Chapter I

INTRODUCTION

"What, then, is the right way of living?

Life must be lived as a play,

playing certain games,

making sacrifices,

singing and dancing,

and then a man will be able to

propitiate the gods; and defend

himself against his enemies and win

in the contest.”

- Plato

“We never appreciate health so much as when we lose it”. Although it may be difficult to change the health habits of adults, schools and colleges can and should educate young people about their health and

fitness. This is not only essential from the individual’s point of view but also in view of this country’s national posture.²

Since many youths and adults do not fully understand and appreciate the importance of health and fitness, a heavy responsibility rests on the shoulders of educators. If a nation is to remain strong physically, mentally, spiritually and socially, there must be education for fitness.³

Positive changes in lifestyle can best occur through education. This education for fitness needs to start with young children to make them aware of their bodies and value of physical fitness to their emotional and physical well-being. In addition, public communication through literature, television and radio should endeavor to educate adults, so that they may take positive steps in improving their physical fitness.⁴

Regular participation in vigorous exercise increases physical fitness. A high level of physical fitness is desirable for a full, productive


life. Sedentary living habits and poor physical fitness have a negative impact on both health and daily living.⁵

Education is a ‘doing’ phenomenon, one learns through doing. Education is not confined to classroom alone, it may take place on the playground, in the library or even at home. Such an education is conductive to the enrichment of an individual’s life. A well-directed programme of physical education leads to healthful living, social efficiency, good physical health and worthy use of leisure time. In the modern context, the term ‘physical education’ has assumed much broader and more meaningful application to our daily life.⁶

In the modern age, scientific progress has gone a long way in providing us with almost all the comforts and opportunities of an easy-going life. Man is hardly expected to do a great physical effort. This is no vigorous living. Consequently, the ‘push button’ civilization has, to a great extent, made man inactive and lazy. He is gradually discarding active participation in physical and active toil and turmoil. If this tendency

⁵ A. K. Uppal, Physical Fitness How to Develop (Delhi: Friends Publication), P.4.

is not checked for the centuries to come, man will be reduced merely to the state of a physical lump, which will be able to think or reflect only and not act. The present circumstance may not demand from man hard physical labour but biological evidence certainly directs him to involve in active and vigorous living.\(^7\)

Man is a biological entity and in hierarchy of biological evolution, he stands at the zenith. Thus science has revealed to us an irrefutable fact that man, like other animals, has a long and natural evolution. It is long way that man has traveled from the primitive type of existence to the present highly complex life.\(^8\)

Biology has revealed to us quite clearly as to what change took place in human physique in the long span of biological evolution. The changing environment on the earth forced that changes in human body structures, which subsequently brought innumerable changes in his mode of walking, running, climbing, hitting, leaping, bouncing, thinking and understanding his environment. The evolution has not come to an end and it is gradually and imperceptibly going on. Perhaps none can predict what

---


\(^8\) Ibid., P. 37.
shall be the final outcome to such an unceasing process not only on the surface of the earth but also in human body as well.\(^9\)

Physical education is basically concerned with the human movement, which is imparted through the ‘physical’. It is human body, which has stood the catastrophic changes of the environment and it is imperative that it should be trained in such a way as to cope with the still changing environment biologically.\(^10\)

Physical education must help to develop a higher and better plane of living as its part in this ‘evolving’ process if it is to justify its worth. A study of evolution shows that people should not follow a sedentary existence, but, instead, should be active, should exercise the various parts of their bodies and should spend more times in the out of doors. Therefore physical education has many potentialities. To train youth successfully, nature’s methods should be followed. This holds true also in regard to the activities in which humans engage. Primitive people obtained food, provided shelter and protected themselves against a hostile environment through activities that involved walking, running, hopping, climbing,
throwing, carrying, leaping and hanging. These are consistent with the evolutionary process and have formed the basic movements for humans throughout their long history. They are a part of our inheritance. The games, dances, other physical education activities that are utilized today have as a basis these racially old activities.\textsuperscript{11}

Today physical education is based on scientific facts and principles. As such its programme is developed as a result of systematized knowledge based on verifiable general laws. This knowledge covers many areas of learning. The physical education programme is established with respect to the biological, psychological and sociological aspects of growth and development. It aims to develop youth into citizen who have the capacity to enjoy a happy, vigorous and interesting life. To accomplish this task, it is necessary to know the individual, how the physical body functions and how the individual learns and each person’s relation to the group, society and world of which he or she is a part. Furthermore, the human being represents a unified whole, each part being necessary to the successful functioning of every other part.

\textsuperscript{11} Bucher, \textit{Foundation of Physical Education}, p. 219.
The individual reacts as a ‘whole’ organism and not just in parts. Therefore, education should be concerned with activities that benefit the ‘whole’ individual and not just one part. When a child swims, there should be concern not only for the physical development that ensues from this experience but for the social, mental and emotional aspect as well.\textsuperscript{12}

Today man is heading towards total automation and is gradually making least efforts with his body. Biology emphasises that this should not continue, otherwise man will forfeit his body and become lump of brown and brain.\textsuperscript{13}

The movements of the body without which the organism cannot survive are called survival activities. Beating of heart, respiration, circulation, peristalsis etc. are some of the instances of these activities. Heart never stops beating, nor do lump stop dilating and contracting. If they do even for a second, the organism is dead. We call them biological reflexes. If, at any stage, one or the other activities are hampered, the existence of the organism is put into jeopardy.\textsuperscript{14}

\textsuperscript{12} Ibid., P. 217.

\textsuperscript{13} Kamlesh and Sangral, \textit{Principles and History of Physical Education}, p. 38.

\textsuperscript{14} Ibid., P. 39.
Ideal state of health cannot be maintained until and unless all these functions of the body are efficiently carried on. For this purpose one shall have to depend on developmental activity.\textsuperscript{15}

Such movement of the body by which the qualitative change in the efficiency of the total body is precipitated. Muscles are the instruments of all our movements; they gain strength, good reaction time etc. only through such activities, which are 'vigorous' and enhance the capability of the body to act, react and even counteract.\textsuperscript{16}

A person can develop optimally by making fullest use of the capacities he has biologically inherited. He can acquire many more skills and habits.\textsuperscript{17}

Motor learning has been recognized as an essential for all children and important to their emotional and social life. It helps the individual to become independent. It plays a part in one's intellectual development. Through motor skills the child acquires concepts of size and weight and finds out about such things as gravity and balance. From an emotional

\textsuperscript{15} Ibid.

\textsuperscript{16} Ibid.

\textsuperscript{17} Ibid., P. 40.
standpoint, motor skills help children to solve problems that would otherwise enrage and stump them.\textsuperscript{18}

Much of this education should take place early in life, when the organic foundations are being laid, skills are more easily learned, and attitudes are formed. Unfortunately too many people do not recognize the need for this education until cholesterol deposits have closed their arteries, ulcers have penetrated their duodenum, or cancer has started its insidious attack on their lungs.\textsuperscript{19}

Lack of activity is bound to create inactivity, which subsequently will result in loss of all skills of its effective movement; organs will lose their activity, ability and capacity. Prolonged disuse of the body will stunt our physical growth and development. Biological; evidence stands the testimony of the fact that proper use of the body is but essential for the sustenance of life and growth of the organism.\textsuperscript{20}

Exercise (vigorous) is a sort of food to the body. Predominance of the scientific evidence indicates that daily exercise stimulates the

\textsuperscript{18} Bucher, \textit{Foundation of Physical Education}, p. 234.

\textsuperscript{19} \textit{Ibid.}, P. 244.

\textsuperscript{20} Kamlesh and Sangral, \textit{Principles and History of Physical Education}, p. 52.
processes of growth and development. The studies indicate that exercise improved muscular strength, girth, size and vascularization there is increased circulation of blood in the body, increased respiration, efficient elimination of waste products from the body, increased metabolic changes that are responsible for increased efficiency of the total body and efficient activity of the nervous system due to regular input and output of healthy impulses.\textsuperscript{21}

If an individual has to keep himself ‘fit’ and healthy, it is necessary that he must do some activities daily. No research in physiology has been able to make it clear as to how much amount of vigorous physical exercise does a man need daily. However, it will be absurd also to reduce the period of activity to some numerical hours. The type of activity changes from person to person, age to age and its need from person to person. For example, in childhood, free play is the best medium of child development. Since children have no other serious business of life, they should be given maximum opportunity of utilizing these play periods through planned experiences in activity pursuits, which are mainly developmental. For them, play is as vigorous as other games and sports.

\textsuperscript{21}Ibid., P. 53.
In the youth period, planned vigorous activity is a must for building up vigour and complete fitness. Here again, the activity plan will differ from person to person depending upon his occupation, his need for exercise and availability of time and good diet. In old age, light exercises and games of carry over value, yoga etc. are very helpful in sustaining strength and vigour through much of the process of development is considerably slowed down due to aging.\(^2\)

Vigorous activity is basically meant for increasing the efficiency of the body and human beings need to be fit and efficient throughout their lives. The cell is considered to be the basic unit of organism; it is the seat of life; it is the basis of life as well. It, like other organism, breathes, eats and eliminates waste products. When cells gain strength and power, we say, they have become efficient. The efficiency of the cell can only increase when it gets abundant supply of oxygen and food. This supply is made available to the cell by the ‘transpiration system’ (circulatory system). The central figure involved in blood supply is heart, which is made of a special muscle. During exercise there is more demand for oxygen and food by the cells. In fact, the cells are the storerooms for

\(^{22}\) *Ibid.*, P. 54.
energy. Thus the circulatory and the respiratory systems are brought into full operation. The law of use and disuse indicates that the organs can only develop in efficiency when a greater demand is made on them. Only then, they will make supreme effort. Thus the heart and the blood vessels become capable of doing more work. The stroke volume of the heart is increased, while the rate of beating slows down so that the trained heart has more rest than the untrained one. In the same way, the respiratory system adopts itself to the situations making greater demand of oxygen on it. Regular training could also lessen the physical stresses of daily life through an increase in the reserves of strength and power and a diminuation in the dead weight fat.\textsuperscript{23}

In general, exercise lowers blood pressure and slows heart rate – two important considerations in heart conditions. Being active is a continuing essential for good health. Exercise is needed all the year long.

Famous physiologists, after a lifetime study of the exercise of the effects of exercise, come to the conclusion that, "Frequently repeated exercise, extending over months and years, is necessary for healthy existence. It is a physiologic need of a primitive kind, which cannot be

\textsuperscript{23} Ibid., pp. 54-55.
safely be eliminated by civilization. It is difficult to find men who have 
been injured by muscular exercise, but easy to find who have failed of 
normal development and been ruined by the lack of it.\textsuperscript{24}

Evidence is available to show that heart muscle increases in size 
through use. With greater demand placed on the heart as a result of 
physical activity, a hypertrophic condition exists. This is a healthy 
condition. ‘Athletic heart’ is a normal condition, which follows the law of 
use. The law of use may be stated in these terms: “that which is used 
develops and that which is not used atrophies”. This applies to all the 
muscles of the body. Since the heart is a muscle, this condition indicates a 
stronger and better developed heart.\textsuperscript{25}

It is generally agreed that there is a greater volume of blood per 
heart beat pumped through the body of the trained person than the 
untrained person.

The state of lactic acid formation is lower in the trained individual, 
resulting in a lower blood lactate concentration. This allows for greater 
work output on the part of the trained individual.

\textsuperscript{24} Bucher, \textit{Foundation of Physical Education}, p. 250.

\textsuperscript{25} Ibid., pp. 257-259.
One of the greatest deterrents to physical fitness is the general lifestyle of our modern age. Many people are eating wrong foods and drinking and smoking excessively. In many cases excessive affluence is detrimental to physical fitness in that affluence directly affects diet and promotes a sedentary life.\(^{26}\)

The development and maintenance of physical fitness can be brought about through a variety of exercise programmes of which a person may adopt any one or more, depending upon the purpose, need, time and the facilities available.

Physical training is done for improving physical performance. The personality of a person has several dimensions, e.g., physical, physiological, social and psychic. These dimensions can be improved through physical training.

Circuit training, aerobic dance, calisthenics etc. are some effective measure to develop physical fitness.

Buffon\textsuperscript{27}, Huges\textsuperscript{28}, Mihevie\textsuperscript{29} and Morgan\textsuperscript{30} agreed that participation in general sports activities does not seem to affect personality but vigorous exercise and programme that increase fitness level may have positive effect on mood, self-concept and general mental health.

Miroslav Vanek\textsuperscript{31} has stated physical effort prevails in training and psychic effort prevails in competition.

The circuit training involves almost all training factors. Circuit training can be designed to develop strength, power, muscular endurance,

\begin{itemize}
\item \textsuperscript{31} Miroslav Vanek, "Preparation Psychologique des Athletes Olympique", \textit{International de Physiologic de Sport II Congress} (Washington, 1968) cited by Homravella, \textit{The International Olympic Academy}: 220.
\end{itemize}
speed, agility and neuromuscular co-ordination, flexibility and cardiovascular endurance.

Circuit training is a formal type of training in which an athlete goes through a series of selected exercises or activities that are performed in sequence or in circuit. Circuit can be set up inside gymnasium, exercise rooms or outside on courts and fields. It combines a number of different components of training, thus total fitness is emphasized. It provides an interesting training environment for the athlete, and there are established times and levels to motivate the athlete to continue improving.\(^{32}\)

Important objective of physical training is to develop the physical fitness level of individual. Physical fitness consists of mainly strength, speed, endurance, flexibility and other co-ordinative abilities. These abilities are essential pre-requisites of active life. Physical training should be concentrated mainly on the development of the kind of fitness that is needed for the active life style and specific sports event or game concerned. The development of desired level of fitness and its components takes several years of systematic training. This needs the use

\(^{32}\) Ajmer Singh et al.; *Essentials of Physical Education*, p. 306.
of different types of physical exercises and various types of training methods for physical training programme for the individual.\textsuperscript{33}

Further the aerobic dance is becoming a popular and rewarding area of specialization for physical educators who wish to render a service by helping young persons to better understand their bodies and to express themselves through rhythmical activity. Although many opportunities present themselves in elementary and secondary schools and also in dance studios and community agencies and recreation programmes, the college and university levels (where more often than not dance teachers work in departments, divisions or schools of physical education) also offer many opportunities to serve. There has been considerable expansion of dance programmes in recent years in institutions of higher learning. Liberal arts colleges are offering expanded programmes of dance experiences for their students, professional preparation programmes are training teachers of physical education with an emphasis in the area of the dance and other institution are providing instruction in modern, ball room and folk dancing for the general student body.

\textsuperscript{33} \textit{Ibid.}, P. 297.
As the dance programmes in schools and colleges becomes increasingly popular, there is a demand of teachers of physical education who are specialists in the various phases of dance. Prospective teachers interested in dance will find more positions available if they prepare themselves to teach the other activities in the physical education programme as well opportunities for teaching dance alone are limited.

In addition to schools and colleges, dance personnels are needed in other places such as the theatre, private studios, recreation centers, armed forces, summer camps and hospital therapy. Roles that dance personnels play include that of teacher, performer, choreographer, notator and director in a concert group and in television, movie and theatre productions.

To render the service of teaching dance effectively requires a study of the scientific principles of body movement; an understanding of dance forms, dance composition and technique; skills of notation; theories relating to costuming, staging and lighting; and also a good grounding in the scientific foundations of physical education and a sound general education.\(^{34}\)

\(^{34}\) Bucher, *Foundation of Physical Education*, p. 432-433.
The elementary school programme in rhythms and dance includes fundamental rhythms, pantomimic and dramatic dances, dramatic and singing games, folk dances and character dances. Dance may constitute as much as 20% to 40% of the entire physical education programme.

In junior and senior high school the more popular phases of the dance programme include social, folk, square and modern dancing.

At the college and university level, folk, square, ballroom and modern dancing are frequently added in the curriculum. In addition courses such as the history and philosophy of dance, methods of teaching various forms of dance, dance production and cultural concepts of dance are offered.\footnote{Ibid., P. 448.}

Some of the benefits of dance like aerobic exercise include the ability to utilize more oxygen during strenuous exercise, a lower heart rate at rest, the production of less lactic acid and greater endurance. Also, many exercise physiologists have found that it reduces blood pressure and changes blood chemistry. It also improves the efficiency of the heart. More evidence is needed to substantiate the belief by some persons that aerobic exercise is responsible for the development of supplemental blood
vessels to the heart, which would be helpful in the event of a heart attack, and also that such exercise results in increasing the size of coronary arteries and thus assisting the flow of blood to the heart when the artery is narrowed by a clot or atherosclerosis.\textsuperscript{36}

Aerobics and dance play a very important role in physical education. They give an all round development and elasticity in muscle and enable one to show various movements with great co-ordination so as to switch of from one activity to another without any difficulty.\textsuperscript{37}

Therefore such study is being undertaken to investigate the effect of circuit training and aerobic fitness programme on physical fitness, anthropometric and physiological variables of secondary school girls.

**Statement of the Problem**

The purpose of this study was to investigate the effects of circuit training and aerobic fitness programme on physical fitness, anthropometric and physiological variables of secondary school girls.

\textsuperscript{36} \textit{Ibid.}, P. 253.

Delimitations

The study was delimited to the 9th and 10th grade school girls of Khirpai S.K.B.M. Girls’ High School, District-Paschim Medinipur, West Bengal, India and their age was ranged between 14th to 16th years.

The Study was delimited to ten weeks physical training programme named by circuit training and aerobic fitness programme.

The study was further delimited to the following physical fitness test, anthropometric, and physiological variables.

Physical Fitness Test

AAHPER youth fitness test.

Anthropometric characteristics

i) Weight

ii) Standing Height

iii) Calf Girth

iv) Thigh Girth

v) Hip Girth

vi) Chest Girth
vii) Upper Arm Girth

viii) Skinfold Measurements
   a. Biceps Skinfold
   b. Triceps Skinfold
   c. Supra iliac Skinfold
   d. Sub scapular Skinfold

Physiological Variables

i) Resting Heart Rate

ii) Working Heart Rate

iii) Resting Systolic Blood Pressure

iv) Resting Diastolic Blood Pressure

Limitations

1. As the subjects selected for this study were not the residents within the residential hostel or camp, the factors like diet, lifestyle, and daily routine were not totally controlled.

2. Owing to the involvement of different technical persons in exercising training programme on different experimental groups,
the pattern of handling training load, training processes and the measurements taken are likely to be vitiated by approximation due to human perception and handling.

**Hypothesis**

i) It is hypothesised that ten weeks circuit training and aerobic fitness programme will not show significant differences among circuit training, aerobic fitness and control groups of secondary school girls in physical fitness (AAHPER Youth Fitness Test) undertaken in this study in pre, post and adjusted post-test means.

ii) It is further hypothesised that ten weeks circuit training and aerobic fitness programme will not show significant differences among circuit training, aerobic fitness and control groups' subjects of secondary school girls in any of the anthropometric variables namely weight, standing height, calf girth, thigh girth, hip girth, chest girth, upper arm girth, biceps skinfold, triceps skinfold, supra iliac skinfold, sub scapular skinfold undertaken in this study in pre, post and adjusted post-test means.
iii) It is also hypothesised that ten weeks circuit training and aerobic fitness programme will not show significant differences among circuit training, aerobic fitness and control groups’ subjects of secondary school girls in any of the physiological variables namely resting heart rate, working heart rate, resting systolic blood pressure and resting diastolic blood pressure undertaken in this study in pre, post and adjusted post-test means.

**Definition and Explanation of Terms**

**Circuit Training**

Circuit training is a very popular and effective organizational form of doing physical exercises. In circuit training, a certain number of exercises are done one after the other in the form of a circuit. This circuit is repeated three or more times. Circuit training can be used for the improvement of conditional abilities.
Normally a circuit consists of 6-10 exercises. The exercises in a circuit are arranged in such a manner that different muscle groups are exercised in rotation.\(^3\)

Interval method was used in this circuit training programme. Eight exercised programmes are selected in this circuit training programme.

**Aerobic Fitness**

Under Aerobic fitness programme the aerobic dance was undertaken in this study, which is consisted with rhythmic and dancing movements along with music, centering upon the components of physical fitness.

Aerobic dance is a series of dance exercises on dance routines performed to music. It is also referred to as aerobics to music or simply aerobics.

Aerobics dance exercises or dance routines performed to music have become popular. Such programmes are often called “aerobics dance” or simply “aerobics”.  

Physical Fitness

1. "Physical Fitness is defined as the ability to carry out daily tasks with vigour or alertness, without undue fatigue and with an ample energy to enjoy leisure time pursuits and to meet emergencies".  

2. "Physical Fitness is the ability to carry out daily tasks with vigour or alertness, without undue fatigue and with an ample energy to enjoy leisure time pursuits and to meet the above average physical stress encountered in emergency situations".

---


Anthropometric Variables

The anthropometric characteristics are studied as anthropometric variables. Anthropometric characteristics are dimensions of the structure of the human body taken at specific sites to give measures of length, girth and width.42

The following anthropometric characteristics were undertaken for this study.

i) Weight

ii) Standing Height

iii) Calf Girth

iv) Thigh Girth

v) Hip Girth

vi) Chest Girth

vii) Upper Arm Girth

viii) Skinfold Measurements

   a. Biceps Skinfold

   b. Triceps Skinfold

---

Physiological Variables

Physiology is the science, which deals with the function of the living organism and its parts and of the physical and chemical factors and processes involved.\(^{43}\)

The following physiological variables were undertaken for this study.

i) Resting Heart Rate
ii) Working Heart Rate
iii) Resting Systolic Blood Pressure
iv) Resting Diastolic Blood Pressure

Significance of the Study

Even though the advantages of circuit training and aerobic fitness programme are recognized fact, for developing physical fitness, body structure and physiological efficiency, however, a question arises that

\(^{43}\) Ajmer Singh et. al., Essentials of Physical Education, p. 66.
what degree of reliance may be placed on these training methods and which one may be admired as highly significant in developing physical fitness, body structure and physiological efficiency in comparison to other training method. Thus, in this study an attempt was made to investigate that which training programme is having distinct role in developing physical fitness, body structure and physiological efficiency in respect to other training programme undertaken in this study.

The results of this study may be helpful for physical education teachers, instructors, students, citizens, coaches and players in the field of physical education, sports, health and fitness etc. in understanding the effects of circuit training as well as aerobic fitness programmes on physical fitness, physical and physiological variables of secondary school girl students.

The results of this study also may highlight in identifying the comparative effect of circuit training and aerobic fitness programme on physical fitness, anthropometric and physiological variables of secondary school girl students.