Chapter 1

INTRODUCTION

"Physical education is the art and science of movement\(^1\) and it is an essential form of non-verbal communication like any other form of art. Physical education of primitive people was informal and unstructural, the main purpose being survival. The Greeks were the first to give some structure to physical education. Bucher\(^2\) has referred to the Greek philosopher Plato having stated as follows about physical education. "They are not intended to train the body, rather mind except incidentally, but to insure a proper harmony between energy and initiative on the one hand and reason on the other hand by tuning to the right pitch".

Training in game and sports is no longer a myth and it has no casual approach, but it provides opportunities for scientific process and verification. Training has been accepted as a highly specialised science involving the use of scientific methods and physical investigations.

According to Nixon and Jewett\(^3\) organised physical education programme


aim at the maximal development of the individual’s potentialities in all phases of life, by placing him in an environment which will promote the movement and related responses or activities that will best contribute to the purpose.

In modern times physical education is considered as the process of “human engineering” and it is having much to do with the human body other than the mental and sociological aspects of life. Therefore physical educators must have a strong grasp over the physical functioning of the body to understand its optimum utilisation. At the present time, in the field of athletic training and high performance games and sports, the physical educator or coach will not be able to do much without the application of up to date scientific knowledge of the related disciplines.

Body composition is defined as a relative percentage of fat and fat free body mass. Excessive body fat is hazard and has been implicated as contributing to a variety of conditioning including hypertension, hyper lipoproteinemia and accident proneness. While all the mechanism of how excess fat causes these problems have not completely explained, few health authorities would argue with the statement. “It is better to be lean than to be fat.”

Body composition is a function of caloric balance, and although the emphasis has traditionally been on the caloric input side of the equation, we are now increasingly aware of the importance of energy output in regulation of body weight. Short-term experimental trials and large-scale community studies show that vigorous physical activity helps to reduce body fat.
Body composition is not only important to health and influenced by exercise, but it is also a massive public health problem, and thus deserve increased attention in fitness testing.\(^4\)

The first step of an exercise prescription is a complete evaluation, while it is advisable for any one who plans to participate in a regular physical exercise programme to have a medical examination. The best way to find out any problem in the body is by analysing the blood urine. Through the blood test we can find out most of the diseases and problems in the body.

During muscular exercise, plasma level of poorly diffusible molecules increases about ten percent as a result of fall in plasma water content.\(^5\) This effect must be taken into account in evaluating effects of exercise on lipoprotein level as well as on molecules which are protein bound such as FFA. As a result of exercise, the levels of plasma triglycerides and very low density lipoproteins remain steady or fall only slightly in fasting subjects during exercise for two hours at load upto 400 kg.m/minute.\(^6\) With more prolonged and heavier exercise their levels fall consistently.\(^7\)


\(^6\) Ibid.

\(^7\) Ibid.
Recent research has shown that exercise not only lowers total blood cholesterol, but also increase the fraction of cholesterol known as high density lipoproteins (HDL) and decreases the low density lipoproteins (LDL) fractions. HDL cholesterol is thought to the protective against coronary heart disease where as LDL is not.

All kinds of cholesterol are not considered to be risk factors. In fact, the high density lipoprotein (HDL) fraction is thought to be protective against coronary heart disease. Regular exercise programmes have been shown to increase the HDL fraction. One of the reasons why HDLs are not harmful is that they do not collect or adhere to the inner linings of arteries. In fact, they actually help to break down the fatty deposits already present. The fatty atherosclerotic deposits are composed of low density (LDL) and very low density (VLDL) lipoprotein cholesterol fractions. Therefore, an overall low cholesterol level, with low LDL and VLDL fractions plus a high HDL fraction, appears to be healthy balance with respect to blood cholesterol.

Physical training or conditioning is the process used in order to develop the components of physical fitness. Conditioning induces physiological changes in almost every system of the body. The changes resulting from training are

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influenced by the frequency, duration and particularly, by the intensity of the training programme, and by the heredity. The effects of training are specific to the type of exercise performed, the muscle groups involved and to the type of training programme used\textsuperscript{10}.

Training is usually defined as a systematic process of repetitive, progressive exercise or work involving also the learning process and acclimatization. Through the use of systematic work increments, improved voluntary response by the organs are attained, through constant repetition, the conscious movement become more automatic and more reflexive in character, requiring less concentration by the higher nerve centres and thus reducing the amount of energy expended through the elimination of movement by necessary for performance of the desired task\textsuperscript{11}.

Body composition plays an important role in athletic performance. A substantial amount of evidence is available to indicate that the relative degree of fat free body weight is an important factor contributing to higher levels of physical performance in activities where the total body weight must be moved. In addition, studies have shown that high percentage of body fat not only serves as dead weight but also lessens the relative ability to support oxygen to the working


muscles then cutting down on one's cardiovascular endurance\textsuperscript{12}.

The variables of body composition and anaerobic and aerobic capacities all play an important role in various sports and games. Body composition has been considered as a vital factor along with the physical fitness components which contribute to the athletic performance. According to Uppal and co-workers\textsuperscript{13} body composition changes as a result of training and they have reported that there is decrease in total body fat and slight change in lean body weight as a result of training.

The assessment and prediction of body composition has gained widespread application in various exercise science disciplines. There are application to physiology of exercise, biochemistry, anatomy, motor integration, and other allied medical fields that consider, such as nutritional and dietary assessment, the man-machine interface, as well as various environment concern. Whatever the application, one major area of interest is the prediction accuracy of percentage body fat and lean body weight\textsuperscript{14}.


\textsuperscript{13}A.K. Uppal; R. N. Dey; and Rajender Singh, "Comparison of Relationship of Percentage of Body Fat and Weight of Physical Education Students Belonging to Different Weight Categories", \textit{SNIPES Journal} 7 (July 1984), p.26.

\textsuperscript{14}Frank I. Katch and Victor L. Katch, "Measurement and Prediction Errors in Body Composition Assessment and the Search for the Perfect Prediction Equation" \textit{Research Quarterly} 51 (March 1980): 249-60.
The scientific study of exercise and its beneficial effects on the body is becoming increasingly important with the growing realisation of the relationship of exercise with health. Field and laboratory observation on exercising human subjects are being supplemented with physiological and bio-chemical studies on laboratory animals, with acute and chronic exercise can now be explained at basis cellular and molecular levels\textsuperscript{15}.

For the physiological system of the body to be fit, they must function well enough to support the specific activity that the individual is performing. Moreover different activities makes different demands upon the organism with respect to circulatory, respiratory, metabolic, neurological and temperate regulating functions. Physiological fitness and explained by scores of physiologists is specific to each activity. With training and conditioning the heart becomes more efficient and is able to circulate more blood while beating less frequently. For standard amount of work the heart becomes slower as training progress. These heart rate changes indicate a decreasing load on the cardiovascular adaptation to exercise. Blood pressure is also influenced by training. Prolonged effort in the untrained subject leads to progressive fall of the systolic pressure which indicates approaching exhaustion\textsuperscript{16}.


\textsuperscript{16} Johnson and Buskirk, \textit{Science and Medicine of Exercise and Sports},p. 278-279.
It is perhaps evident that there is growing realisation of importance of physiological variables enhancing the human health and performance. Therefore physiological variables such as vital capacity, heart rate, blood pressure, anaerobic power per kg, body weight and lean body mass receive special consideration and it is an important pre-requisite for outstanding performance in speed and power sports activity.

Balsevitch and Siris\textsuperscript{17} have pointed out that the Russian are strongly guided by the anthropometric data derived from statistics of large number of world champions.

The knowledge of science is to formulate but too difficult to practice. The system is quite complicated in this regard. However a theoretical base-line once formulated can help to add to the knowledge by further analysis and interpretations and therefore it seems reasonable to work on this system. The physique is however not the only instrument. There are combinations of factors, which may help us to reach some useful conclusions. For example if an athlete possesses the required body size of a middle and long distance runner, but less of aerobic capacity, then it seems logical for a coach or a trainer to decide his or her future. Therefore we can depend on such tests that may be formulated by understanding the structure of performance in a sport.

The time when sports were nothing more than an enjoyable recreation for individual is irrevocable past. The phenomenon of sports today intervenes in almost all fields of human endeavour and very often it even has a central position. Sports, thus has experienced an enormous extension quantitatively as well as qualitatively with many positive but also some negative aspects. Apart from health sports with their special meaning as prophylaxis against civilisation damage and as many sided therapy, there is high performance sports also.

Specialisation and intensification of sports of necessity demands an absolutely serious and professional foundation. The necessity has led to developments of special scientific sports. Subjects covering the needs of medicine and physiology, motion mechanics, training theory, pedagogues and sociology as well as some other marginal area\textsuperscript{18}.

There are various degrees of health an individual can attain. To attain prefect health is quite impossible and is beyond our reach. If individual attain optimum health then life can be meaningful. Each person or individual should feel responsible for his or her health. The health of the individual depends partly on his inheritance and chiefly on those factors, which influence health.

\footnote{Luduing Prokop, “The contribution of Sports Medicine to the Improvement of Performance”, Reports of the 17\textsuperscript{th} Session of the International Olympic Academy at Olympia (Athens 1978): 186.}
Kamat\textsuperscript{19} says, to learn the art of healthy living one should learn to tackle his best ability, his physical, biological and social environments. The health of a person is really the foundation upon which all their power of state depends. Real wealth of a country is its healthy men and women and not the mineral wealth or natural resources. The health of the people reflects the nations economic and social well being. Health is our most precious possession both individually and collectively. Nothing is possible without health. Health is not everything but health affects everything. Health is very flexible state of body or mind, it is never static, it fluctuates and to keep pace with it, it has to be renewed every now and then. Health is fundamental human right. It has to be earned by individual efforts. It is a key to success in life. Without health, life is deprived of its joys and pleasure. Health is only a means to live a better life. So to make the life fuller, richer and happier one must have a strong will to live healthy. Unless there is a will to live healthy it is impossible for anyone to draw the best of life.

Quality of life has become one of the major aims of contemporary societies. Society is constantly changing and this is mirrored with the profession of physical education and exercise sciences. During the last 20 years, a great deal of evidence has been reported in medical literature supporting the value of regular vigorous exercise for health promotion. A growing body of research indicates that

many diseases that are overly manifested only in adults are results of chronic
disease processes that begin in childhood. Recent medical research clearly
documents that childhood obesity, which is likely to persist into adulthood, is
significantly related to exercise and nutritional habits during early stages of
growth and development.

"Health for all by 2000 A.D", a target set by the WHO is not so simple as
it seems to be. The problem lies in diagnosing and evaluating individual health
capacities. Proper evaluation of the level of individual’s health, and the health
hazards that often hinder the development of individual’s health are necessary for
planning, promoting and predicting greater goal oriented programmes.

In the contemporary living style, physical fitness, health and nutrition
seems to have gained a place of priority. One of the most important goals of
physical education programme is to develop physical fitness. Physical fitness is
considered as a pre-requisite to healthful and recreational living and is not an end
unto itself. Physical fitness can be health related in as much as it preserves
healthful function of the body over extended periods of time into adult’s life.
Health related physical fitness components are those development of which enrich
one’s health, and on the other hand which are related to certain diseases\textsuperscript{20}.

\textsuperscript{20}Ted A. Baumgartner and Andrew S. Jackson. \textit{Measurement for
Evaluation in Physical Education and Exercise Science}, 3\textsuperscript{rd} Ed. (Dubuque,
These components include cardio-respiratory endurance, muscular strength endurance, flexibility and body composition.\textsuperscript{21}

Physical education acts as an intermediary between health and fitness, while the degree of physical fitness depends on the individual’s state of health, constitution, present and previous activities\textsuperscript{22}.

It is a vital issue now to discuss that exercise physiologists have expressed that physical exercise improves and promotes the efficiency of the whole organism and is essential for the proper functioning and maintenance of all systems of the body. A balanced programme of physical fitness is of profound importance to the life of an individual. There is scientific evidence that neglect of regular activity mainly during adolescence cannot be fully compensated later on in life\textsuperscript{23}.

A well-balanced scientific activity programme of physical education depends upon the knowledge of physiological principles of training. Knowledge of past and present activity experience, plus a careful evaluation of the person’s


adaptability to a standard exercise task must provide the framework for the intelligent formulation of activity programmes. The SAID\textsuperscript{24} principles applies equally to the development of health related parameters. It refers to the fact that the human body is extremely adaptable in its ability to accommodate itself to the various kinds of stresses imposed upon it. However, the adaptation is very specified to the type of demand (stresses) imposed, SAID, a coined word which explains this concept, means "Specific Adaptation to Imposed Demands".

Since different activities make different demands upon the organism with respect to circulatory, respiratory, metabolic and neurological and temperature regulating function, physical fitness is specific to activity. The physiological mechanism that sustains and acts as the basis of every body response to exercise is very interesting. In the course of physical exertion, a number of co-ordinated and compensatory adjustments take place throughout the body which involve the metabolic functions and the nervous, muscular, circulatory and respiratory systems\textsuperscript{25}.

The association of obesity with increased risk of developing hypertension, diabetes, cardio-vascular disease and cancers has made it a very complex health problem. Exacerbating the problem is the realisation that there are multiple


\textsuperscript{25}Morehouse and Miller, \textbf{Physiology of Exercise}, p. 225.
factors, both physiological and psychological that interact to induce obesity, as well as myriad of components that may be useful in the curtailment of obesity. It is generally accepted that genetic, hormonal and metabolic factors play an etiological role in the development of obesity, while an imbalance between energy intake and energy expenditure is the major patho-physiological disturbance that results in increased body fat deposition\textsuperscript{26}.

Regular exercise is of proven value in the regulation of obesity or excess body fat. Used as an adjacent to a controlled low calories diet, exercise will increase the percentage of muscle in the total body composition and decrease the percentage of fat.

Systematic physical activity and athletic training can change body composition in a characteristic way, under these conditions lean body mass increase significantly at the expense of fat. This applies to growing children as well as adults and the aged\textsuperscript{27}.

One way to establish what constitute health related fitness among children is to assess the relationship of physical fitness and physical activity to known adult risk factors of cardiovascular diseases. Despite an impressive decline in


mortality over the years, coronary heart disease is still the leading cause of death and disability. Compelling evidence exists that atherosclerotic process begins in early childhood and progresses slowly into adulthood, at which time it leads frequently to Coronary Heart Disease (CHD).

Regularly performed exercise induces major adaptation that beneficially affect a number of coronary risk factors. One of the major pathways by which regular exercise may provide health benefits is through its effects on circulating lipoproteins. Exercise training has shown to decrease the total cholesterol and triglyceride level and in increasing High density Lipoprotein – Cholesterol (HDL- C) levels, an increase level of HDL-C component is associated with a relatively lesser risk to Coronary Heart Disease. Thus the estimation of the cholesterol contents is an indication of individual’s health status.

Across the world, physical education programmes are experiencing a metamorphosis. The changes are partially the result of recent studies pointing out the substandard health related fitness abilities of nation’s youth. As another contributory factor many physical education teachers and school administrators are becoming dissatisfied with the relatively poor influence the traditional sport skill curriculum has had on the long term physical activity patterns of the students.

\^{28}Kalf and Lyon, The Female Athlete p.104.
A well conceived physical education programme can make immeasurable contribution to the total education of an individual. The importance of physical activity has been substantiated across life span, from paediatric to gerontologic perspectives and has been shown to be a significant mediator in coping with life’s pressures.29

The health related physical fitness is a dynamic process and can be developed through systematic and planned training programme. The capability of an athlete to enhance cardiac out-put and consequently to deliver increased quantities of oxygen and other nutrients to his or her tissues is a major factor that determines the degree of prolonged heavy exercise that the athlete can sustain. For instance, the speed of marathon runner is almost directly proportional to the ability to enhance cardiac out-put. Therefore, the ability of the circulatory system to adopt to exercise is as important as the muscles themselves in setting the limits for the performance of muscle work.

So far many research scholars have worked to find out the effects of training programmes of small duration on physiological and biochemical parameters. There are also studies wherein effects during the training or immediately after it have been studied. However, very small attention has been paid on the long duration effects of sports participation and training.

Hence, an effort has been made in the present study, to study the beneficial effect of a long duration programme of physical education.

The present study is an investigation to evaluate the effect of fourteen weeks physical education programme on health related fitness variables of male and female students in a professional preparation institution.

**Statement of the Problem**

The purpose of the study is to evaluate the effect of a physical education programme on health related fitness variables of male and female students of a professional institute.

**Delimitations**

1. The study was delimited to thirty boys and thirty girls students admitted in the B.P.E. 1st year course from the Degree College of Physical Education (HVPM Amravati).

2. The study was delimited to the following health related fitness assessment:

   (i) ICHPER. SD. Asia Youth Health Related Physical Fitness Test comprising of:

   (a) Endurance run (One mile run)

   (b) Muscular endurance (sit ups)

   (c) Muscular strength (pull ups)

   (d) Flexibility (sit and reach)
(e) Body composition – skinfold measurements (sum of triceps and calf skinfolds)

(ii) Body composition variables:

(a) Total Body Weight

(b) Fat weight

(c) Lean Body Mass.

(iii) Cholesterol Components:

(a) Total Cholesterol

(b) Triglyceride

(c) High Density Lipoprotein Cholesterol (HDL-C)

(d) Low Density Lipoprotein Cholesterol (LDL-C)

Limitation

Though the subjects were selected from a fully residential professional preparation institute, any variation in their living condition and life style from subject to subject may be considered as a limitation of the study.

Hypothesis

It was hypothesised that there may be significant changes in the selected health related fitness variables of male and female students following the fourteen weeks physical education programme.
Definition and Explanation of Terms

Health Related Physical Fitness

Tanered\textsuperscript{30} defines the health related physical fitness as development of qualities necessary to function efficiently and maintain a healthy life style. Each of the components of health related fitness are, cardio-respiratory endurance, muscular strength and endurance, flexibility and body composition.

Falls\textsuperscript{31} explains health related physical fitness as "the aspects of psychological and physiological functioning which are believed to offer the individual some protection against degenerative disease such as coronary heart disease, obesity and various musculo-skeletal disorders".

Body Composition

Body composition is the proportion of the lean, fat free body mass and depot fat. It is one of the most important morphological feature characterising human organism\textsuperscript{32}.


Cholesterol

A monatonic alcohol, occurring in the form of square scaly crystals with a notched corner. It is found in bile, in gallstones, in brain, blood cell, plasma, egg yolk, seeds and animal tissue generally in varying amount\textsuperscript{33}.

A fat like material (a sterol) present in the blood and most tissue, especially nervous tissue. Cholesterol is synthesised in the body from acetate mainly in the liver, and its blood concentration is normally 140-300mg/100ml\textsuperscript{34}.

Triglycerides

Triglycerides are the esters of fatty acids with the trihydroxyl alchohol glycerol. These are neutral fats which are insoluble in water and soluble in non-polar solvents\textsuperscript{35}.

Blood triglyceride level above 250 mg/dl are considered high and may also play a role in forming plaque. Being overweight, drinking large amounts of alcohol or having diabetes can cause high blood triglycerides. To get a blood lipid profile, which includes a reading of your total cholesterol, HDL-cholesterol and triglyceride level, (LDL-cholesterol is estimated from these numbers) you need to fast for 14 hours.

\textsuperscript{33} Stadman Medical Dictionary S.V. “Cholesterol”

\textsuperscript{34} Concise Medical Dictionary S.V. “Cholesterol”

High Density Lipoprotein Cholesterol (HDL-C)

HDL is often referred to as ‘good’ cholesterol. It is formed in the liver and walls of the small intestine. While maturing in the blood stream, it obtains cholesterol from the surrounding tissues. The blood circulation then transports the HDL back to the liver, from where the cholesterol is excreted in the bile. This is how the HDL cleanses the body and helps a person get rid of excessive amounts of cholesterol. Women, in general, tend to have a higher amount of HDL; that is one of reasons why women tend to have a lower incidence of heart attack, at least until the age of menopause. Adults with a HDL level below 35mg are at a greater risk of heart attack. Those with a HDL level of less than 25mg may get a serious heart attack even though their total cholesterol level may be within normal limits, that is, less than 200mg\textsuperscript{36}.

Low Density Lipoprotein Cholesterol (LDL-C)

LDL is the most cholesterol-rich lipoprotein in the blood. A portion of LDL is used for fat storage; the rest is sent back to the liver for excretion. Excessive accumulation of LDL in the blood is definitely harmful, since it gets deposited in the wall of the arteries and slowly results in the clogging and narrowing of the arteries. LDL is often referred to as the ‘bad’ cholesterol. In

healthy adults, LDL concentration of over 130mg/100ml of blood is considered to be unsafe. The higher the LDL level, the more the danger of a heart attack.\textsuperscript{37}

**Significance of the Study**

The training of adequate intensity and volume of stimulus leads to noticeable changes in the physiological and biochemical system of the body. These changes are affected by a number of factors including age, sex, environment and fitness level. Though the effect of the training is supported by circulatory system, respiratory system, nervous system, endocrine system and many other relative systems, yet the actual work is done at tissue level especially in the active muscles. To assess the effect of a long term physical education programme and to study the changes which takes place in health related fitness variables including serum lipids and body composition variables, the investigator tried his best to gather adequate information. The present study will make worth while contribution in the following ways:

1. The study will evaluate the effect of fourteen weeks physical education programme on health related fitness variables.

2. The outcome of the study will be useful in evaluating the degree of adaptive and beneficial changes brought about by regular exercise on cholesterol levels.

\textsuperscript{37} Ibid.
3. The findings will be helpful in guiding the research workers in planning their research programmes in the light of observation made and interpretation recorded.

4. The study will help to establish the role of physical exercise as a preventive medicine for obesity, and coronary heart disease by its beneficial effects on fat percentage and cholesterol levels.

5. The study will provide a feedback to physical education personnel in planning effective physical education programme with respect to health enhancement.