CHAPTER I

INTRODUCTION

During the last two decades, there has been a tremendous increase in the number of people participating in Physical Fitness fad. In the early 1970s, fitness programs have become a trend that is now very much a part of the life. The increase in the number of fitness participants is attributed primarily to scientific evidence linking vigorous exercise and positive lifestyle habits to better health and improved quality of life.

Many research findings show that the physically inactive and negative life style leads to serious threat to an individual’s health. Movement and activity are basic functions needed by the human organism to grow, develop and maintain health. However physical activity is no longer a natural part of our lifestyle. We live in automated world where most of the activities that used to require strenuous physical exertion can be accomplished by machines with the simple pull of a handle or push of a button. Most of them use machines even for small works. So, people are loosing power, Endurance, co-ordination and making the body lazy.

With developments in the technology, three additional factors have significantly changed our lives and have had a negative stress and environment. Fatty food, sweets, alcohol, tobacco use, excessive stress
and pollution in general, have determined effect. The leading causes of death in the country today are basically Cardio-vascular disease which includes heart disease and cerebro-vascular disease and Cancer.

While Physical inactivity is one of the most significant risk factors, so studies have also documented that multiple interrelation usually exists between risk factors. Physical inactivity, for instance often contributes to an increase in (a) Body Weight (fat) (b) total cholesterol /HDL-Cholesterol ratio (c) triglycerides (d) tension and stress (e) blood pressure and (f) risk of diabetes. Research, however also indicates that the odds of surviving a heart attack are much greater for people who engage in a regular aerobic program.

Athletes in various sports seemingly have different objectives when it comes to weight control and proper body composition. For some, gaining weight through lean body mass (muscle) is the goal, for others to look slim or making weight is the goal. The non athlete may have a simple concern to avoid obesity. The common goal is an adequate knowledge about physical fitness and nutrition values to fit the athletes or non athletes to their lifestyle.¹

**Somatotype**

Body build or Somatotype as a term means the morphological or structural characteristics of the human body as reflecting qualities related to

1. Health, disease, immunity.
2. Capacity for physical exertion.
3. Social adaptability through and personality attitudes.

Psychologist often classifies individuals on the basis of body type or physique. This is based on the body structure of an individual through such classification it has been thought possible to distinguish certain physiological and personality trait might be associated with each type. One method of classification is that promulgated by Kretchmer who classified the human body today into four groups, Asthenic, Athletic, Pyknic and Dyplastic.²

Sheldon’s³ three aspects or components of bodily morphology as determined by him were called Endomorphy, Mesomorphy and Ectomorphy. The three descriptions were derived from the terms used to describe the three initial layers in the early embryonic forms of higher life.

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(I) **Endomorphy**

Total Physique: Round and soft with large fat storage. In extreme form pear shaped. Abdomen is full and extensive and the thorax appears small. The limbs appear short and ineffective. Shoulders are full and round supporting a round head. The skin is soft and smooth, fine hairs with little showing on the body.

Endomorphic skeleton: In side view the vertical column appears straightened in the thoracic region. Body girdles of trunk and pelvis is approaching the circular. All the bones are small with tuberocities and protections rather rounded.

Head and Trunk: Features small and in obtrusive small cranium in relation to wide palate and face and short neck. The trunk is ling and heavy at the base. The greatest body width is near the waist, which is difficult to determine the thorax is wide at the base. The whole trunk and head has a forward pushing penguin-like appearance.

Arms and Legs: The limbs are short and from an inflated appearance proximal they rapidly taper down to small and weak dorsal extremities. There is no angularity and so in the male where there can be appearance of breasts, there is a suggestion of femenity.
(II) Mesomorphy

Total Physique: Square and rigorous in appearance, with much prominent muscle. Shoulder predominates with thorax wide at the apex and the abdomen small. The limbs appear large and strong. Neck is short with a rugged head showing prominent eminencies. Skin is rather coarse, as is the hair.

Mesomorphic skeleton: All the curves of the vertebral column are well shown. Bony girdles of trunk and pelvis are wider laterally than in the antero-posterior dimension. All the bones are heavy, with all the ridges and processes well defined.

Head and Trunk: The face is large compared with the cranium. The forehead is often shallow and facial eminencies and angular tends to approach 90 degrees. The neck is long and the sternomasloid triangle well marked. The massive thoracic, the waist is low with the abdomen almost perpendicular in profile.

Arms and legs: There are generally heavy and well muscled, particularly at their proximal ends. The hands and foot are also large capable in appearance and the forearm and calf muscles are very prominent.

(III) Ectomorphy

Total Physique: Fragile and slender with a minimum of either factor muscle. The trunk generally appears short and poorly positioned and is
accompanied by long spindly limb shoulder are wide but droop, the neck is slender and can appear inadequate for the head, which often has cranium. The skin is thin and hairs brittle.

Ectomorphic skeleton: In the vertebral column the cervical thoracic curves are well marked to the point of distortion, and the lumbar curves is flattened. The sub-coastal angle is acute although the thorax is shallow in anterior posterior dimension particularly in the region of the Sternum bone. Bones are light but so variable in length, for the stature in this component has a wide range.

Head and Trunk: Feature is finely etched with a slight chin brow can be large, the cranium and brain are very extensive. The thyroid gland is prominent and the neck hangs forward from the shoulders. The trunk is shallow and flat, the abdomen protruding in front of thorax in profile. The distinct sag forward of the abdomen is due to ineffective musculature. They appear weak and long with slight musculature. Their weakness is more noticeable at the proximal ends and toes and fingers are long and delicate.

Physical Fitness

The American Medical Association defines fitness as the general capacity to adapt and respond favorably to physical effort. This implies that individuals are physically fit when they can meet ordinary as well as
the usual demands of daily life safely and effectively without being overly fatigued and still have energy left for leisure and recreational activities.

Physical Fitness can be classified into two categories: Health-related fitness and Motor skill related fitness.

**Health related Physical Fitness**

Physical Educators have long believed that exercise is important to maintain good health. Today degenerative diseases like Cancer, Heart disease, Strokes have replaced communicable disease like tuberculosis, Pneumonia as leading to death. Medical Research shows that poor aerobic fitness, obesity and lack of development of certain types of muscular strength, flexibility are related to certain disease. Health related Physical fitness is defined by the following components.4

- Muscular strength endurance
- Cardiovascular endurance
- Muscular Flexibility
- Body composition

The motor skill-related aspects of physical fitness are greater significance in athletics. General Motor ability has been considered as

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one’s level of ability in wide range of activities. It has been thought of as an integrated composite of such individual traits as

- Agility
- Balance
- Coordination
- Power
- Reaction time
- Speed

While these components are important in achieving success in athletics and games, they are not crucial for the development of better health. So the investigator has given importance on the Health-related Fitness as the experimental variable.

**Muscular Strength endurance**

Strength is the ability to overcome resistance or to act against resistance. Strength should not be considered a product of only muscular contraction. It is, in fact, a product of voluntary muscle contraction caused by the neuro-muscular system. The ability of strength is divided into three types. They are Maximum Strength, Explosive strength and Strength Endurance. The Strength Endurance

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consists of two motor abilities. It is the ability to overcome resistance under condition of fatigue.

Muscular strength and endurance\(^6\) are interrelated, a basic difference exist between the two. Strength is defined as ability of muscle or group of muscles to exert maximum force against resistance. Endurance is the ability of a muscle to exert sub-maximal force against on cardiovascular endurance. Weak muscle cannot repeat an action several times, nor sustain it for a prolonged period of time.

**Cardio Vascular Endurance**

Cardio-vascular Endurance, Cardio-vascular fitness or aerobic fitness has been defined as the ability of the lungs, heart and blood vessels to deliver adequate amounts of oxygen and nutrition to the cells to meet the demands of prolonged physical activity.

Cardiovascular endurance is determined by maximal amount of oxygen that the human body is able to utilize per minute for physical activity. The value is commonly expressed in millimeters of oxygen per kilogram of body weight per minute of physical activity (ml/kg/min). Since all tissues and organs of the body utilize oxygen to function, a

\(^6\) Werner W K. Hoeger and Sharon A. Hoeger, *Fitness and Wellness* (Colorado: Morgan publishing company, 1990), P.16.
higher amount of oxygen consumption is required for a more efficient cardiovascular system.\textsuperscript{7}

**Flexibility**

Flexibility, mobility and suppleness all mean the range of limb movement around joints. In any movement there are two groups of muscles at work; protagonist muscles which cause the movement to take place and opposing the movement and determining the amount of flexibility are the antagonistic muscles.

**Body Composition**

Athletes in a variety of sports seemingly have different objective when it comes to weight control and proper body composition. For some, gaining lean body weight (muscle) is the goal for others looking slim or making weight is a goal. The non athletes may have a simple concern to avoid obesity. Common among these goals is an adequate knowledge base concerning nutrition and obesity.

The body may be regarded as being composed basically of two functions: Body fat and lean body mass (fat free weight)

1. **Body Fat:** The amount of body fat (adipose tissue) that is stored is determined by two factors: the number of fat storing cells, or adipocytes; and the size, or capacity, of the adipocytes. It has been

\textsuperscript{7} Ibid., P.12.
shown that the number of fat cells cannot be effectively decreased by exercise or dietary restriction once adulthood is reached. During weight reduction fat loss in adults, it is the size but not the numbers of adipocytes that decreases. However, exercise and diet programs introduced during the early childhood lead to a reduction in both number and size of fat cells during adult years. This is true even though exercise and diet programs may not be continued into adulthood. This emphasise how important it is to formulate good nutritional habit and good exercise habit early in life as well as throughout life.

2. Fat Free weight (Lean Body Mass): When the weight of body fat is subtracted from the total body weight, the remaining weight is referred to as fat free weight or lean body weight. The fat free weight (FFW) consists of skeletal muscle mass, bone, skin, non-fat organ tissue and other tissues in the body. The muscle mass makes up about 40 percent to 50 percent of the fat free weight and that of college age men is about 85 percent of their total body weight and the women 75 percent.⁸

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Biochemical variables

Blood

Blood is considered a tissue consisting of Red blood corpuscles (erythrocytes), White blood corpuscles (Leukocytes), platelets and liquid plasma. It is a carrier for gas, oxygen, carbon-di-oxide, metabolites, and products of digestion, hormones, enzymes and clotting factor.

A 70 kg individual has a blood volume about six liters (85ml/kg) about one twelfth of the body weight and about three liters of plasma (45ml/kg). Blood has many diverse functions.

1. Respiration- transport of oxygen from the lungs to the tissues and carbon dioxide from the tissue to the lungs.


3. Excretion- transport of metabolic wastes to the excretory organs.

4. Maintenance of body temperature and osmotic pressure.

5. Defense against infection.

6. Transport of metabolites and hormones from the sites of production to target organs and enzymes, chiefly the plasma specific enzymes.

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The substances present in the blood could be divided into three major types,

1. Protein like (albamin & enzymes), 2. Neutral molecules (Glucose), Ionic species (Sodium, Potassium & Bicarbonate).

**Lipids**

Lipid\(^\text{10}\) comprises 18-20 percent of the total body weight in the human adult. Neutral fat (Triglycerides, triacyl glycerols) is the forms in which fat is stored in the body adipose tissue, the subcutaneous fat pads, peri-renal fat depots, inter-muscular connective tissue and the fat depots of mesentery and omentum. About 70-80 percent of the lipids in adipose tissue are due to triacyl glycerols.

Lipids are also present in other areas of the body. In the decreasing order of lipid content in percentage, the tissues rank as follows: skeleton 25, heart 17, pancreas 14, brain 12, kidney 7, muscle 6, lever 3 & blood 0.57.

Phospholipids, cholesterol and cerebrosides are not stored in the adipose tissue. They are present, however, in all other tissues and have certain structural functions and physiological roles in the cells. The lipids of the brain are mostly cholesterol, phospholipids and cerebrosides. But they are low neutral fat. The adrenal cortex, testes, ovary and

\(^{10}\text{Ibid., P. 209.}\)
corpus luteum have high content cholesterol. The major part of the lipids of our diet consists of neutral fat with smaller amounts of phospholipids, steroids and glycolipids.

Lipids are transported through blood plasma, from their sites of origin to their sites of utilization or storage, the level of plasma lipid at any time can be considered to represent the net balance between production, utilization and storage. Lipids, through hydrophobic compound, are present in plasma as stable hydrophilic lipoprotein complexes. These complexes are combination of triacyl glycerols and phospholipids, with cholesterol and plasma protein.

Chylomicrons: The fat derived from intestinal absorption is transported to storage depot as chylomicrons, which consist of 1 percent of protein and 99 percent of lipid. The lipid fraction contains triacyl glycerols (88 percent), which are kept as stable emulsion by combining with phospholipids (8 percent) and cholesterol (4 percent).

Very low density lipoprotein (VLDL): The triacyl glycerols derived from the liver are transported as very density lipoprotein consisting of protein (7-10 percent) and total lipids (90-93 percent). This density is 0.96-1.006. The total lipids are made up of 56 percent triacyl glycerols, 20 percent phospholipids, 15 percent cholesterol ester, 8 percent free cholesterol
and one percent free fatty acids. The Svedberg floatation unit of VLDL is 20-400.

Low Density Lipoprotein (LDL): These are formed from VLDL during circulation in blood. Their Sf values are 2-20 and density of 1.019-1.063. LDL has 21 percent protein and 79 percent lipids. The total lipids are made up of 14 percent free cholesterol and 1 percent free fatty acids. LDL is rich in cholesterol (58 percent) and carrier of cholesterol from the liver to the peripheral cells (direct cholesterol transport).

High density lipoprotein (HDL): There are three fractions of high Density Lipoproteins, HDL1, HDL2 AND HDL3 of density 1.063-1.210. HDL2 contains 33 percent protein and 67 percent total lipid in which Phospholipids and cholesterol fractions are greater than triacyl glycerol. It has 16 percent triacyl glycerols 43 percents Phospholipids and 41 percent cholesterol, HDL is very low. Changes in HDL run parallel to those of HDL2. HDL (reverse cholesterol transport) transports Cholesterol from the peripheral cells to the liver.

Free fatty acids: The free fatty acids derived from adipose tissues and released by lipolytic hormones are transported as FFA-albumin complex (contains 99 percent albumin and one percent fatty acids). Some 25-30 molecules of free fatty acids are present in combination with a molecule
of albumin. The FFA of plasma are metabolically the most active and have a half-life of only 2 - 3 minutes.

**Triglycerides or Triacyl Glycerol**

Fat has a basic usable form in the body fatty acid. Fat taken in through diet are digested, producing fatty acid and substances called Glycerol. After fatty acid is absorbed by intestinal cells, they are converted into Triglycerides. Triglycerides are broken down, into one mole of glycerols and three moles of free fatty acids and released.

Triglyceride represents the storage form of fatty acid that is found in the adipose (fat) tissue and in the skeletal muscle. When needed by the muscle the fatty acid from the adipose tissue are released from the triglycerides and are transported by the blood to the muscle, where they are oxidized.

Mobilization of fatty acid from the body fat stores to the muscle is an important consideration with respect to the reduction of body weight through the loss of body weight.

There are two major fuel form of fat available to the muscle during exercise.

1. Fatty acid transported by the blood stream from adipose tissue - during prolonged exercise of moderate intensity these blood
Borne fatty acid represent a major source of fuel for ATP production by the oxygen system.

2. Triglyceride stores within the skeleton muscle, studies show that the T.G are used to considerable extent during prolonged endurance activities.

**Hemoglobin**

Heme is a prosthetic group of some conjugated protein in the body like hemoglobin, myoglobin and cytochromes, which are of paramount importance in respiration.

Hemoglobin is the combination of heme with globin through different linkage like salt linkages polar and van der Waal’s forces gives function of transport of oxygen and to a minor degree carbon-di-oxide during respiration. The oxygen that is inhaled should be taken to each cell to be used for cellular respiration by mitochondria in the utilization of nutrition like glucose. Heme alone without globin cannot combine with oxygen reversibly. Human hemoglobin contains 0.34 percent of iron which corresponds to the molecular weight of 16400. But, osmotic pressure weights of about 65000 for hemoglobin suggesting 4 irons per atoms per molecule of Hb.

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Yoga

Yoga is a way of life, an integrated system of education for the body, mind and inner spirit. The art of right living was perfected and practiced in India thousands of years ago but, since yoga deals with Universal truth its teachings are as valid today as they were in ancient times. Yoga is a practical aid, not a religion and its techniques may be practiced by Buddhist, Jews, Christians, Muslims, Hindus and Atheist alike. Yoga is union for all.

Over the centuries four different paths of yoga have been developed. They are

1. Karma Yoga - Active path - It is selfless service, works in both Physical and mental, eliminates ego, but it works on Spiritual levels.
2. Jnana Yoga - Philosophical path - An Intellectual approach (Viveka - discrimination, Vairagya - dispassion to spiritual).
3. Bhakthi Yoga - Devotional path - teaches techniques for their sublimation such as Chanting, Prayer and repetition of Mantras. Emotional energy is channeled into devotion, tuming anger, hatred and jealously in a positive direction.
4. Raja yoga - Scientific path – It prescribes a Psychological approach, based on practical system of concentration and control of the mind. Right conduct, a healthy body and steady posture, breath control and withdrawal of senses.

The eight stages or limbs of Raja yoga called Astanga Yoga. They are:

1. *Yamas* (abstension) - Truth, non-violence, control of sexual energy, non-stealing, non-covetousness.
2. *Niyamas* (observances) - Austerities, purity, contentment, study, surrender of the ego.

Hatha Yoga is a form of Raja yoga which emphasizes only Asanas and Pranayama.12

**Asanas**

The third limb of yoga is asana or posture. Asanas bring steadiness, health and lightness of limbs. A steady and pleasant posture produces mental equilibrium and prevents fickleness of mind. Asanas are not merely gymnastic exercises they are postures. Asanas have been evolved over the centuries so as to exercise every muscle nerve.

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and gland in the body which includes fine Physique and keep body free from disease.

The names of the asana are significant and illustrate the principle of evolution. Some are named after Vegetation like the tree (Vrksa) and the lotus (Padma), some insects like the locust (salabha) and the Scorpion (Vrschika), some aquatic animals and amphibians like the fish(Matsya), the tortoise (Kurma) the frog (bheka or manduka), or the crocodile (nakra), some birds like the cock (kukkuta) the heron (baka), peacock (mayura), the swan (hamsa) some quadruped the dog (svana) the horse (Vatayana), the camel (Ustra) and the lion (simha). Creatures, that crawls like the serpent (bhujanga), human embryonic state (garabha pinda). Asanas are named after legendary heros like virabhadra and Hanuman, son of the wind. Sages like Bharadvaja, Kapila, Vasistha, Visvamithra are remembered by having asana named after them. Some asanas are also called after god, of the Hindu pantheon like Avatars.

**Pranayama**

‘Prana’ means breath, respiration, life vitality wind, energy or strength. It also called vital breath. ‘Ayama’ means length, expansion, stretching or restraint Pranayama thus connotes extension of breath and its control. The control is over all functions of breathing, namely
(1) Inhalation or Inspiration which is termed as Puranka (filling up)
(2) Exhalation or expiration which is called rechaka (emptying the lungs) and
(3) Retention or holding the breath, a state where there is no inhalation or exhalation which is termed as Kumbhaka.

Pranayama practices the nostrils nasal passages and membranes, windpipes lungs and diaphragm are the only parts of the body actively involved. These alone feel the impact of the body of prana the breath of life. Improper practice of Pranayama leads to respiratory diseases and nervous system. By its proper practices one is freed from most disease.13

**Aerobic Fitness**

Aerobic (with oxygen) endurance is generally characterized by modern contraction of large muscle group for an extended period of time, during which maximum cardio respiratory adjustment are necessary, as in swimming, bicycling and distance running. Since aerobic endurance refers to ability of heart, vascular system and lungs to provide oxygen and nutrient to working tissues and to remove the waste product of metabolism, it is quite clear that the primary goal of aerobic

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endurance training is to improve and/or increase the capacity and efficiency of three systems in order that a greater amount of oxygen can be supplied to the cells. This type of training is often referred to as cardiorespiratory or cardiovascular training.  

Aerobic dance a way to fun as well as a way to be fit. Muscle building exercises, fat burning movements and stretching into routine are some aerobic exercises played on music. Many dance forms are used, including disco, jazz, and ballet. All ages can benefit from aerobic dance.

STATEMENT OF THE PROBLEM

The purpose of the study was to investigate the effect of selected Yogic Practices (Asana & Pranayama) & Aerobic exercises on Somatotype Components and its relationship with selected Health Related Physical Fitness Components such as Muscular Strength & Endurance, Cardiovascular Endurance, Muscular Flexibility and Body composition, and Bio-chemical variables of collegiate men.

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HYPOTHESES

Keeping in view the statement of the problem, it was hypothesized that:

1. There would not be any significant effect on Somatotype components such as Endomorphic component, Mesomorphic component and Ectomorphic component as a result of fourteen weeks of training on selected Yogic Practices & Aerobic exercises.

2. There would not be any significant effect on Health Related Physical Fitness Component such as Strength endurance, Muscular flexibility, Cardio-vascular endurance and Body composition as a result of fourteen weeks of training on selected Yogic Practices & Aerobic exercises.

3. There would not be any significant effect on Bio-chemical changes such as Fasting Blood Sugar (FBS), Hemoglobin (Hb), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), Triglycerides (TG), Total Cholesterol (TC) and Very Low Density Lipoprotein (VLDL) as a result of fourteen weeks training on selected Yogic Practices & Aerobic exercises.
4. There would not be any significant relationship among Somatotype components such as Endomorphic component, Mesomorphic component and Ectomorphic component on select Health Related Physical Fitness Variable and Bio-chemical variables as a result of fourteen weeks training on selected Yogic Practices & Aerobic exercises.

**DELIMITATION**

1. For the purpose of this study forty five college men were selected at random from the colleges around the Puducherry, and they were staying in the Government hostel during the training period.

2. The training period was limited to 14 weeks.

3. The tests were administered for College men age ranged from 18 to 25 years.

4. Motivational techniques were not used to attain maximum performance.

5. The subjects were divided into three groups. The Control group consisted of 15 subjects, who were not undergone any training. The Yogic group consisted of 15 subjects, who had undergone asanas and pranayama practices. The Aerobic group consisted of 15 subjects who had undergone rhythmic aerobic exercises.
6. The Harpend skinfold caliper was used to find the skinfold thickness of the subjects.

7. The skinfold from seven sites in the body was tested to assess percent body fat.

8. The Cooper test (Twelve minutes run or walk) was used to find the cardiovascular endurance.

9. Only shoulder, trunk, hip and back flexibility were measured.

10. Only arm and abdominal strength test were used to find a strength endurance.

11. The Bio-chemical variables such as, LDL, HDL, TG, TC, VLDL, FBS and Hb were considered.

**LIMITATION**

1. The participation in sports competition and other physical activities by the subjects during the training period could not be controlled.

2. The effect of unidentified and uncontrollable factors like food habits, lifestyle that might have influenced the selected test item is accepted as limitation.

3. Previous training and experience were not taken into consideration.
4. The changes in climate condition such as temperature, atmospheric pressure humidity during the training as well as testing period could not be controlled and their influence on the result of the study was recognized as a limitation.

**DEFINITION OF THE TERM**

**Somatotype**

There is some difference between Body build, Body size and Body composition. These are the main factors considered for the study. The Body build refers to morphology or the form and structure of the body.

Sheldon assisted by Stevens and Trucker, after extensive research came to the belief that human being could not be classified into first three physique types, but that nearly all the three individual are mixture. However, they did designate three primary components of body build that provide first order criteria for differentiating among individuals. The names of the three components were derived from three layers of embryos namely Endomorph, Mesomorph & Ectomorph.

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**Endomorphic components**

The first component of the somato type is called Endomorphic component. The Endomorph is named after endoderm, from which functional elements of digestive system emanate. Endomorphy is measured by the fat underneath the skinfold in relation to height.

**Mesomorphic component**

The Second component of the somatotype is called Mesomorphic component Mesomorphy named after the mesoderm, from which Anthropometric measurements of muscles and bones are assessed. Mesomorphy is measured by joint widths (a measure of skeletal size) and lean limb girths (as a measure of lean muscle mass, corrected for fat mass) in relation to height.

**Ectomorphic component**

The Third component of the somatotype is called Ectomorphic component. Ectomorph is named after the ectoderm, from which develops sensory organs. Ectomorphy is measured as the Ponderal index (a measure of mass per unit in kg and height in cms).
Heath-Carter

For assessment of Body Build and composition somato typing system is used. It is a Sheldon system of Classification proposed to assess by Heath-Carter\textsuperscript{16} somato-rating. Heath-carter rating helps to assess the first, second and third component of Somatotype.

Yoga

The word Yoga is derived from Sanskrit root ‘yuj’ means to mind and yoke. It is true union of our will with the will of God. Our ancient stages have suggested eight sages of yoga to secure purity of body, mind, soul and final communion with God. These eight stages are known as Ashtanga Yoga.\textsuperscript{17}

Asanas

Asanas is a state of being, and by definition there could be thousands of probable states, which one can achieve. Pathanjali has defined asana ‘Sthir Sukha Asanam’ that is ‘Asana means steady and comfortable posture’.\textsuperscript{18}


\textsuperscript{18} Jack Peter, \textit{Master the Yogic Power}, (Delhi: Punithi, Abisheek Publication, 2006), P.37.
Pranayama

Pranayama means breath control. In Sanskrit, Prana means breath and ayama means a control. In modern literature, on yoga prana, means even in the compound Pranayama, has been often interpreted to means a subtle psychic force or a subtle cosmic element.\(^{19}\) According to Geore,\(^{20}\) prana means a subtle life Geore which provides energy to different organs (including mind) and also many vital processes (eg. Circulation, respiration etc.,) Ayama means signifies the voluntary effort to control and direct this prana.

Aerobic Fitness

Aerobic fitness has been defined as the ability of the lungs, heart, and blood vessels to deliver adequate amount of oxygen and nutrients to the cells to meet the demands of prolonged activity. Aerobic capacity is usually assessed by measuring maximal oxygen consumption (VO\(_2\) max). The oxygen required for the break down of carbohydrate and fat comes from air we breathe.\(^{21}\)

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\(^{19}\) Swami Kuvalayananda, Pranayama, (Bombay: Popular Prakashan, 1966), P.35.


**Strength Endurance**

Strength Endurance is the ability to overcome high resistance or to act against high resistance under condition of fatigue. Strength Endurance can be form of static of dynamic strength depending on the fat whether the movement is static (Isometric) and dynamic (isotonic).\(^{22}\)

**Flexibility**

Johnson and Nelson\(^{23}\) defined flexibility as the ability of an individual to move the body and its part through a wide range of motion as possible with undue strain to the articulation and muscle attachment.

**Cardiovascular Endurance**

Cardiovascular endurance is the body's ability to do large muscle work, for example moving the body over a period of time. This ability is dependent on the cardiovascular system's ability to pump blood and deliver oxygen through your body. Cardiovascular endurance should be a central component of your overall fitness program. Improving cardiovascular endurance not only increases the supply of oxygen and energy to your body, but also decreases your risk of important diseases.

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that may shorten your life, such as heart disease, stroke and high blood pressure.\textsuperscript{24}

**Body composition or Percent body fat**

The amount of body fat (adipose tissue) that is stored is determined by two factors: the number of fat storing cells, or adiposities and the size, or capacity, of the adipocytes. It has been shown that the number of fat cells cannot be effectively decreased by exercise or dietary restriction once adulthood is reached during weight reduction involving fat loss in adults, it is the size but not the numbers of adiposities that decreases.\textsuperscript{25}

**Skinfold Measurement**

Body fat composition may also be reasonably estimated from measurement of subcutaneous fat as reflected by skinfold thickness. The thickness of the fold reflects the amount of fat underneath the skin and it is measured in millimeter with the skinfold caliper.\textsuperscript{26}

**Blood lipids**

Lipids may be defined as organic substances insoluble in water but soluble in organic solvent like Chloroform ether and benzene.

\textsuperscript{24} Werner Op. cit., P.42.


Lipoproteins are complex lipid. Lipoproteins are formed with by combination of prosthetic group. eg. Serum lipoprotein like LDL, HDL, VLDL, Chylomicrons etc.  

**Low Density lipoprotein (LDL)**

Low Density Lipoprotein are synthesized in plasma VLDL. The function is to transport cholesterol from liver to peripheral tissues. Low-density lipoprotein (LDL) cholesterol is being referred as bad cholesterol. High LDL cholesterol leads to a buildup of cholesterol in arteries. The higher the LDL level in your blood, the greater chance you have of getting heart disease.

**High Density lipoprotein (HDL)**

High-density lipoproteins are synthesized in liver and intestine. HDL helps to transport free cholesterol from peripheral tissue to the liver where it can be categorized. It is a reverse cholesterol transport. High-density lipoprotein (HDL) cholesterol is sometimes called good cholesterol. The higher your HDL cholesterol level, the lower your chance of getting heart disease.

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28 Ibid.

29 Ibid.
Total Cholesterol (TC)

Total Cholesterol is a measure of approximate cholesterol level in the blood consists of total LDL, HDL and one fifth of Triglycerides. The increase of total cholesterol level to 200 is the risk of heart problem.

Very-low-density lipoprotein (VLDL)

Very-low-density lipoprotein cholesterol is synthesized liver which transports of endogenous triglycerides from liver to peripheral tissues. VLDL is one of the three major types of lipoproteins. Each type contains a mixture of cholesterol, protein and triglyceride, but in varying amounts. LDL contains the highest amount of cholesterol. HDL contains the highest amount of protein. VLDL contains the highest amount of triglyceride, a blood fat. Like LDL cholesterol, VLDL cholesterol is considered a type of "bad" cholesterol because elevated levels are associated with an increased risk of coronary artery disease.

Triglycerides (TG)

Triglycerides are fatty acids that are required from optimal health and cannot be synthesized by the body are called as essential fatty acid. Which is supplied through diet. TG is major storage and transport from fatty acid. TG is highly concentrated stores metabolic energy which have two significant form of metabolic fuel, polysaccharides such

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30 Ibid.
as glycogen. The main function serves more energy stores and supply energy. Hormones regulate the release of triglycerides from fat tissue so they meet the body's needs for energy between meals.\(^{31}\)

**Fasting Blood sugar**

Glucose is the primary energy source for the human body. After absorption, the metabolism of all human body hormones proceeds according to the body requirement. This metabolism results in energy production by conversion of carbon-dioxide and water, storage of glycogen in liver or triglycerides in adipose tissues and conversion to keto acids or amino acid or protein. The concentrations of blood glucose in the blood are regulated by a complex interplay of multiple pathways modulated by several hormones. Normal glucose disposal depends on ability of pancreas to secrete insulin, the ability of the pancreas to secrete insulin, the ability of insulin to promote uptake of glucose into peripheral tissues and the ability of insulin to suppress hepatic glucose production.\(^ {32}\)

\(^{31}\) Ibid.

**Hemoglobin (Hb)**

Iron rich substances inside red blood cells called Hemoglobin. The blood becomes bright when hemoglobin and oxygen are combined. The blood turns dark red when oxygen transfers from the hemoglobin into the body cells.  

**SIGNIFICANCE OF THE STUDY**

1. The findings of the study will provide guidance to physical educationist and coaches to analyse the body type or somatotype components of the athletes which help to adopt the proper training schedule.

2. The findings of the study will add to the quantum of knowledge on effect of the Yogic practices and the Aerobic exercises on physical, physiological, body composition and bio-chemical changes.

3. The result of the study will be helpful to the physical educationist and coach to adopt the Yogic practices or aerobic exercises.

4. The result of the study will help to find the relationship between somatotype components and health related physical fitness such as physical, physiological and Body composition of variables and

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Biochemical variables with the effect the Yogic practices and Aerobic exercises of fourteen weeks training.

5. The result of the study will help to impart the Yogic practices or Aerobic Exercises to overweight and obese people depending on the age group and health status or lifestyle.

6. The result of the study will help to overcome the lifestyle diseases.

7. The result of the study will help to find the relationship between somatotype and physical fitness components and biochemical variables.