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EFFECTS OF LOW INTENSITY EXERCISE ON INSULIN LEVEL OF UNTRAINED COLLEGES' STUDENTS

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ABSTRACT

The current study aimed to assess the effects of six-week low intensity exercise program on insulin level of untrained colleges' students, Punjab College, Piplan campus, Mianwali, Punjab, Pakistan. A sample of n=50 students was categorized into two different groups such as experimental group (EG=25) and control group (CG=25). A pre- and post-intervention experimental research design was used. Both pre- and post-intervention measurement on anthropometrics, urine sugar level and blood sugar level were taken. Independent sample *t*-test, Paired Sample *t*-test and One-way ANOVA were applied to analyze the measurements. When comparing the pre-test and posttest differences of control group in blood sugar level and urine sugar level, the analyzed data revealed statistically significant differences in blood sugar level ($P > 0.05$) and no statistically significant difference found in urine sugar level (Nil). The obtained results indicated no statistically significant differences in blood sugar level ($P > 0.05$) and no statistically significant difference found in urine sugar level (Nil). Based on the analyzed data, it has been concluded that the results show clear evidence for the effectiveness of structured exercise programs, which therefore may be recommended to reduce IR in T2DM. However, the sample size for all studies was low. Hence, we need studies with adequate sample size and randomized controlled trials to provide statistically significant results.

Keywords: Low Intensity Exercise, Urine Sugar Level, Blood Sugar Level & Untrained College's Students

1. INTRODUCTION

1.1 Historical Perspective

Ancient Egyptians expressed some important facts about insulin- related ailments before 3000 years ago. Cappadocia (81-133AD) was the region from where a person named Araetus first told the world about diabetes. Thomas Willis (Britain) in 1675 explained to world about the sweetness of Urine and the blood of person (Ahmed, 2002). Egyptian manuscript depicts diabetes one of the very few maladies described from 1500 BCE (Leutholtz et al., 2011). Diabetes speeded up in 1960. Obesity was also considered the major cause (Moscou et al., 2013). Thirty million people in 1985 and three Ninety-two million people in 2015 were diagnosed with diabetes (Smyth et al., 2006). Despite being associated with middle or ripe age it is still on the rise in younger lot (Tfayli et al., 2009), (Imperatore et al., 2012). Life expectancy mostly is reduced to ten years in type-II diabetes (Melmed et al., 2011). Diabetes is increasing rapidly quite like epidemic it has been reported

that every five second one person falls prey to diabetes. Diabetes does a lot of damage to the patients. It may cause disability, increase health cost and reduction in life spam. Thus diabetes has been causing untold complication like cardiac issue, loss of eyes side, kidney failure and organs amputations (Alberti, Zimmet, & Shaw, 2007).

Around the world, the ailment of diabetes has increased with dramatic pace. For example, millions of people have been diagnosed with diabetes in America and Europe. Due to large number of diabetes, it is considered as one of the chronic epidemic. The rates of type-II diabetes are increasing day by day throughout the world. According to a study more than 150 million peoples were reported to be the victim of diabetes. This rate risen quickly in the several decades (Day, 2001). This sharp hike in diabetes is due to several factors like aging population particularly in developing countries as well as increase in obesity worldwide. It is reported that high prevalence of diabetes found in developed countries including America, Europe and West Africa (Riste, 2001).

As far as Asia is concerned, it is considered that Asia is believed to be the epicentere of the explosion of diabetes (Wild et al., 2014) & (Sicree et al., 2006). Presently Asia, unfortunately is hit hard by this disease. India and China are the major country in the highest numbers of diabetic patients among the top ten countries immersed with this horribility. There are four more countries in Asia including Indonesia, Pakistan, Bangladesh and Philippine which have high ratio regarding its rapid increase. Unfortunately, three countries India, China and Pakistan are the major having parts of the world, rapid enhancement in diabetics with 21%, 12% and 5%. (WHO, the world health report 2004).

Due to type-II diabetes, the quality of the life of people of Pakistan is destroyed (Basit et al., 2004). According to various population-based studies and national surveys, statistically, the prevalence of diabetes mellitus in Pakistan is high; in 2011 it was estimated that 5.2 million people affected by this disease and it will reach to 14 million by 2030. Presently, Pakistan is placed at seventh number in the world in the countries facing hazards of this vary disease. Unfortunately, if such situation prevails it may hit hard our homeland. (Hussain, & Ali, 2016).

1.2 Introduction

The studies about type-II diabetes were significant. It seems to be a big threat to the world population. The reason behind increasing this threat are overpopulation, aging, urbanization, weight gain, physical inactivity. Moreover, high blood sugar, resistance to insulin or deficiency of insulin. According to Wild et al., 2004 these results covering 30 years from 2000 to 2030. It is characterised by high blood sugar, insulin resistance and lack of insulin. (Ahlqvist et al., 2018). According to World Health Organisation Diabetes is metabolic disorder due to disturbance of carbohydrate, fat, and protein as a result disturbed insulin secretion or insulin action prolonged diabetes has a risk of heart diseases, damage to kidney or slow blood flow in limbs resulting in amputations.

Diabetes is associated with reduced life expectancy both in the developed and developing countries. Diabetes type-II poses two risk factors that are modifiable and non-modifiable. Diets, high blood pressure (≥140/90 mm Hg), overweight, low levels of physical activity are the modifiable factor. Age, family history and high blood sugar level during a previous pregnancy are non-modifiable risk factors. If not properly managed can cause untold complications related to micro vascular, macro vascular and cerebrovascular disease (Alberti, 2007).

According to World Health Organization over weight, sloth and little exercise mainly cause type-II diabetes. Regular exercise, balanced diet and normal weight can be best preventive measures in this regard. According to World Health Organization regular exercise and proper diet are the treatment. Type-II diabetes complications are the cause for morbidity and fatality. Prolonged complications can be mitigated by proper medications and proper healthy lifestyle (i.e., diet and physical activity) (Motahari-Tabari et al., 2014).

Physical activity has long been suggested (since 5th century) in the treatment of diabetes. Even recently studies have proved that physical activity has a positive effect. The risk of diabetes is less by 33% in women who exercise regularly than the non-exercising one. (Borghouts & Keizer, 2000). Physical exercise is highly beneficial in the prevention and treatment of

factors that lead to type-II diabetes. Exercise not only helps maintain weight, it also has effects that increase insulin action. (Ivy, Zderic, Fogt., 1999).

Keeping in view the historical perspectives and background of the study, it can be said that type-II diabetes has increased all over the world from the centuries behind. Most of the world researcher investigated maximum aspects, treatments, medication, causes and demerits of diabetes to control it. The efforts of the world researcher were very fruitful and considerable but mostly work has been done for diabetes control and remedies in other discipline but very little work has been done in the field of sports and exercise. A number of studies has been made on this subject in grown up people. Physical exercise protects against development of type-II diabetes (Knowler et al., 2002). Study report that regular exercise brings improvements in insulin sensitivity even when you are not dieting (Gan et al., 2003).

1.3 Objectives of the Study

1. To measure the pre- and post-intervention anthropometric parameters of participants.
2. To analyze the pre- and post-intervention urine sugar level of the participants.
3. To examine the pre- and post-intervention blood sugar level of the participants.

1.4 Hypothesis of the Study

HA1: It is hypothesized that there is a statistically significant difference in pre- and post-intervention anthropometric parameters of participants.

HA2: It is hypothesized that there is a statistically significant difference in pre- and post-intervention urine sugar level of participants.

HA3: It is hypothesized that there is a statistically significant difference in pre- and post-intervention blood sugar level of participants.

1.5 Delimitations of the Study

The delimitations of the study were as follow;

1) The study was delimited to the Punjab Group of Colleges, Piplan Campus, Mianwali, Pakistan.
2) The study was further confined to male students having age between 16-19 years.
3) The study was delimited to only one Independent variable low intensity exercise protocol and one dependent variable level of insulin.

1.7 The Key Terms Explained

1.7.1 Exercise

Exercise is a physical exertion designed to improve or sustain health and fitness level. (Winter & Fowler, 2009).

1.7.2 Low Intensity Exercise

Low-intensity exercise has been designed to put less pressure on the body with the aim to improve body fitness.

1.7.3 Pancreas

The body cells require fuel. Pancreas an organ located behind the stomach in body convert food into fuel for the body's cells. Pancreas play mainly two functions: helps in digestion and regulates blood sugar.

1.7.4 Insulin

Insulin is hormone secreted by the body cells, it maintains blood glucose level. It facilitates cells glucose optics. It regulates carbohydrate, lipid and protein metabolism. It promotes cell division and growth (Wilcox., 2005).

2. Literature Review

2.1 Introduction

Regular sport participation has got positive and everlasting effects upon health of individual and participants. Regular participation in sports and exercise is guaranty of prolong life. (Seligman & Csikszentmihalyi, 2014). Almostly children learn the basic movements for their survival while following their elders. The basic movement maybe walking, running, throwing, pulling, jumping, pushing, climbing, catching and many more. For comfortable and safe life initial movements provide bases for the fine and gross motor skills which are needed not only for the essentials. Fundamental movements play vital

role in sport participation and domination. We develop physical fitness due to fundamental movements which later on leads towards fitness which is key to success in all sects, age, gender, social status and professions of life. Exercises, physical activity and physical fitness enable a person to perform routine tasks and enjoy the life without feeling boredom (Reddy, 2012).

When an individual participate in exercises on daily basis, it has got very positive effect upon health and it improves the fitness level. Regular participation in exercises improve the overall performance of the body and enable a person to do his daily activities effectively. Exercises make different systems of the body healthy and efficient to promptly cope with the everyday assignments of the life. Literature has severally endorsed that regular participation in physical activities makes the person mentally alert, physically sound, socially and emotionally stable and calm. Regular participation in sports also eradicate a number of social evils and provides chances for healthy and productive use of leisure.

Social interaction is developed among the participants of physical activities which is key to enhance sense of brotherhood, equality, justice, tolerance, cooperation, fraternity and positive attitude (WHO, 2003). The habit of regular exercises and physical activity improves the heart functioning, lungs capacity, kidneys performance, functioning of stomach, pancreas and all other vital organs of various systems of the body. Habit of regular exercise brings positive visible changes in human behavior, attitude and approach. Physical activity and exercises have physiological and psychological benefits directly related to the participants. (Shahana, Usha & Hasrani, 2010). Aproximately 2 billion citizens are victim of overweightness and more than half billion peoples are facing obesity as reported by World Health Organization (WHO, 2014). It is also worth mentioning that non habiting of exercise leads towards obesity throughout the world, where 11% of them are men and 15% women (WHO, 2010; WHO, 2014).

Recently obesity has been declared as Global health problem which is the main cause of cardiovascular diseases, diabetes, cancer, stress, anxiety and pre-mature deaths (WHO, 2014). Previously the morbidity and mortality rate of obesity was reasonably high and was considered major cause of sudden deaths (Hall & Neubert, 2005). Overweightness and Obesity has become a universal problem and results of various studies have shown that presently even 10% of children are also victim of obesity and same is the case with adults (Wang, 2011). The ratio of type II diabetes has been observed higher and increasing in the young population of the world *(*Tfayli et al., 2009). Diabetes is recently becoming most mortal although it is known as friendly disease. It develops and causes increased health cost, reduce life expectancy and disability etc. This disease may cause damage of kidneys, foot amputations, cardiovascular diseases and blindness (Alberti, Zimmet, & Shaw, 2007).

2.2 Healthy Life

Prosperous life makes the one to live happy, simple and meaningful time. There may be a benefit of one mile walk for five days in a week for one person but it may not be beneficial for the others. Such is the case will various food eating with daily routine of various persons. Proper changes of exercise, physical activity and eating may health in improving the fitness as well as healthy lifestyle. Conducive environment and healthy habits may reduce the risk of onset of various chronic diseases, which may harm the individual and families. In various research studies, it has been reported that good and regular habit exercising, physical activity and sport along with daily proper food intake has lowered the risk of type II diabetes up to 25%.

According a universal proverb, a small (10 to 15 mints) daily exercise may enhance years in your life span. Findings of various research studies have concluded that 10 to 15 minutes' moderate or vigorous intensity exercises had lowered the risk of sudden death in population as compared to those who take part in the same intensity exercises for low span of time. The results have shown that 8 to 10 hours daily involvement in normal exercises may result the same as reported above.

Better health and meeting with the doctor is inversely proportional. Regular habit of exercises and physical activity is the treatment of our body with no cost while the habit of no exercise may compel you to have costly life and less pain of life. Due to regular participation in

sport and exercise we may maintain healthy weight, activeness and delayed onset of fatigue. Physical activities participation lengthens the life span of participants. When proper regular habit of exercise is multiplied with diet, it results in healthy lifestyle.

2.3 Definition of Physical Activity, Exercise and Sports

2.3.1 Physical Activity

Those bodily movements which are responsible foe the strength at expenditure of more energy by skeletal muscles are improved by exercises and physical activity. One can perform various physical activities during his leisure time which may be of low, moderate and vigorous level, leading towards physical fitness, improved social interaction and better health. Sport, exercises and physical activities play vital role in the life of individuals. Findings of various research studies have pointed out that regular participations in exercise and physical activity programs may strengthen mental, physical, social, emotional and spiritual abilities of participants along with the good health (WHO, 2014; DOHSA, 2015).

2.3.2 Exercise

Physical activity and exercise improves physical fitness, health and output of the body when they are performing in organized shape with proper routine (Plowman & smith, 2013). Exercise and physical activities enables the participants to improve their physical fitness, overcome emergency demands and accomplish the desire the task without feeling undue fatigue (Chen, 2010). It is established fact that exercises have paramount importance in our daily lives that is why we must understand the pros and cons of the physical activities. The human organism has been made by creator in such a manner that it's more and most use polishes its efficiency and functioning while it's no use may cause decay or decline in its efficiency. Through this quotation we may understand the importance of physical activity and exercise as essential for our body designs. Physical activities not only develop physical fitness but it develops the most important aspects of our life's which may be social interaction, psychological dealings and intellectual development. In recent days the involvement of youth in social media and electronic media, who sit at a desk or in front of the television all day and get no exercise develop health problems over time. Exercise is a physical activity that is done to improve or maintain physical fitness and general health. Exercise is any physiological activity that results in sufficient frequency, duration, and intensity of physical exertion to attain or maintain fitness, or other health or sporting goals (Abou Elmagd, 2016).

2.3.3 Sport

According to "ES Charter 2012" Sport actually is a competition in the form of physical activity with a purpose to enhance physical ability and some certain skills to pave the way for enjoyment for the participants and audience. Sports aims to improve the participant's physical fitness. In some specific games like racing, the competitors try hard to excess others.

Both physical fitness and mental health require exercise and physical activity. Taking exercise assists a person in developing and keeping a strong self-image and a sense of emotional balance. With a passage of time, as people grow old in age they are in dire need of physical activity. It is concluded that the hearts blood pumping potential goes down at a rate of about 8% every decade. Children should also exercise for physical fitness. For the Childs overall physical growth vigorous exercising activity is must. A certain amount of calories is required for everybody every day. If a person consumes more calories than the requirement of his/her body, these will be stored as fat. For example, if a person has an excess of 5 kg fat, and each gram contains 9 calories, then he has 45000 calories for his/her body to utilize. Physical activity aids a person in achieving or maintaining a healthy weight because his metabolism works properly and burns the extra calories. With the exercise, the body of a person works harder and as result it needs more energy. When a person stops exercises, his body keeps on burning calories at an increased weight for some hours. The more the work a person does, the more calories he actually burns. He can reduce the fat of his body by burning the more calories and consequently he gains a healthier and fitter body. Obesity can be avoided by losing body fat (Abou Elmagd, 2016).

Physical activity can prove a great helping hand in ending the lipid dis-functioning, diabetes mellitus and overweight. Exercise can help a person in reducing blood pressure and as a result it decreases the chance of heart attack which is one of the greatest cause death. The more the hard exercise, the more beneficial it proves to be. For example, 30 mints quick walk for a week is quite healthful (Haskell et.al, 2007).

Regular exercise reduces the danger of type II diabetes. This disease has reached to great endemic proportions, because it effects 170 million individuals in whole world. The body's insulin regulatory system is the outcome of lack of exercise. Enhance insulin and blood glucose level pave the way for non-insulin dependent diabetes. With the irregularity in insulin function, the blood sugar in the body rises and leads to pre-diabetes and later on to type II diabetes. Overweight and lack of exercise are the main culprits for diabetes. Daily physical activity increases insulin sensitivity and glucose metabolism which makes the cells of the body efficiently transporting the glucose into the liver and muscle cells.

2.4 Physiological Effects of Exercise

Intensity, duration, frequency of physical activity along with environmental conditions, pave the way for physiological response. Oxygen is required while taking exercise. Metabolites and carbon dioxides are also removed during exercise. Daily physical activity and exercise improves muscle strength and enhance endurance. Tissues of the bodies are strengthened and cardiovascular system performs commendably well, when exercise is done on the regular basis. Daily routine activities can be performed with more energy and power when the health of heart and lungs is good. Blood vessels become flexible and blood pressure remains normal when a person habitually takes exercise daily. Physical activity makes a person's heart powerful and improves his blood circulation. When the blood vessels become flexible, blood flows properly into them and enhances the oxygen level in human body. These exercising activities lower the danger of heart attack and diabetes mellitus. Regular physical activity can also regulate insulin level in human system (Burton, Stokes, & Hall, 2004).

2.5 Metabolic Effects of Exercise

Physical activity has a powerful effect on human metabolic system. Exercise boosts energy levels in person and there are rapid and guaranteed secretion of hormones in a person. A certain style of muscle activity is related to molecular mechanism controlling fiber phenotype and muscle function. Endurance and strength exercises are among the essential components of physical fitness which we need for whatever physical activity is required. In a single session of exercise, through some physical movements, there appear some certain changes in a body which are inculcated into body and the potential for chronic adaptation is enhanced and the process of lack of energy in the body is stopped and at the same time deterioration of any form in the body is curtailed. Metabolic disorders can be avoided by improving muscle insulin sensitivity that is how the metabolic effects are healthier and wholesome (Moghetti, *et. all*, 2016).

2.6 Medial Evaluation as a Part of Exercise Planning

Physical activity is one of the greatest preventive measures taken up against diseases. Exercise has proved to be effective in decreasing mortality rate by heart disease and by some other fatal diseases. Exercise stands for regular structured program of physical activity and a physical activity is an activity in daily life that can be classed as professional games, job activities, domestic chores or others (Erlichman, et.all, 2002).

It is shown in previous studies that physical activity and exercise can improve anatomy structure and physiological positions in older people which actually reduces the dangers of their falling down and improves their upright stance. Exercise and physical activity enhances physical health as well as mental health of people and eventually they are saved from some certain mental ailments like depression, mood swings and dementia. In the universe, there is no specific agreement on intensity, frequency and kinds of physical activity and exercise. The definition of exercise intensity is commonly understood as how hard the exertion is during physical activity and that is calculated in metabolic equivalent task (MET). Metabolic equivalent task is further

defined as the rate of energy which a person uses while he is in a rest position. People falling between 3.0 and 6.0 category are thought to have moderate intensity while people with physical activity above 1.5 metabolic equivalent tasks and below 3.0 metabolic equivalent tasks are categorized in low intensity activity. Specific low intensity physical activities for the people contain different type of exercises like push-up against the walls, sit-ups, walking, stretching and lifting hand weight. These combined physical activities with low intensity are most of the time called as exercise program. Through many researches, it has been displayed that physical activities including low and moderate intensity activities could decrease the risk of mortalities, stroke, high blood pressure, type II diabetes mellitus, breast cancer, dementia and symptoms of depression etc. Centrally, the effect of low intensity physical activity decreases the risk of injuries (Andy, et all 2015).

2.7 Exercise Prescription

Globally, the physical activity and exercise has become the part and parcel of physical health and it is crucial key for overall health of the person. For managing many chronic condition of the person, there is a strong recommendation through clinical practice guidelines that physical activity is instructed to gain different results or outcomes for specific populations (Slade, et all 2012).

Exercise which is a non-specific term contains activities that are different in type, frequency, environmental requirements. Conceptually, exercise is a series of specific movements which means to train the body to promote overall physical health. According to World Health Organization the chronic diseases have long duration ans are generally in slow progression. In response to the specific burden linked with chronic conditions like heart disease, type II diabetes mellitus, osteoporosis and osteoarthritis. WHO has developed a global strategy for diet and exercise. Accordingly, for important targets are set to achieve the results. These are exercise, enhanced awareness of positive effect of physical activity, implementation of strategies and a specific producing new skill in certain games.

Exercise is to be applied to adults for all ages. It's another thing that competitively old adults would respond in a different way to these stimuli. So, the exercise plan must fit all ages according to their expected response. The exercise prescription is different for aerobic fitness for general health. The older age adults must follow the exercise prescription and physical activity to keep fit rather than for aerobic fitness. The American College of Sports Medicine (ACSM) and the Center for Disease Control (CDC) recommended that every adult should go through at least 30 mints of physical activity every day. The following exercise prescription consistency recommended the betterment of physical fitness and health rather than aerobic fitness. These are warm-up, intensity, duration, frequency and exercise type.

2.7.1 Warm up

Every exercise should begin with warm-up and muscle stretching. This is even more important for the elderly people for they are more injury prone than the younger ones. Apart from general warm-up light movement is also recommended.

2.7.2 Exercise Intensity

For the older adults the intensity of exercise should be lower. Even the irregular adults should also start with the lower intensity. In comparison with the high intensity exercise, low intensity exercise causes less injury to the adults. Exercise intensity can be categorized in several different ways. Heart beat is the most common indicator. Heart beat rate of 50 to 70 % and heart rate reserve a 40 to 60 % is in according with a low intensity of exercise. Despite the variation the age predicted equation has been used for gagging heart rate. There is a recent study however combining meta-analysis approach and laboratory approach shows that the equation in use (i.e. 220 – age) does not give the accurate result of maximum heart rate in older results. The available precise equation is 208 – (0.7 * age) in healthier adults. Even then the use of measured maximum heart rate is to be preferred. Moreover, medication and smoking do have their impact on maximum heart rate. Maximum heart beat measures in swimming is different in because of the position. 10 beats/min

lower compared with upright position exercise such as running etc. The prescription of exercise can also be applied with the rating of perceived exertion.

2.7.3 Exercise Duration

The duration and intensity of physical activity are closely interlinked. Low to moderate intensity of physical activity is recommended for non-sporting peoples and for the older adults. Minimum of 30 minutes per day of exercise is the bench mark. The duration of the exercise is to be increased gradually. When the intensity of exercise is higher, the duration must be curtailed. The single bout of activities is less beneficial than the total volume of activities. A series of shorter bout of exercises should be spread to the whole day. If such an exercise exceeds 30 minutes, it may produce much better results, particularly in older ad non-sporting adults. It can easy be planned out as going to work on bicycle or to climb stairs instead of taking the elevator. The available data is in favor of total amount of activity rather than the specific manner.

2.7.4 Frequency

Low level of exercise and physical activity offers more benefits. If the Center for Disease Control and the American College of Sports Medicine are follows, the adults should go through low intensity exercise on regular basis all the days of week.

2.7.5 Exercise Type/Mode

Fitness level, the interest and the resources of the participants are the major things which pave the way for exercise type. Physical activity is choosing on the basis of its enjoybility and at the same time it should have the minimum portion for any type of injury. The recommendation for physical activity is to be made on everyday life activity. So the best choice for a person to exercise is walking. It is given priority over other activities among the aged persons because it does not need special feats to perform. The only preferable requirement is a friend or a partner to accompany in daily walking. The people with poor balance and musculoskeletal issue may need to do cycling, jogging or swimming rather than walking. A person should be more cautious while performing physical exercises in water because it is bristled with danger of being drowned. If a person is gifted with specific abilities to achieve appropriate health benefits, then he could opt for running and swimming. The fitness clubs have proved quite beneficial and have achieved significant place into the matter of daily exercise. These fitness club facilitate the participants to indulge in different type of exercise in a certain environment. These type of physical activities are with certain advantages because they are prone more too physical wholesomeness and less to even smaller type of injuries. A study recently published has also displayed the fact that these exercises which have been performed at facility-clubs gift a person some such healthy benefits as are enjoyed in aerobic exercises (Mazzeo, 2001).

2.8 Association of Exercise with Physiological and Environmental Condition

The brain as we know is the hub of control for human body. It has to respond to various conditions. Permanent energy is needed to human body to carry on its functions both for physical exertion and homoeothermic status. The mechanical energy that is needed for physical effort some of the energy to be stored and rest is to be dissipated as heat. Basal metabolism is to be maintained which depend upon sex, age and body federate. The energy in the metabolism must be equal to the heat loss of the body. When a human exercise regularly human body adapts to it. The body temperature rises and a limited amount of energy changes into mechanical energy and the rest convert to thermal energy (Gibson, 2004).

Sweating and dissipation are effective ways for protecting human body against too much heat load by thermoregulatory system. The thermal interaction between the human body and the environment does exist during exercise and physical activity. The air conditional system is thus installed in the gymnasium and sports halls. The element of sponsorship is boosting the sports economy and also the participation level as audience or participants has risen considerably. These activities have become important part of our daily life. Exercise and physical activity on the other hand is necessary for maintaining fitness and leading healthy life.

2.9 What Kind of Exercise for Prescribe?

Studies shows that low intensity exercise coupled with vascular occlusion augment muscle size and strength. This increase has even been comparable with the gains from high intensity resistance exercise (Takarada, Y., Nakamura et al. 2000).

Takarada and associates (2000) found the results of 16-week low intensity isotonic elbow flexion physical activity as well as elbow flexion physical activity even the low intensity exercise had a better result. Moreover, the low intensity exercise combined with vascular occlusion increased the muscle size and strength as much as the high intensity exercise. Takarada and Ishii 2002 made experiment on already train athletes with 8-week low intensity isotonic knee extension physical activity and exercise. There was an increase in isotonic torque muscle CSA and endurance of the knee muscles conversely little changes were found after the exercise with vascular occlusion (Takarada, Ishii 2002). The study of Abe, Kearns, and Sato 2006 observed increase in muscle size and strength through walking combined with vascular occlusion. The treadmill walking of 3 weeks showed increased in the CSA of the leg muscles, leg curl and thigh muscles while no improvement observed in the non-occlusion group (Abe, Kearns, Sato 2006). It is generally recognized that moderate to high intensity resistance physical activity and exercise increases muscle size and strength (Teramoto, Golding, 2006). On the other hand, low intensity resistance physical activity and exercise increases muscle endurance. Quite a few number of studies show that low intensity resistance physical activity and exercise is helpful for strength in untrained individuals. There is an unanimity that resistance of at least 60% of one RM for untrained persons and 80 % of one RM for trained persons is required to increase strength gain (Kraemer, et al. 2002).

2.10 Diabetes and Exercise

More than one hundred million people worldwide are diabetic. This disorder is caused by disorder in the production of insulin by pancreas which causes increase or decrease of glucose in the blood. It causes damage to heart, kidney, blood vessels, nerves and eyes. Diabetes has been categorized into two types. One is Insulin dependent diabetes mellitus (IDDM) and other is non-insulin dependent diabetes mellitus (NIDDM). The type I diabetes is a cause selective destruction of insulin secreting cells but type II diabetes is peripheral insulin resistance and impaired insulin secretion. Many complications are the hazard such as peripheral vascular disease, cardiovascular disease, renal failure, neuropathy, stroke, blindness and even amputation. Drugs are used to save life. Insulin replacement therapy is effective for type I diabetes mellitus. While diet and life style are the main stay for the treatment of type II diabetes mellitus. It has been estimated that by 2030, 438 million peoples are feared to have diabetes.

2.10.1 Pathophysiological Aspects

Insulin insensitivity is the major characteristic of type II diabetes mellitus. Liver receives decreased level of glucose and same is the case with muscle fat cells. Fat break down rapidly with hyperglycemia. Since type I diabetes patients are young. They are not obese in the beginning. The tendency of diabetes through inheritance is quite pronouns. Studies shows that genetically pre disposed persons are also exposed to viral infection and this viral infection may do damage to cells and expose antigens to kick starts auto immune process. After 90 % of the body cells have been destroyed the patient become overtly diabetic. Impaired insulin secretion and insulin resistance are due to type II diabetes such patients are generally obese (Heilbronn, 2004).

The insulin resistance that can take to type II diabetes can be checked through exercise. Physical activity and exercise a part from preventing obesity, it also can have increased isocline actions. Muscle glucose transportation can be increased through exercise. Physical activity and exercise increases insulin sensitivity and also insulin responsiveness (Hawley, 2004).

Exercise can bring about positive adaptation in only 7 to 10 days of training. The research is still in progress about the effect of exercise on patients with insulin resistance and diabetic glucose tolerance. Several studies have been made and it has been found through short time exercise to evaluate the effect of exercise training on insulin actions. A recent study was conducted to ascertain whether improvement in

peripheral insulin action take place (Kirwan, 2009).

3. Methods and Materials

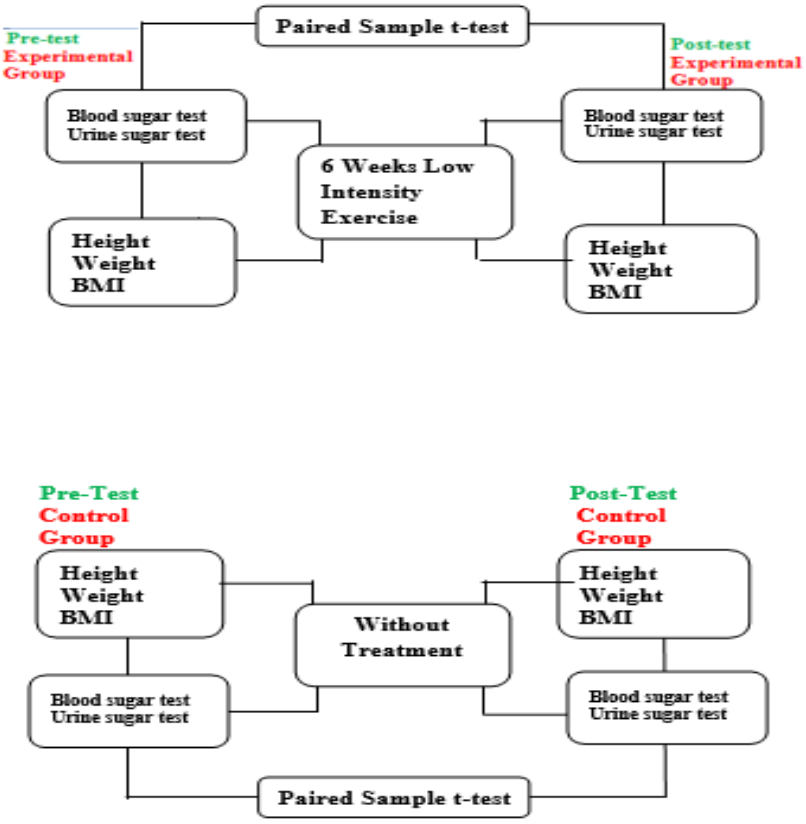
3.1 Study Design

Study design is chalked out for the solution of the problem (Jones & Lyons, 2004). The current study was an experimental, randomized, pre-/post-intervention. The study sample was collected from Punjab Group of colleges, Piplan Campus, Mianwali. In order to participate in the program, participants were required to meet the following criteria;

- Subjects having no chronic disease such as cardiovascular disease, diabetes, hypertension or cancer, and was not taking any medication (Medical certificate was filled by Students).
- Subjects having age 16-19 years.
- Subjects who voluntarily participate in the study.
- All subjects were nonsmokers.

Figure No 1

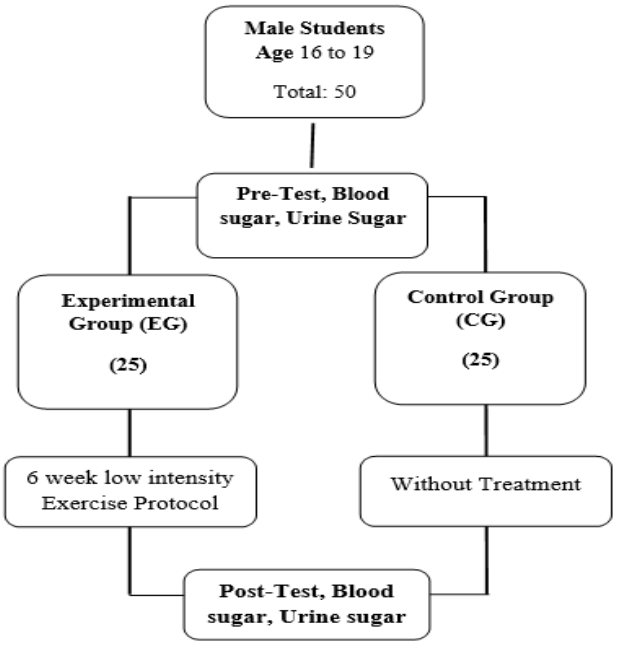
The flow chart is providing appropriate visual explanation for pre- and post-test experimental design in detail;



3.2 Subjects

Subjects were recruited by means of pre-test. The initial sample was consisted of 50 subjects who were randomly arranged into two groups. One group was labeled as an experimental group (EG n=25) and the second group was named as control group (CG n=25). The final sample was decided after applying the exclusion criteria.

Figure No 2



3.3 Collection of Blood Sample

The blood sugar test requires blood sample that is usually drawn from the veins on the inside of the elbow and urine sugar test requires urine. Two (2) cc blood and Five (5) ml urine were collected from all the subjects for the assessment. The blood was kept in gel-tube and urine was kept in urine container and was send to Bio-Test Laboratory for testing. Each blood sample and urine sample was marked with separate identification code.

3.4 Instrument and Procedure

Both the groups were processed. The anthropometric measurements, sugar and urine level of both the groups were measured before and after intervention. The intervention program was continued for six weeks. During this period, the subjects of experimental group ((EG) were given an exertion program, whereas the subjects of control group (CG) were not given any exertion program.

3.4.1 Anthropometric Measurement

i. Height

Height of the subjects was measured through stadio-meter, and this measurement was taken in feet. Therefore, following were the main steps which were kept during measurement.

Step 1: Remove shoes, hats and bulky clothing such as coats and sweaters.

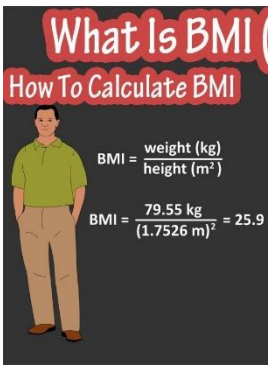
Step 2: Ask the subject to stand against the stadio-meter with heels together and legs straight.

Step 3: Note the record of measurement in notebook

ii. Weight

Weight of the subjects was measured through weight meter and this measurement was taken in Kg.

iii. **Body Mass Index (BMI)**



For measurement of BMI, subjects were measured height and weight of each respondent. The formula of BMI is (BMI = kg/m2) where kg is a person's weight in kilograms and m2 is their height in meters squared.

3.4.2 Insulin Level

i. Blood Sugar level

For the assessment of insulin level, the researcher was taken blood sugar test also referred to as fasting blood sugar. This test is used to measure the amount of glucose in blood of the body. It is also used to monitor the treatment of abnormal insulin level and also to monitor insulin resistance. The normal range of blood sugar level is 70/110 mg/dl.

ii. Urine Sugar level

For the assessment of urine sugar level, the researcher was taken urine sugar test. This test is used to measure the amount of glucose in urine of the body. The normal range of urine sugar level is 0.

3.5 Training Program

Following is the table of training program

Table 3.1

Six-week training program

Duration	Frequency of exercise protocol	One Session Duration	Intensity of the activity	Type and description of the activities
Six Week	Four session per week (Monday, Tuesday, Wednesday, Thursday)	30 minutes regular with no rest (The time spent on warming up and cool down activities is in addition to 30 minutes time limit)	Low intensity (50% of the MHR)	1.Warm up= 10 mints (gradual walking and stretching arms and legs) 2. Jogging= 10 mints 3. Running on the spot= (10 mints) 02 rep. each of 4 mints. Interval between trial 02 mints 4. Vertical Jump= (5 mints) 05 sets, each of set 1 mint. 5. Knee band sit-ups= (5 mints) 05 sets. each of 1 mint 6. Cool down= 10 mints (sit on floor and static stretching)

3.6 Statistical Analysis

The collected data was processed through statistical package for social science (SPSS, version, 26). For this purpose, description as well as inferential test was applied. Descriptive test such as frequency, percentage, mean and standard deviation was applied to analyze the demographic as well as anthropometric measurements of the participants. Paired sample t-test was used for hypothesis.

3.7 Ethical Approval

As this research study is associated with human being, therefore ethical approval was taken from ethical and review board of Gomal University, Dera Ismail khan, Khyber Pakhtunkhwa, Pakistan.

Chapter 4: Results and Discussion

Section A: Descriptive of different Characteristics of the Participants

Table 4.1

Frequency and percentages of the participants according to their different characteristics

Variables	Categories	Frequency	Percent
Group	Control	25	50.0
	Experimental	25	50.0
	Total	50	100.0
Age	16 Years	11	22.0
	17 years	13	26.0
	18 Years	23	46.0
	19 Years	3	6.0
	Total	50	100.0
Class	1st Year	30	60.0
	2nd Year	20	40.0
	Total	50	100.0
BMI pre	Underweight	20	40.0
	Normal	27	54.0
	Overweight	2	4.0
	Obese	1	2.0
	Total	50	100.0
Blood Group	A+	6	12.0
	B+	16	32.0
	O+	20	40.0
	AB+	5	10.0
	O-	1	2.0
	A-	1	2.0
	B-	1	2.0
	Total	50	100.0
BMI post	Underweight	19	38.0
	Normal	28	56.0
	Overweight	2	4.0
	Obese	1	2.0
	Total	50	100.0

Total two groups were entertained in the sample i.e. experimental group and control group total 25 participants were in the experimental group and 25 were in the control group. In respect of age the respondents having 16 years were 11, 17 years were 13 18 years were 23 and 19 years were 3. Total respondents from 1st year class were 30 and 2nd year class were 20. The respondents having BMI in

underweight range were 20, normal were 27, overweight were 2 and obese were 1. The respondents having A+ blood group were 6, B+ group were 16, O+ were 20, AB+ were 5, O- were 1, A- were 1 and B- were also 1. The respondents having BMI in posttest underweight were 19, normal were 28, overweight were 2 and obese were 1. The total respondents in the study were 50 (100%).

Section B: Descriptive

Table 4.2

Descriptive of research variables

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age	50	16.00	19.00	17.3600	.89807
Weight Pretest	50	42.00	94.00	59.8800	10.62657
Weight Post	50	41.00	95.00	59.7000	10.43591
Height	50	5.10	6.20	5.5346	.30461
Body Mass Index Pretest	50	14.90	33.10	20.2800	3.31151
Body Mass Index Posttest	50	15.00	32.70	20.1320	3.23245
Blood Sugar Level Pretest	50	75.00	133.00	97.6400	15.37658
Blood Sugar Level Posttest	50	75.00	120.00	98.0000	11.77164
Urine Sugar Level Pretest	50	.00	.00	.0000	.00000
Urine Sugar Level Posttest	50	.00	.00	.0000	.00000

Table 4.2 shows the descriptive of research variables. Total number of respondents was 50. The minimum age recorded in the sample was 16 years and maximum was 19 years, the mean for age was appeared as 17.36±.898. The minimum weight in the sample was 42 kg, maximum was 94 kg, and mean for weight was 59.88±10.62. On the other hand, the mean of weight after the period of treatment was 59.70±10.43. the mean of the height of respondents was 5.53 ±.304. The mean of BMI in pretest was 20.28±3.31. The mean of BMI in posttest was 20.13±3.23. The mean of Blood Sugar Level in pretest was 97.64±15.37 and in posttest was 98.00±11.77. The Urine Sugar Level in pretest and posttest of the whole respondents was Nil (000).

Section C: Testing of Hypothesis (pretest and posttest Comparisons)

Table 4.3

Comparison of anthropometrics parameters of participants in pre- and post-test (Paired sample t-Test)

Measurements	Pretest n=50	Posttest n=50		
	Mean ± SD	Mean ± SD	T	Sig.
Weight	59.88±10.62	59.70±10.43	.932	.356
BMI	20.28±3.31	20.13±3.23	1.517	.136

Table 4.3 shows the differences in pretest and posttest of 50 participants of the study with special references to weight and Body Mass Index of the respondents. No statistically significant differences were found in weight (P > 0.05) and BMI (P > 0.05).

Table 4.4

Pretest comparison of Control and experimental group in Blood Sugar Level and Urine Sugar Level. (Independent sample t-Test)

Measurements	Pretest (Control) n=25	Pretest (Experimental) n=25		
	Mean ± SD	Mean ± SD	T	Sig.
Blood Sugar Level	89.60±13.07	105.68±13.30	-4.310	.062
Urine Sugar Level	00.00±0.00	00.00±0.00	.000	NIL

Table 4.4 shows the pre-test differences in experimental group and control group on blood sugar level and urine sugar level. No statistically significant differences were found in blood sugar level (P > 0.05) and urine sugar level (P > 0.05).

Table 4.5
Posttest comparison of Control and experimental group in Blood Sugar Level and Urine Sugar Level (Independent sample t-Test)

Measurements	Posttest (Control) n=25	Posttest (Experimental) n=25		
	Mean ± SD	Mean ± SD	T	Sig.
Blood Sugar Level	91.48±11.80	104.52±7.41	-4.677	.000
Urine Sugar Level	00.00±0.00	00.00±0.00	.000	NIL

Table 4.5 shows the post-test differences in experimental group and control group on blood sugar level and urine sugar level. Statistically significant differences were found in blood sugar level (P < 0.05) and no statistically significant difference found in urine sugar level (Nil for both groups).

Table 4.6
Pretest and posttest comparison of control group in Blood Sugar Level and Urine Sugar Level

Measurements	Pretest n=25	Posttest n=25		
	Mean ± SD	Mean ± SD	T	Sig.
Blood Sugar Level	105.68±13.30	104.52±7.41	.642	.527
Urine Sugar Level	00.00±0.00	00.00±0.00	.000	NIL

Table 4.6 shows the pre-test and posttest differences of control group in blood sugar level and urine sugar level. No statistically significant differences were found in blood sugar level (P > 0.05) and no statistically significant difference found in urine sugar level (Nil).

Table 4.7
Pretest and posttest comparison of experimental in Blood Sugar Level and Urine Sugar Level

Measurements	Pretest n=25	Posttest n=25		
	Mean ± SD	Mean ± SD	T	Sig.
Blood Sugar Level	89.60±13.07	91.48±11.80	-2.114	.045
Urine Sugar Level	00.00±0.00	00.00±0.00	.000	NIL

Table 4.7 shows the pre-test and posttest differences of experimental group in blood sugar level and urine sugar level. Statistically significant differences were found in blood sugar level (P > 0.05) and no statistically significant difference found in urine sugar level (Nil).

Section D: Testing of Hypothesis (Demographic differences)

Table 4.8

Age wise comparison in posttest (Blood Sugar Level and Urine Sugar Level)

Variables	Age groups	N	Mean	Std. Deviation	F	Sig.
Blood Sugar Level Posttest	16.00	11	98.2727	14.02919	1.645	.192
	17.00	13	103.4615	9.10691		
	18.00	23	95.6957	10.87714		
	19.00	3	91.0000	16.82260		
	Total	50	98.0000	11.77164		
Urine Sugar Level Posttest	16.00	11	.0000	.00000	NIL	NIL
	17.00	13	.0000	.00000		
	18.00	23	.0000	.00000		
	19.00	3	.0000	.00000		
	Total	50	.0000	.00000		

In Table 4.8 a single factor ANOVA was applied to test the mean difference between the blood sugar level of respondents having different age group. The sig. value for blood sugar level was greater than the alpha level 0.05 (sig.= .192 > 0.05). No statistically significant differences were found in blood sugar level (P > 0.05) and urine sugar level (Nil) in respect of age of the respondents.

Table 4.9

Class wise comparison in posttest (Blood Sugar Level and Urine Sugar Level)

Variables	Class	N	Mean	Std. Deviation	t	Sig.
Blood Sugar Level Posttest	1st Year	30	100.0667	13.07520	1.542	.130
	2nd Year	20	94.9000	8.92011		
Urine Sugar Level Posttest	1st Year	30	.0000	.00000[a]	NIL	NIL
	2nd Year	20	.0000	.00000[a]		

at cannot be computed because the standard deviations of both groups are 0.

In Table 4.9 an independent sample t-test was applied to test the mean difference between the blood sugar level of respondents having different Classes. The sig. value for blood sugar level was greater than the alpha level 0.05 (sig.= .130 > 0.05). No statistically significant differences were found in blood sugar level (P > 0.05) and urine sugar level (Nil) in respect of Class of the respondents.

Table 4.10

Body Mass Index Category wise comparison in posttest (Blood Sugar Level and Urine Sugar Level)

Variables	Categories	N	Mean	Std. Deviation	F	Sig.
Blood Sugar Level Posttest	Underweight	19	102.9474	11.70695	4.009	.013
	Normal	28	94.2857	9.66803		
	Overweight	2	92.0000	19.79899		
	Obese	1	120.0000	.		
	Total	50	98.0000	11.77164		
Urine Sugar Level Posttest	Underweight	19	.0000	.00000	NIL	NIL
	Normal	28	.0000	.00000		

	Overweight	2	.0000	.00000
	Obese	1	.0000	.
	Total	50	.0000	.00000

In Table 4.10 a single factor ANOVA was applied to test the mean difference between the blood sugar level of respondents having different Body Mass Index. The sig. value for blood sugar level was lesser than the alpha level 0.05 (sig.= .013 < 0.05). Statistically significant differences were found in blood sugar level (P < 0.05) in respect of BMI of the respondents. On the other hand, no statistically significant difference found in urine sugar level (Nil) of the respondents in respect of BMI of the respondents.

Table 4.11
Blood Group wise Comparison in posttest (Blood Sugar Level and Urine Sugar Level)

Variables	Blood Groups	N	Mean	Std. Deviation	F	Sig.
Blood Sugar Level Posttest	A+	6	104.5000	17.54708	.534	.779
	B+	16	96.2500	10.82897		
	O+	20	96.7500	11.45644		
	AB+	5	98.8000	11.47606		
	O-	1	109.0000	.		
	A-	1	95.0000	.		
	B-	1	100.0000	.		
	Total	50	98.0000	11.77164		
Urine Sugar Level Posttest	A+	6	.0000	.00000	NIL	NIL
	B+	16	.0000	.00000		
	O+	20	.0000	.00000		
	AB+	5	.0000	.00000		
	O-	1	.0000	.		
	A-	1	.0000	.		
	B-	1	.0000	.		
	Total	50	.0000	.00000		

In Table 4.11 a single factor ANOVA was applied to test the mean difference between the blood sugar levels of respondents having different Blood Groups. The sig. value for blood sugar level was greater than the alpha level 0.05 (sig.= .779 > 0.05). No statistically significant differences were found in blood sugar level (P > 0.05) in respect of Blood Groups of the respondents. On the other hand, no statistically significant difference found in urine sugar level (Nil) of the respondents in respect of Blood Groups of the respondents.

Discussion:

The main objective of the present study was to assess the effect of low intensity exercise on insulin level of untrained colleges' students of District Mianwali. The researcher formulated research hypothesis based on the recorded data, these hypothesis was analyzed below; the first research hypothesis concerned the effect of exercise on blood sugar level of participants. The analyzed data showed that participation in exercises produced better results on blood sugar level. The data shown that pre- and post-test are statistically significant. As a result, the difference between pre- and post-test of experimental group has shown significant increase the functioning of insulin in human body. Similar findings have been obtained from the study of Stephen & John (2017) who summarizes the findings of different studies in which authors concluded that regular physical activities reduces the risk of metabolic syndrome, type II diabetes mellitus and insulin

resistance. Another study conducted by Jing Li et al. 2017 revealed that 12 weeks of low intensity exercises have positive effects on the production of insulin. According to this study, previous research indicates that low intensity exercise induced improvements in insulin action, and decreased the risk of type II diabetes mellitus and insulin sensitivity. Another study revealed that short term low intensity exercise increases the functioning of glucose metabolism in the form of improvements in insulin sensitivity, and also decreased weight (Powell et al., 2010).

The second research hypothesis which concerned the effect of exercise on urine sugar level of the participants is as under; Physical activity produced enormously wholesome effects on the overall health of the person. The impact of exercise had been remarkable in reducing and at the same time maintaining a healthy glucose level in blood but we found no significant difference in urine sugar level. Though, there has not been found a noticeable difference in urine sugar level by the exercise, but the outcome of the hypothesis has been positively appreciative because the sugar level in the urine has remained within the normal limits. According to Lonneke et al., (2016) & Wayne et al., (1987) concluded results regarding the effect of exercise on glucose level in urine, exercise directly effects the glucose level in urine. These glucose level in urine remain normal because of exercise. According to authors, the person participating in exercise maintains his glucose level in urine. So exercise has beneficial effect on human body because it does not let glucose level increase in urine.

Apart from the above discussed elements further experiment could be carried out assertion the effects. Dietary plan is to be checked. Nutritional intervention is very likely to have its positive impacts. Furthermore the obese persons could be included in the diabetes patient list to check out the effects. Even a female population can be put under such test. It is also recommended that the low intensity exercise could be taken up to the moderate level to see the weather it has more positive effects. Since low intensity exercise on a single category may not show all the effects. These steps are likely to give more efficient and better results.

Chapter 5: Summary, Findings, Conclusions and Recommendations

5.1 Summary

The researcher focused in the present study on the insulin level of the experimental and control group by using six-week exercise protocol. The control group was left untreated and thus blood glucose level and urine glucose levels were accordingly checked and compared. The exercise protocol consisted of low intensity exercises. The researcher after analysis have summarized that low intensity exercises have placed significant positive effect on the weight of the participants. The weight of the subjects was observed to be decreasing by the six weeks' low intensity exercise protocol on the participants aging from 16-19 years. It is worthwhile to mention here that reduction in body mass index was also observed after treatment of six weeks of low intensity exercise protocol. The blood sugar level of the experimental group of the treatment of six weeks' low intensity exercise protocol shown significant lowering same was the case with the urine sugar level of the post test results of the participants where slight change was observed.

5.2 Findings

On the basis of data analysis following findings were made:

1. It has been found that there is no statistically significant difference in weight and Body Mass Index on pretest and posttest of all respondents (Table 4.3).
2. It has been found that there is no statistically significant difference in Blood Sugar Level and Urine Sugar Level between control group and experimental group before the treatment (Table 4.4).
3. The data analysis found that there is statistically significant difference between experimental group and control group in Blood Sugar Level after the treatment. On the hand no statistically significant difference found in Urine Sugar Level which was nil in both groups after the treatment (Table 4.5)
4. It has been found that there is no statistically significant difference

between pre-test and post-test of Control group in Blood Sugar Level. On the hand no statistically significant difference found in Urine Sugar Level which was nil in both data collection points (Table 4.6)

5. It has been found that there is statistically significant difference between pre-test and post-test of experimental group in Blood Sugar Level and Urine Sugar Level (Table 4.7)
6. It has been found that there is no statistically significant difference between the respondent having different age groups (16 years, 17 years, 18 years and 19 years) in Blood Sugar Level and Urine Sugar Level after the treatment (Table 4.8)
7. It has been found that there is no statistically significant difference between the respondent having different Classes (1st Year and 2nd year) in Blood Sugar Level and Urine Sugar Level after the treatment (Table 4.9)
8. It has been found that there is no statistically significant difference between the respondent having different Body Mass Index (Underweight, Normal, Overweight, Obese) in Blood Sugar Level and Urine Sugar Level after the treatment (Table 4.10)

5.3 Conclusions

Low intensity exercise represents an effective interventional strategy to improve glycemic control in insulin level. A systematic review with meta-analyses provides useful information for the clinical application of exercise in the management of T2DM. The results show clear evidence for the effectiveness of structured exercise programs, which therefore may be recommended to reduce IR in T2DM. However, the sample size for all studies was low. Hence, we need studies with adequate sample size and randomized controlled trials to provide statistically significant results.

5.4 Recommendations

In light of the results of this study the researcher recommended that;

1. The Govt. should arrange the workshops and seminar for fresh students at educational institutes to aware them about the advantages of exercise both low-intensity and high-intensity exercises.
2. The college administration should include 30 minutes period to perform physical activity on daily basis in any college.
3. All possible opportunities should be given to all private and govt. sector colleges to perform physical activity easily.
4. Low intensity exercise protocol which was applied in the present study should be followed by youth to maintain the level of insulin in the body and gain fitness.

5.5 Future Directions

1. The present study was conducted on college level, future studies may be conducted on secondary school level to assess the effects of low intensity exercise on insulin level of untrained students.
2. The present study was conducted to include the male adults aging 16-19 years, similar study may be conducted by participating female population.
3. The present study was conducted on male non-sporting college students, future studies may be conducted upon the comparison of insulin level of sporting and non-sporting students.
4. It is recommended by the researcher that another study may be designed to investigate the effects of moderate-intensity and high-intensity exercise on insulin level of non-sporting colleges' students.
5. Similar study may be designed by selecting large sample to generalize the findings.

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