lifters have all been shown to have greater bone density than sedentary persons. Mineral lose in bones occurs with age and therefore it is very important to start exercising at early stages when increased stress on the developing bones will cause more calcium to be added to them.

Carbohydrate and Insulin

Exercise appears to normalize the way the body processes carbohydrates. During large muscle exercise of moderate intensity, the body uses glycogen stored in the muscles to provide energy. For several days after the stored glycogen is depleted, it is replaced by glucose in the blood. While reducing the concentration of glucose in the blood, exercise also reduces the body's need for insulin. A study reported by the

Stanford Centre for Research in Disease Prevention established that none- exercisers required twice as much insulin as the exercisers to remove glucose from their blood.

Blood Lipids

It is a scientifically established fact that exercise affects the cholesterol balance of the blood by reducing the levels of the harmful type (low-density- lipoprotein cholesterol (LDL) and increasing levels of beneficial type (high-density – lipoprotein cholesterol or HDL). Studies have shown that athletes such as marathon runners, cross country runners, and dedicated tennis players have much higher levels of the beneficial HDL cholesterol than others. No wonder cross-country and long distance running is such a common practice among military personnel.

High Blood Pressure

There is now increasing evidence that exercise can help to prevent the rise in blood pressure experienced with increasing age of individual. There is also evidence endurance exercise training programmes decrease blood pressure in some hypertensive patients. Some of this decrease may result from the weight reducing effects of exercise.

Psychological Benefits.

People who exercise regularly report less anxiety and depression and feel they are better able to cope with stress when they exercise than when they don't. Some people have suggested that the reason for this improvement in mental state may be found in a reduction of **adrenaline** in the blood and an increase in **endorphins**, a natural tranquilliser produced by the body. Exercise improves mental outlook and ability to control stress by providing a socially acceptable way to spend time away from the stresses of everyday life and by improving self-image and self-esteem. Exercise gives someone the feeling that they have accomplished something worthwhile and at the same time can make one look and feel younger.

Ageing

Exercise can help to hold back time by making one physiologically younger than the sedentary contemporaries. If we take various measures of body function and structure and compare exercisers in their 50s and 60s with sedentary people of the same age, the result is that exercisers are physiologically 10 to 20 year younger. Their cardiovascular function, body composition, blood lipids and their appearance are all in significantly better condition than those of their contemporaries who are growing old in rocking chairs.

COMPONENTS OF PHYSICAL FITNESS

Many writers in the areas of medicine and exercise science have done a lot of research work to explain about effects of exercise on the human body. The interest in establishing the level of fitness may be for **health related fitness** or **skill related fitness**.

In Basic Exercise science, Physiology, related to fitness explained the relationship of energy to work, immediate sources of energy, short-term sources of Adenosine

triphosphate (AP) and long-term sources of energy. These scientists also explain metabolic, cardiovascular, and Respiratory Responses to Exercise such as sub maximal "steady state" exercise, Graded Exercise Test (GXT) which describes oxygen uptake and maximal aerobic power. Blood lactic acid changes, Heart Rate (HR), stroke volume and cardiac output which is the volume of blood pumped from the heart per beat, oxygen extraction, blood pressure (BP), pulmonary ventilation which is the air breathed per minute and cardiovascular responses to isometric and isotonic exercise.

In order to keep the discussion at a level where the common person understands and benefits from this paper, attempt has been made to avoid making it too scientific for a person interested in the practice and benefit of exercise for physical fitness for work, especially those jobs require developing and maintaining a high level of fitness especially in the armed forces.

The components of Physical Fitness

	Health related Fitness	.cardio respiratory endurance .muscular strength .Body composition .Flexibility
Physical Fitness	Skill related Fitness	.Ability .Balance .Coordination .Speed .Power .Reaction time

Muscular Strength and Endurance

Muscular strength and endurance even though quite separate components of fitness, are highly related in many activities. The strength of the muscle is its capacity to exert force through contraction of muscle fibres. Because the force that a muscle exerts is directly related to its size, those individuals with large muscles have the potential to develop a lot of strength and exert large amounts of force. Differences in strength between individuals and between sexes can be partially explained by factors including amount of muscle tissue and amount of sex hormones (mainly the male hormone testosterone), and social or cultural influences.

While strength is an important fitness component, the optimal amount varies with individual needs and occupations. Fire fighters and construction workers for example, have strength needs that are quite different from those of a person who works at a desk all day. With the military personnel, the job demands are such that even those doing administrative duties must through exercise develop muscular strength. Athletes have other strength requirements that are specific to demands of each sport. Physically

demanding occupations and sports require certain levels of strength development for safe participation.

Muscular endurance refers to the ability of any muscle group to repeat muscle contractions against resistance over a period of time. It can also be measured as the amount of time one can sustain a specific contraction. Muscles develop endurance as they develop mechanisms to accommodate the increased metabolic demands placed on them. Repeated muscular contractions stimulate an increased blood flow to the muscle, providing the extra oxygen, nutrients and enzymes necessary for the muscle to continue to work and postpone fatigue.

Muscular strength and endurance can be developed by using *static isometric contractions* and *dynamic isotonic* and *isokinetic* muscle contractions. Charles Atlas in the 1950s in his dynamic tension programme popularised isometric contractions. Studies later showed that strength could be increased with isometric exercises, but not to the extent previously claimed. An example of an isometric contraction would be to simply contract the quadriceps muscle of the thigh with the knee extended, not moving the hip or knee joint which should be held for at least six seconds several times per day. Isometric or static exercises should be used with caution especially for older adults or those with or suspected to have coronary heart disease. This type of exercise causes an unusually high rate of blood pressure relative to the heart rate and a possible reduction on oxygen supply to the heart.

Isotonic contractions

Isotonic contractions are valuable in developing strength, the type used when one engages in activities such as lifting a box to move from one table to another. An isotonic workout involves placing weight at a given distance from the joint axis of rotation and lifting it. When the weight is at its greatest perpendicular distance from the axis of rotation, the muscle is worked to its maximum capacity.

Effective strength training programmes using isotonic techniques usually apply the "progressive resistance exercise" and "overload" principles. In the progressive resistance approach, the exerciser works with a specific weight until it can be lifted for several repetitions. Further strength gains are made by adding small increments of additional weight over resistance. Strength improvement using the overload concept results from muscles being loaded beyond their normal capacity. Traditional barbells or free weights are still favourite equipment for serious strength training.

Isokinetic contractions

Isokinetic contractions effectively address the limitations of strength development associated with both isotonic and isometric contractions. In isokinetic contraction, the speed of the contraction remains constant, but the resistance offered by the machine matches the individual's capability throughout the range of motion which is referred to as "accommodating resistance" and permits a maximum contraction to be performed through a full range of movement.

Isotonic or isokinetic equipment can be used to develop both muscle strength and endurance. If strength is the main requirement, the number of repetitions for an exercise is kept low and the resistance is high. In a muscular endurance programme,

the repetitions are high and the resistance low. Many machines have been developed for strength and endurance development for example *Nautilus*.

Cardiovascular Endurance

Cardiovascular endurance includes stamina, aerobic fitness, aerobic capacity, and functional capacity. Although aerobic fitness is the current "in" term used to describe cardiovascular endurance, *functional capacity or maximum oxygen consumption (VO₂ Max)* is the accepted universal terminology.

The ability to exercise continuously for short or long periods of time depends upon how effectively the heart, lungs, arteries, capillaries and veins can transfer oxygen (O₂), carbon dioxide (CO₂), nutrients and waste products to and from the working muscles.

As soon as an individual starts to exercise, the body adapts to the increased energy demands being placed on it. Energy stores of glycogen are mobilized with muscles to provide the fuel necessary for them to contract. At the same time, since the muscles also need more oxygen, the heart and respiration rates increase to provide more oxygenated blood.

As long as the working muscles can receive an adequate amount of oxygen to continue a process called **oxidation** in the muscle cells, exercise can continue and fatigue is offset. This type of exercise is referred to as **aerobic exercise**. When the working muscle build up waste products such as lactic acid at a rate that outstrips the supply of oxygen to the muscle cells, this is referred to as **anaerobic exercise**, and fatigue results in a short period of time.

Oxygen supply for the muscles depends on a healthy heart which must make more oxygen available to the muscles by increasing its rate of contraction during exercise. As heart rate increases, more blood circulates each minute, thereby increasing the cardiac output of the heart. Direct measurement of cardiac output is a complicated procedure done primarily in a laboratory setting. Fortunately, it can be measured indirectly by determining a person's VO₂ Max or the amount of oxygen the body is able to use per minute when exercising maximally during a medically supervised exercise test. Simply stated, if cardiac output increases, so does maximal oxygen consumption.

Another term that is frequently used in place of maximal oxygen consumption is **functional capacity**, measured in millilitres of oxygen per kilogram of body weight per minute (ml/Kg/min). People who lead active lifestyles, independent of age, have higher VO₂ Max values than their sedentary counterparts.

Cardiovascular endurance can be developed by a training programme based on variations of the "F.I.T" principle: that is, with the **Frequency**, **Intensity**, and **Training duration** necessary to produce physiological changes over a period of time. These may include changes in:

- Resting heart rate and blood pressure, submaximal exercise.

- Body composition (the percentages of the body that are muscle, bone, and connective tissues by comparison with body fat).
- Lipoproteins (chemical structures present in the blood that carry fat, proteins and cholesterol).
- Fat and carbohydrate metabolism (the way the body utilizes fat and sugar carried in blood)
- And bone mineralization.

Accompanying psychological changes may include a reduction in stress, depression, and anxiety, and an improvement in self-image.

The training intensity necessary to produce such physiological and psychological change is not constant. It differs from one individual to another and is different for people of different ages, sex, and health status. However, if appropriate type of exercise for one current level of fitness is set at the proper intensity, duration, and frequency, then improvements in physical fitness and associated health benefits should occur. Fitness books and magazines recommend an exercise intensity in a target heart rate zone of 70-85% of ones age predicted maximum heart rate. This is high intensity exercise for the majority of the population. Maximum heart rate (MHR) can be determined by using the simple formula: -

$$\text{MHR} = 220 - \text{Age (low estimate)} \text{ or } 210 - (.5 \times \text{age}) \text{ (high estimate).}$$

A variety of training programmes exist to develop cardiovascular endurance which consist of the following methods:

- Interval training (exercise and test intervals are organised in various combinations).
- Continuous training (exercise intensity is adjusted to permit long bouts of continuous exercise).
- Interval - circuit training (running, walking, and calisthenic exercise is incorporated into a circuit that can vary in distance and time).

Flexibility

Flexibility is the range of movement of limbs around a joint. Flexibility exercises are useful because they increase the range of motion of a joint, allowing muscles to exert strength (force) for a long period of time. Flexibility exercises are recommended as part of warm up period that precedes exercise. Flexibility exercises fit into one of two categories:

- Static or
- ballistic stretches.

A more recent approach to flexibility exercise is called proprioceptive neuromuscular facilitation (PNF) where muscle and joint stretching starts with tightening the muscle (contracted) and then statically stretched.

Body composition

Body composition is the term used to describe the proportions of muscle, fat, bone and other connective tissues in the body. These various body tissues are classified

further to describe lean body weight (LBW) and fat weight (FW). It is possible to determine the relative percentage of total body weight that is composed of LBW and FW by using a variety of assessment techniques.

Effective weight and body composition control involves both caloric expenditure (exercise) as well as carolic restriction (diet). In 1985, a National institute of Health consensus panel on obesity underscored the importance of optimal body composition by indicating that losing weight is not just a matter of vanity, it is a matter of health.

Physical fitness is important to the development of optimal health. It helps us avoid the significant negative physiological and psychological effects on health that results from inactivity and deconditioning.

Duties in the military require alertness, physical fitness and healthy status of all personnel. It is therefore recommended that the military organisation be aware of values of fitness and practice it for job related demands made on all.

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