Chapter-I

INTRODUCTION
Physical wellness dimension has become an important factor of interest among the people. This dimension of wellness has been recognized as a significant factor of prevention from various degenerative diseases like Cardiovascular Diseases, Diabetes Mellitus, Obesity, Certain types of cancers. Scientific way of exercise training is the only way to achieve this physical wellness. Physical Wellness denotes the efficient functioning of various systems of the body so as the body can counteract and control the degenerative factors of various degenerative diseases as mentioned. These diseases are also now recognized as Lifestyle disorders and synonymously they may also be termed as Hypokinetic diseases. Since, the occurrence of these diseases is inversely related to the physical activity involvement. Decreasing physical activity trends across the globe has seen rapid increase in these types of diseases especially the cardiovascular diseases like Hypertension, Atherosclerosis, Coronary Heart Diseases and metabolic disorders like Diabetes Mellitus.

Physical activity involvement increases physical fitness of the individuals and this in turn enhances the capacity and opportunity of individuals to engage in more intensified physical activity for better health benefits. Physical fitness per se is not directly linked to the enhanced health status as some individuals though possess high levels of physical fitness may still carry degenerative disease factors.

1 Siddiqui NI, Nessa A, Hossain MA et al. (2010) have advocated regular physical activity of different types to keep functional efficiency of different systems of the body so that the degenerative disease affecting different systems may be prevented. They have recognized the necessity of promoting regular physical activity among public through extensive public awareness programs and creation of facilities for various physical activities.
Several scientific studies in the field of fitness management have conclusive evidences that the regular involvement in physical activity can prevent several degenerative diseases and as well can control them effectively by bringing positive changes in several risk factors and bio markers of these diseases. Woolf K, Reese Ce, Mason et. al (2008) found significant inverse correlations between activity (steps per day based on Pedometer study) and body mass index, insulin level, CRP concentration, leptin level, waist circumference, and body fat among adult women. Significant positive correlations were found between age and body mass index, total serum cholesterol level, low-density lipoprotein cholesterol level, serum triglyceride level, leptin level, plasma glucose level, CRP concentration, waist circumference, and body fat.

Coronary Artery Disease (CAD) has significant correlation to the increments in certain bio markers like Circulating lipids, cholesterol sub fractions along with the precipitating factor the presence of hypertension.

Atherosclerosis and Coronary Artery Disease: George A Brooks and Thomas D Fahey (1990) have outlined the process of atherosclerosis. Atherosclerosis starts as an injury to arterial endothelium because of various factors. The injury to this endothelial wall may be because of chronic Hypertension, wear and tear and toxic chemicals. The injury at endothelium allows substances in the plasma, like Cholesterol to penetrate into the intima of the artery. Ordinarily, endothelial cells act as a barrier to cholesterol and other lipids. However, an injury to the endothelial cells results in their inundation with blood fats. This process causes a proliferation of the arterial smooth muscle that eventually results in it’s encroachment into the intima and arteriovascular space. Circulating platelets and monocytes are thought to release
substances at the injury site that stimulate the migration of smooth muscle cells also fill with fats. In addition blood cells called platelets cluster around the exposed smooth muscle and release substances that are thought to result in further proliferation of the arterial smooth muscle. The smooth muscle cells have difficulty in removing cholesterol, so this substance tends to accumulate, gradually increasing the size of the lesion. This process is accelerated by a variety of conditions such as Hyperlipidemia and Hypertension. Eventually, the plaque calcifies and connective tissue forms producing a narrowed and rigid blood vessel. Once, the vessels have been narrowed blood flow may be impaired or the vessel can be blocked by a clot, resulting in a Coronary Thrombosis. In summary, atherosclerosis develops because of smooth muscle proliferation, lipid accumulation and connective tissue formation in the arterial intima.

It is observed that there is direct strong relationship between blood pressure ie Hypertension, cigarette smoking total cholesterol(lipid profiles), stress and tension, family history, some haemorheological factors like platelet count, plasma fibrinogen levels. The most important biomarkers of CAD seem the resting lipid profiles of the individuals.

Hyperlipidemia and atherosclerosis

Higher levels of circulating lipids in the blood than normal levels may be considered as Hyperlipidemia and epidemiological studies indicate a general trend towards a greater incidence of Atherosclerosis and incidence of Cardio Vascular Disease among people with hyperlipidemia. Hypercholesterolemia (HCH) is characterized by an increase of the total-Cholesterol and LDL-cholesterol in serum, and is generally recognized as a risk factor of atherogenesis, oxidative stress and oxidatively modified LDL play a crucial role.
Ondrejovicova I, Muchova J et al (2010) conducted a study on children with elevated total cholesterol (above 4.5 mmol/l) which included. Parameters of lipid profile, lipophilic vitamins and antioxidants and markers of oxidative damage to lipids (lipoperoxides and 8-isoprostanes) and they found that children with hypercholesterolemia have significantly increased parameters of lipid profile and these are gender dependent only in HDL-cholesterol (1.27 ± 0.10 mmol/l in boys vs. 1.53 ± 0.07 mmol/l in girls; p<0.05). In addition they also found that children with HCH have decreased total antioxidant capacity of serum (TEAC) (about 19.64%, p<0.05) and increased lipoperoxides (LP) (about 45.73%, p<0.001). In conclusion, they confirmed relation between hypercholesterolemia and oxidative stress and effect of gender on these processes already in childhood. Since the atherosclerotic process begins in childhood before clinical symptoms, early detection of hypercholesterolemia and oxidative stress is important in later atherosclerosis prevention.

Lipid profiles and Circulating lipids as precipitating factors of atherosclerosis

More body fat percentage leads to the risk of more circulating fats in the shape of FFAs (free fatty acids) and cholesterol. Excessive body fat can elevate the triglyceride concentrations in the circulation. Hence, excessive fat percentage in body composition is a risk factor. But, various subcomponents of cholesterol are to be considered, like HDL (high density lipoproteins), VLDL (very low density lipoproteins), LDL (intermediate level density lipoproteins) and LDL (low density lipoproteins). Among these HDL cholesterol acts as a scavenger of LDL and reduces the dangerous LDL and other low-density lipoproteins, and hence, HDL cholesterol favorable concentrations are good for health. Metabolic dislipidemia in which the circulating HDL cholesterol decreases significantly is pro-atherogenic risk factor.
Koba S and Hirano T (2011) claimed that Dyslipidemia is the most important risk factor for atherosclerosis. LDL, VLDL remnants, chylomicron remnants, small dense LDL (sdLDL), Lp(a), and oxidized LDL are pro-atherogenic and HDLs are anti-atherogenic lipoproteins. Not native LDL but modified LDL causes to the formation of foam cells. Among LDL particles, smaller denser LDLs (sdLDL) are more susceptible to oxidation, and have longer residence time and higher affinity to the extracellular matrix. They have identified that the delayed clearance of triglyceride-rich lipoproteins results in the formation of sdLDL which is associated with insulin resistance and postprandial hyperlipidemia. HDL plays an important role in the reverse cholesterol transport as well as having antiinflammatory and antioxidative effects. Dysfunction of HDL is an independent pro-atherogenic factor. In addition, decreased HDL-cholesterol is a feature of the metabolic dyslipidemia.

The circulating lipids in the blood may be categorized into five types according to the density, composition and size. They are Very Low Density Lipoprotein (VLDL), Low Density Lipoproteins (LDL), Intermediate Density Lipoprotein (IDL), High Density Lipoproteins (HDL) and Chylomicrons. HDL subfractions are HDL-1, HDL-2 and HDL-3. The percentage of LDL is most significant factor than others as this factor is highly influencing factor for atherosclerotic plaque. With its enzyme called Lecithin Cholesterol Acid Transferase (LCAT), the HDL cholesterol scavenges the cholesterol possessed by the LDL into liver, thereby HDL acts as reverse transfer system to LDL for cholesterol. High prevalence of LDL in blood is a strong precipitating factor for atherosclerosis of arteries. It is also low HDL cholesterol concentration than normal limits viewed as potential causative factor for atherosclerotic condition. Physical activity and especially Cardio respiratory endurance runs are helpful in controlling these bio markers of the CHD.
Kelly G A and Kelly K S (2006) in their meta-analysis on aerobic exercise and Cholesterol levels, which contained Forty-nine randomized controlled trials representing up to 67 outcomes from 2,990 men (1,741 exercise, 1,249 control) Using random-effects modeling, found statistically significant improvements for Total Cholesterol (TC), HDL-C and Triglycerides(TG), and a trend for decreases was observed for LDL-C. The changes were equivalent to improvements of 2% for TC and HDL-C, 3% of LDL-C, and 9% for TG. They have concluded that Aerobic exercise reduces TC and TG and increases HDL-C in men 18 years of age and older.

Abdominal obesity and elevated Triglyceride levels: Elevated Triglyceride (TG) concentrations reflect poor lipid metabolism among the individuals. This is generally seen among the individuals with abdominal obesity and poor cardiovascular fitness levels. Even the metabolic dyslipidemia or reduced HDL concentrations may be because of the elevated TG levels among individuals. Charles Couillard, Jean Pierre Despress et al. (2001) have identified that regular endurance exercise is particularly helpful in improving lipid lipoprotein profile of individuals with low HDL cholesterol levels along with abdominal obesity and elevated TG concentrations. Hence, TG metabolism through exercise program is the potential way to tackle the Dyslipidemia especially among those with abdominal adiposity.

It may not be possible to enhance the HDL cholesterol levels among the individuals with low baselevel HDL levels through exercise training, especially when the individuals are non obese, normotriglyceridemic and insulin sensitive. Exercise training may be beneficial to enhance the HDL cholesterol levels when the individuals are high of their base level TG values before training is commenced.
**Cardiovascular efficiency and fitness**

Cardiovascular efficiency or Aerobic fitness is an important component of Health Related Fitness as this fitness is essential to conduct aerobic endurance exercise programs at desired intensity and for desired duration to derive the desired health benefits. Especially, the aerobic endurance training in any form is quite useful and effective in initiating the required metabolic cascading and can bring positive changes in resting state lipid profiles of individuals.

Functional capacity of cardiovascular system may be denoted by several objective and subjective criteria. VO$_2$ max capacity of individual may be considered as one important factor which can describe the cardiovascular endurance capacity. But, there are other criteria like cardiac output and resting heart rate(RHR) are also taken into consideration.

Cardiac output = Heart Rate X Stroke Volume.

Heart rate may be at rest or during exercise. Stroke volume denotes the amount of blood pumped out from the left ventricle into the aorta in one systole. Hence, Cardiac output denotes the amount of blood pumped out by the heart’s left ventricle in one minute time and it may be during resting time or during the exercise. Endurance training tends to lower the resting heart rate and this phenomenon may be called as ‘Bradycardia”. This phenomenon may be because of the increase in the stroke volume among aerobically trained individuals. Hence, the trained individuals can have more margin of heart rate because of the lower resting heart rate and so an aerobically trained individual may be more efficient during the aerobic exercise programs.
Exercise metabolism and lipid profiles of individuals

Aerobic exercise and aerobic metabolism

When oxygen is available in sufficient quantities, aerobic metabolism provides energy for the working muscles. While the breakdown of glucose from glycogen is same for aerobic metabolism as like of anaerobic metabolism, but the pyruvic acid molecules are not converted to lactate, instead they diffuse from the sarcoplasm fluid across the mitochondria membrane to the inside of the mitochondria, where a series of chemical reactions take place simultaneously. Performances of long duration activities like recreational jogging, long walking are aerobic activities. While the anaerobic break down of glycogen and phosphagens contribute major portion at the beginning of this sort of exercise, the energy provided for this type of work after few seconds into exercise will be from aerobic breakdown of pyruvate and free fatty acids. As the work prolonged, and the glucose supply is nearly depleted, a greater contribution of the energy comes from the stored fat as well as from the fatty acids of the blood.

Especially when the exercise is sustained for more minutes at a comfortable intensity, the aerobic metabolic pathway dominates in the energy supply to such exercise. More free fatty acids are mobilized from the adipose tissue through the release of lipolytic enzymes. Also the Plasma Adiponectin concentration may be an influencing factor in fat oxidation. Total adiponectin and other Oligomer forms of Adiponectin during the exercise regimen may determine the amount of fat oxidized during the exercise. Different intensities of aerobic training may impose different demands on the metabolic cascades and may cause differently for the exercise concentrations of adiponectin oligomers. There were studies supporting the increments in plasma total adiponectic due to aerobic training and consequent increase in the capacity of fat oxidation.
8. Jurimae J, Kums T, Juriame T. (2010) in a study evaluated, whether circulating adiponectin concentration is associated with physical activity (PA) level in healthy older females using the accelerometry, which objectively measured minute-by-minute movement to assess PA volume and intensity performed by elderly females. In addition, body composition, leptin and insulin resistance values were measured to assess the influence of these parameters on the possible relationship between adiponectin and PA levels in this specific age group of older women. On 49 women (mean age: 73.6 +/- 4.2 years), adiponectin, leptin, insulin resistance, body composition and 7-day PA parameters were measured. Average daily accelerometer step counts and time spent in different PA levels were obtained from 7-day PA measurement. Average daily accelerometer step-count was 7,722 +/- 3,069 steps day (-1) and the recommended 150 min weekly of at least moderate/vigorous PA in bouts of at least 10 min was achieved by 71.4% (35/49) of the participants. They found that plasma adiponectin concentration (16.0 +/- 6.1 microg ml(-1) ) was related (P < 0.001) to steps per day (r = 0.438) and leptin (r = -0.443) values. Multivariate regression analysis further revealed that only steps per day and leptin were independent predictors of circulating adiponectin concentration in healthy elderly females. They have concluded that being physically active is associated with better adiponectin concentration and a reduced risk of having metabolic disease risk in the specific group of healthy elderly females.

With aerobic training the mobilization of fats from various sources in the body may be done effectively causing changes in lipid profiles of the individuals who train aerobically regularly. There are many forms of aerobic training like swimming, cycling, Jogging, dancing, trekking, skiing etc. Aerobic exercises in general are favorable in utilizing the fat resources of the body more effectively especially among
the aerobically trained individuals. Aerobic exercises regularly done may be useful in influencing significantly and positively the lipid profiles of the individuals. Endurance exercise training improves plasma lipoprotein and lipid profiles and reduces cardiovascular disease risk.

Halverstadt A, Phares DA et al. (2007) studied the effect of endurance exercise training, independent of diet and body fat phenotypes, on plasma lipoprotein subfraction particle concentration, size, and composition as measured by nuclear magnetic resonance (NMR) spectroscopy. They hypothesized that 24 weeks of endurance exercise training would independently improve plasma lipoprotein and lipid profiles as assessed by both conventional and novel NMR measurement techniques. One hundred sedentary, healthy 50- to 75-year-olds following a standardized diet was studied before and after 24 weeks of aerobic exercise training. Lipoprotein and lipid analyses, using both conventional and NMR measures, were performed at baseline and after 24 weeks of exercise training. It was observed that the relative and absolute maximum oxygen consumption increased 15% with exercise training. They have also found that the most lipoprotein and lipid measures improved with 24 weeks of endurance exercise training, and these changes were consistently independent of baseline body fat and body fat changes with training. It was found, with exercise training, total cholesterol, triglycerides, and low-density lipoprotein cholesterol (LDL-C) decreased significantly (2.1+/-.1.8 mg/dL, P=.001; -17+/-.3.5 mg/dL, P<.0001; and -0.7+/-.1.7 mg/dL, P<.0001, respectively), and high-density lipoprotein cholesterol subfractions (HDL3-C and HDL2-C) increased significantly (1.9+/-.0.5 mg/dL, P=.01, and 1.2+/-.0.3 mg/dL, P=.02, respectively). Particle concentrations decreased significantly for large and small very low-density lipoprotein particles (-0.7+/-.0.4 nmol/L, P<.0001, and -1.1+/-.1.7 nmol/L, P<.0001,
respectively), total, medium, and very small LDL particles (-100+/−26 nmol/L, P=.01; 
-26+/−7.0 nmol/L, P=.004; and -103+/−27 nmol/L, P=.02, respectively), and small 
HDL particles (-0.03+/−0.4 micromol/L, P=.007). Mean very low-density lipoprotein 
particle size also decreased significantly (-1.7+/−0.9 nm, P<0.0001) and mean HDL 
particle size increased significantly with exercise training (0.1+/−0.0 nm, P=.04).

From these findings they have concluded that 24 weeks of endurance exercise training 
induced favorable changes in plasma lipoprotein and lipid profiles independent of diet 
and baseline or change in body fat.

Different intensities and different forms of aerobic training could impose 
different demands on the metabolic system and endocrinal system and hence may 
bring different adaptations in metabolic cascades. Different intensities trigger 
different effects on the metabolic preferences leading to utilization of different 
metabolites and thereby causing changes in the resting levels of blood lipids and body 
composition.

**Strength training and resting metabolic rate (RMR)**

Strength training in the form of resistance training leads to muscle protein 
anabolism and may lead to both strength increments and muscle hypertrophy.
Increased muscle protein content demands more energy for resting biological 
purposes and causes for the increase in resting metabolic rate.  

Burd NA, Holwerda 
AM, Selby KC et al. (2010) aimed to determine if any mechanistic differences exist 
between a single set (1SET) and multiple sets (i.e. 3 sets; 3SET) of resistance exercise 
by utilizing a primed constant infusion of [ring-13C6]phenylalanine to determine 
myofibrillar protein synthesis (MPS) and Western blot analysis to examine anabolic 
signalling molecule phosphorylation following an acute bout of resistance exercise.
Eight resistance-trained men (24+/−5 years, BMI=25+/−4 kg m²) were randomly assigned to perform unilateral leg extension exercise at 70% concentric one repetition maximum (1RM) until volitional fatigue for 1SET or 3SET. Biopsies from the vastus lateralis were taken in the fasted state (Fast) and fed state (Fed; 20 g of whey protein isolate) at rest, 5 h Fed, 24 h Fast and 29 h Fed post-exercise. Fed-state MPS was transiently elevated above rest at 5 h for 1SET (2.3-fold) and returned to resting levels by 29 h post-exercise. They have found that exercise induced increase in MPS following 3SET was superior in amplitude and duration as compared to 1SET at both 5 h (3.1-fold above rest) and 29 h post-exercise (2.3-fold above rest). Phosphorylation of 70 kDa S6 protein kinase (p70S6K) demonstrated a coordinated increase with MPS at 5 h and 29 h post-exercise such that the extent of p70S6K phosphorylation was related to the MPS response (r=0.338, P=0.033). Phosphorylation of 90 kDa ribosomal S6 protein kinase (p90RSK) and ribosomal protein S6 (rps6) was similar for 1SET and 3SET at 24 h Fast and 29 h Fed, respectively. However, 3SET induced a greater activation of eukaryotic translation initiation factor 2B (eIF2B) and rpS6 at 5 h Fed. These data suggest that 3SET of resistance exercise is more anabolic than 1SET and may lead to greater increases in myofibrillar protein accretion over time.

There are some studies which do not favor the hypertrophy outcome through the resistance form of training. But, definitely the resistance form of strength training is favorable in bringing the positive changes in muscle protein content through the powerful muscular contractions inherent perse than the Growth Hormone and Testosterone interactions. 11. West DW, Phillips SM. (2010) have indicated that Testosterone supplementation acts via numerous mechanisms as a highly potent anabolic agent to skeletal muscle. Although growth hormone (GH) strongly affects collagen synthesis and lipolysis, as well as increasing lean body mass, it is not
anabolic toward the contractile (ie, myofibrillar) muscle tissue in healthy individuals. Exercise paradigms are designed based on the assumption (not necessarily evidenced-based mechanisms) that GH and testosterone facilitate anabolic processes that lead to skeletal muscle protein accretion and hypertrophy. Instead, their data indicated that exercise-induced hormonal elevations do not enhance intracellular markers of anabolic signaling or the acute postexercise elevation of myofibrillar protein synthesis. Furthermore, data from their training study demonstrated that exercise-induced increases in GH and testosterone availability are not necessary for and do not enhance strength and hypertrophy adaptations. Instead, their data lead to conclude that local mechanisms that are intrinsic to the skeletal muscle tissue performing the resistive contractions (ie, weightlifting) are predominant in stimulating anabolism. Clarifying both the role of hormones in replating muscle mass as well as the underlying basis for adaptation of skeletal muscle to resistance exercise will hopefully enhance and support the prescription of resistance exercise as an integral component of a healthy lifestyle.

The effort should also be to understand the effect of resistance form of strength training in controlling the resting lipid profiles of individuals.

Relevance of criterion variables (Resting Heart Rate, LDL cholesterol, HDL Cholesterol, VLDL cholesterol and Triglyceride levels) and experimental variable (progressive combined brisk walking, jogging and resistance form of strength training) in prevention of Atherosclerosis in general and Coronary Heart Disease: Regular Involvement in physical activity has been postulated as a healthy lifestyle factor, which improves the health status of the individual by slowly and gradually modifying the risk factors of many degenerative diseases like Coronary Heart
Diseases, Diabetes Mellitus, Hypertension, Certain types of cancers, Arthritis etc.
And also regular involvement in physical exercises improves the physical fitness levels of the individuals thereby allowing the individuals to take up higher order exercise programs to become more immune to degenerative diseases. Cardiovascular fitness which can be estimated through the VO_{2}max of the individual and also to certain extent by resting heart rate is considered as one important form of exercise which can influence positively on the several precipitating factors of atherosclerosis. Lower resting heart rate provides much larger Heart Rate Reserve (HRR) and capacity to take up higher intensities of aerobic exercise programs. Aerobic activities like brisk walking and jogging are helpful in improving the physical fitness levels and also may be helpful in regulating the precipitating factors of degenerative diseases. Brisk walking among youngsters may not prove as effective way when compared to the jogging in controlling the lipid profiles positively. The different intensities of aerobic running followed by brisk walking might work differently on the preference of the substrate type for energy purpose, in different proportions and hence there may be changes in lipid profiles of the individuals. Even the resistance form of strength training independently is a potential influencing variable on certain aspects of lipid profiles of individuals. But, there is severe shortage of information with regard to the effects of combined aerobic running and resistance form of strength training on lipid profiles of individuals especially on women.

Objective of the study

The study aimed to examine and analyze the effect of different progressive intensities of combinations of brisk walking, aerobic running and resistance training on the Resting Heart Rate (RHR), HDL-C, LDL-C, VLDL-C and Triglycerides among healthy, young and previously untrained Women.
Statement of the problem

The purpose of the study was to experiment, analyze and understand the effect of forty percent intensity, fifty percent intensity, sixty percent intensity and seventy percent intensity aerobic running for a period of five months on the selected precipitating factors which are considered as risk factors for degenerative diseases like Coronary heart disease, hypertension, diabetes etc on the previously untrained young women in the age group of twenty to twenty four years.

Experimental or Independent variable

Progressive intensities of aerobic jogging after brisk walking, followed immediately by resistance form of strength training in every session was the independent variable used in the experiment. The selected starting intensities for the study were forty, forty five, fifty, fifty five and by the fourth month of experimentation the groups worked in the intensities of fifty five, sixty, sixty five and seventy percent.

Criterion variables of the study

1. Resting Heart Rate (RHR): Heart rate of the individuals of the study when the individuals are at complete rest, when the individuals did not perform any physical exercise for at least twenty four hours prior to taking the pulse measurement of radial artery.

2. Lipid profile:

Only resting LDL cholesterol, resting HDL cholesterol, resting VLDL cholesterol and resting Triglycerides of the individuals have been verified through this study.
Delimitations

1. The study was confined only to seventy five young women selected from the various local colleges of Sri Venkateswara University area, and mainly from the exclusive women colleges of the university. The individuals were selected from out of the volunteers only.

2. The age group of the individuals ranged between 18 and 21 years.

3. Only four initial intensities of aerobic jogging and resistance form of strength training were incorporated.

4. The study was conducted on five groups of 15 individuals each assigned on random basis.

5. The individuals participated in the study were never involved in regular exercise training previously.

6. All the four groups of exercise practiced only four times a week and early in the morning.

7. Physiological factors or dependant variables were selected keeping in view of the Atherosclerosis of arteries.

8. The study was conducted for a total of five months in which one month was meant for orientation to the individuals and makes them ready to their intensity.

Limitations

1. Hereditary and endogenous factors could not be controlled, which might have influenced the results of the study, especially the HDL and LDL cholesterol levels. Only statistical baseline matching was done, both through randomization and through Analysis of Covariance.
2. Orientation period to the individuals to familiarize the exercise protocols and bring them to the level of experimental intensity through Heart rate monitors (watch type portable) may not be sufficient.

3. The time period of experimentation i.e. five months was considered as medium range period to elicit the responses physiologically and was based on the knowledge of relevant material.

4. The study was conducted during the months of September to January and this could have influenced the metabolic rate and this might show some impact on the results of the study.

5. The study was conducted on the individuals, having no prior experience of regular physical activity and this could have affected in the reinforcement levels of the individuals.

6. Social and economic status which might influence the food habits and lifestyle, which could also influence on the results significantly, could not be monitored and controlled totally. Only orientation on these aspects was provided to the individuals.

7. No special motivation was provided to undergo the experimentation and testing.

**Hypotheses**

The following three hypotheses were formulated at the start of the study to conduct verification with the results of the study.

1. Among all the four exercise protocols, fifty-five to seventy percent intensity exercises protocol would bring significant reduction in the Resting Heart Rate of the subjects.
2. Forty to fifty percent intensity starting exercise protocol would not cause any significant reduction in the Resting Heart Rate of the subjects.

3. Among all the four experimental exercise protocols, fifty five to seventy percent intensity exercises protocol would bring significant changes in the triglyceride measures of the subjects.

4. Among all the four experimental exercise protocols, fifty five to seventy percent intensity exercises protocol would bring significant reduction in the LDL-C and VLDL-C measures of the subjects.

5. Among all the four experimental exercise protocols, fifty five to seventy percent intensity exercises protocol would bring significant increase in the HDL-C measures of the subjects.

*Significance of the study*

Improving physical fitness and involvement in regular physical activity and keeping healthy lifestyle happens to be the prime intention of modern day humans. They are more and more concerned to live healthy and qualitative life without any ailments especially degenerative ailments. The physical educationists and fitness experts across globe are more concerned in developing different ways and means to harness the precipitating factors of the degenerative diseases.

The researcher endeavored in this research to contribute at least minute constructive information in this direction.

1. More constructive evidence will be available regarding the effect of various selected exercises or protocols of conditioning on the status of the selected risk factors, that cause or precipitate the occurrence of the diseases like Coronary Heart Disease, Atherosclerosis of small blood vessels, Diabetes Mellitus, Certain types of cancers, Arthritis etc.
2. This kind of specific experimentation on different intensities of aerobic jogging with resistance form of strength training on the lipid profiles of the individuals might contribute for the enhancement of knowledge in this area, and these results will be useful to create different protocols of exercise to different kinds of individuals basing on the individual requirements especially for women.

3. This study also creates a path to conduct several further researches in the same direction especially using the most fancied type of physical activity ie Aerobic dancing and its various forms with various intensities on different kinds of populations with different durations keeping in view of various precipitating factors and variables like bio markers of degenerative diseases.

4. This kind of research is very much useful in creating new ideas, and may lead to considerable knowledge on the effects of exercise on the individuals health related fitness.

**Important terms: (as appear in the introduction)**

**Hypertension**

High blood pressure or hypertension is a chronic medical condition in which the systemic arterial blood pressure is elevated. It may be either primary (essential) or secondary. Secondary hypertension is caused by conditions that affect the kidneys, arteries, heart, or endocrine system. Persistent hypertension is one of the risk factors for stroke, myocardial infarction, heart failure and arterial aneurysm, and is a leading cause of chronic kidney failure.

**Coronary Heart Disease (CHD):**

Refers to the failure of coronary circulation in supplying adequate circulation to cardiac muscle and surrounding tissue. It will be the common form of disease affecting the heart and an important cause of premature death by 2030.
**Atherosclerosis:**

It is a condition in which an artery wall thickens as the result of a build-up of fatty materials such as cholesterol. It is a syndrome affecting arterial blood vessel, a chronic inflammatory response in the walls of arteries, in large part due to the accumulation of macrophage white blood cells and promoted by low-density lipoproteins without adequate removal of fats and cholesterol from the macrophages by functional high density lipoproteins. It is commonly referred to as a hardening or furring of the arteries. It is caused by the formation of multiple plaques within the arteries.

**HDL Cholesterol**

High-density lipoprotein (HDL) is one of the five major groups of lipoproteins which, in order of sizes, largest to smallest, are Chylomicrons, VLDL, IDL, LDL, and HDL, which enable lipids like cholesterol and triglycerides to be transported within the water-based blood stream. In healthy individuals, about thirty percent of blood cholesterol is carried by HDL. The amount of cholesterol contained in HDL particles is termed as HDL cholesterol. HDL particles are able to remove cholesterol from atheroma within arteries and transport it back to the liver for excretion or re-utilization, which is the main reason why the cholesterol carried within HDL particles, termed HDL-C, is sometimes called "good cholesterol". Those with higher levels of HDL-C seem to have fewer problems with cardiovascular diseases, while those with low HDL-C cholesterol levels (less than 40 mg/dL or about 1 mmol/L) have increased rates for heart disease.
Body Mass Index

Body mass index is defined as the individual's body weight divided by the square of his or her height. BMI does not actually measure the percentage of body fat.

LDL cholesterol

Low-density lipoprotein (LDL) is one of the five major groups of lipoproteins, which in order of size, largest to smallest, are chylomicrons, VLDL, IDL, LDL, and HDL, that enable lipids like cholesterol and triglycerides to be transported within the water-based blood stream. Blood tests typically report LDL-C, the amount of cholesterol contained in LDL. In clinical context, mathematically calculated estimates of LDL-C are commonly used to estimate how much low density lipoproteins are driving progressions of atherosclerosis. Higher levels of LDL particles promote health problems and cardiovascular diseases, they are often called the bad cholesterol particles, (as opposed to HDL particles, which are frequently referred to as good cholesterol or healthy cholesterol particles).

VO₂max

VO₂ max (maximal oxygen consumption), is the maximum capacity of an individual's body to transport and use oxygen during incremental exercise, which reflects the aerobic capacity of the individual. VO₂ max is expressed either as an absolute rate in liters of oxygen per minute (l/min) or as a relative rate in milliliters of oxygen per kilogram of bodyweight per minute (ml/kg/min), the latter expression is often used to compare the performance of endurance sports athletes.
**Cardio respiratory Endurance**

It is the ability of the circulatory and respiratory systems to meet the demands of increasing intensity of exercise. One of the five factors of the Health Related Physical Fitness and by improving this ability the individual’s capacity to exercise increases.

**Degenerative disease**

A degenerative disease, also called neurodegenerative disease, is a disease in which the function or structure of the affected tissues or organs will progressively deteriorate over time, whether due to normal bodily wear or lifestyle choices such as exercise or eating habits. Degenerative diseases are often contrasted with infectious diseases.

**Plasma fibrinogen**

Fibrinogen or factor I is a soluble plasma glycoprotein, synthesised by the liver that is converted by thrombin into fibrin during blood coagulation. This is achieved through processes in the coagulation cascade that activate the zymogen prothrombin to the serine protease thrombin, which is responsible for converting fibrinogen into fibrin. Higher levels are, amongst others, associated with cardiovascular disease (>3.43 g/L). It may be elevated in any form of inflammation, as it is an acute phase protein.

**Aerobic Exercise**

It is physical exercise that intends to improve the oxygen system. Aerobic means "with oxygen", and refers to the use of oxygen in the body's metabolic or energy -generating process. Many types of exercise are aerobic, and by definition are performed at moderate levels of intensity for extended periods of time.
**Hypercholesterolemia**

It is the presence of high levels of cholesterol in the blood. It is not a disease but a metabolic derangement that can be caused by many diseases, notably cardiovascular disease.

**Biomarker**

A biomarker, or biological marker, is in general a substance used as an indicator of a biological state. It is a characteristic that is objectively measured and evaluated as an indicator of normal biological process, pathogenic processes, or pharmacological responses to a therapeutic intervention.

**Precipitating factor**

An element that causes or contributes to the occurrence of a disorder. The catalyst for an illness, symptom, or episode. This may not be the underlying cause of the illness; rather it is what elicits it.

**Total Cholesterol**

Total cholesterol is the sum of all the cholesterol in the blood. High total cholesterol level, means greater the chances for heart disease.

**Dislipidemia**

A disorder of lipoprotein metabolism, including lipoprotein overproduction or deficiency. Dyslipidemias may be manifested by elevation of the total cholesterol, the "bad" low-density lipoprotein (LDL) cholesterol and the triglyceride concentrations, and a decrease in the "good" high-density lipoprotein (HDL) cholesterol concentration in the blood.
Atherogenesis

The process of forming atheromas, plaques in the inner lining (the intima) of arteries. The process of atherogenesis starts as early as the teens, with the formation of fatty streaks. Fatty streaks lie under the endothelium which lines the interior of the arteries. Over time, deposits can form over the fatty streaks, gradually causing the artery to narrow. Athersclerosis, in which such deposits are clearly present on the arteries, is sometimes referred to as “clogged arteries,” a rather apt descriptor for what happens over time as atheromas build up.