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Effect of Aerobic Training with Kettlebell Exercise on Cardiorespiratory Fitness in Type 2 Diabetes Mellitus

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ABSTRACT

Background: Type 2 diabetes mellitus is commonly associated with reduced cardiorespiratory fitness, impaired pulmonary function, and altered hemodynamic responses. Exercise interventions are an important non-pharmacological strategy to improve overall fitness and metabolic control in these patients. Kettlebell training, which combines aerobic and resistance elements, has recently gained attention as a potential modality to enhance cardiorespiratory health.

Objectives-1 To study the effect of kettlebell training on pulmonary function, 2. To study the effect of kettlebell training on cardiorespiratory fitness.3 To study the effect on heart rate and blood pressure in type 2 diabetes mellitus.

Method- A total 120 type 2 diabetes mellitus subject were selected and divided into two groups. Group 1 (n=60) control received free resistance training and Group 2 (n=60) experimental received aerobic training with kettlebell exercise. The pre assesssment is measured by parameters blood pressure, heart rate, PFT, and treadmill test (FBS) And post interventional assessment was taken after 6 months.

Result-Statistical analysis for heartrate, blood pressure, PFT, fasting blood sugar parameters revealed significant in postintervention for group 2 ($p<0.0001$). Group 2 aerobic training with a kettlebell was given to improve cardiorespiratory fitness, showing a statistically significant improvement.

Conclusion- Aerobic training using kettlebell exercises is effective in improving heart rate, blood pressure, pulmonary function, and fasting blood sugar in patients with type 2 diabetes mellitus. These findings suggest that kettlebell training can serve as a beneficial adjunct to traditional exercise programs for improving cardiorespiratory fitness in this population. Keywords- kettlebell training, cardiorespiratory fitness, type2 diabetes mellitus.

INTRODUCTION

Type 2 diabetes mellitus is common metabolic disorder which is caused due to two main factors defective insulin secretion by pancreatic β-cells and the inability of insulin-sensitive tissues to respond to insulin. Type 2 diabetes mellitus is an insulin-resistance condition with associated beta-cell dysfunction. Initial increases in insulin secretion keep blood sugar levels within the normal range . As disease progresses, beta cells change, and insulin secretion is unable to maintain glucose homeostasis, producing hyperglycemia. Patients with Type 2 diabetes mellitus have higher body fat percentage. If there is metabolic imbalance that leads to the pathogenesis of T2DM then there is a defect in mechanism.[1,2]

Current studies suggest that prevalence of metabolic diseases such as diabetes mellitus is increasing worldwide. Prevalence of diabetes was 6.1% among women and 6.5% among men. Apart from these, studies reported that India has a massive pool of pre-diabetic subjects (77 million people) who have a high potential to develop type 2 diabetes. The age group of 40 to 59 years old suffer more in number.[3]

Diabetes mellitus was associated with increased levels of inflammation-sensitive plasma proteins identified as a contributor to risk of stroke and cardiovascular diseases. The side effect of medication in patients with type 2 diabetes also partially contributes to the risk of stroke because a prior study found that therapy with thiazolidinedione accelerated the development of subclinical atherosclerosis in individuals with type 2 diabetes.[4,5,6] Cardiovascular diseases can be prevented on large scale including physical exercises. Observational studies have shown that low self-reported physical activity and low objectively measured cardiorespiratory fitness at baseline are both associated with increased risk of cardiovascular disease and death, although for low fitness that is measured scientifically, the connection is stronger.[7,8,9] Other studies have demonstrated that a decline in risk is connected with improved objectively evaluated fitness over time, but not with self-reported physical activity. Cardiorespiratory fitness is strongly associated with various health outcomes, including cardiovascular disease and all-cause mortality.[10,11] Functional capacity, estimated by peak oxygen consumption (VO2max), was significantly reduced in DM patients by incorporating cardiorespiratory fitness program.[12,13,14] Pathophysiology of reduced functional capacity in

type2 diabetes mellitus patients is yet to be cleared, but there is evidence and studies done that pulmonary function is reduced in type2 diabetes mellitus patients.
Study of meta-analysis showed that all variables of lung function, except FEV1/FVC ratio, were reduced in type2 diabetes mellitus patients, which indicated restrictive type of lung pathology. Vanidassane et al. showed not only reduced pulmonary function type2 diabetes mellitus patients but also revealed negative correlation between parameter of glycemic control and indexes of pulmonary function.[15,16]
In type2 diabetes mellitus individuals may have increasing level of blood pressure and glycemic control, dyslipidemia, So to avoid such complications exercise is proven useful which can further increase the cardiorespiratory fitness among type II diabetic mellitus patients.Aerobic and resistance exercise training may be more effective for blood glucose, but literature supporting this are less.[17,18]
Further studies were done and According to the International Diabetes Federation (IDF), in 2019, diabetes caused 4.2 million deaths and 463 million adults aged between 20 and 79 years old By 2045, there will probably be 700 million people worldwide who have diabetes.[19.20]
Kettlebells have been used for years but have recently gained more recognition as a useful exercise tool. Most kettlebell exercise routines only require the use of one or two kettlebells. Purchasing two kettlebells is a much more cost effective way to exercise than it would be to purchase a treadmill or resistance training equipment. Kettlebells are potentially useful for improving muscular strength and cardiorespiratory fitness, in that, they use ballistic full-body movements using accumulated forces from numerous muscle group. Biomechanically, training with a Kettlebell is associated with the generation of high peak forces of the posterior muscle chain, mediated by cyclic deceleration–acceleration, in an explosive manner.[21] A few studies have investigated the effects of Kettlebell exercise on cardiorespiratory fitness. Current Studies of workout routines have (kettlebell weight, exercises, sets repetitions, duration rest) results indicate that the intensity is sufficient to improve cardiorespiratory fitness. Kettlebell training has existed for several years and is known to result in significant improvements in muscular strength and power output. Exercises may be performed at a slightly lower percentage of the one repetition maximum and with less recovery time between exercises than in typical strength training, which can be a considerable difference. Kettlebell training is comparable to circuit training in many ways and is a combination of traditional resistance and endurance training.[22,23]
Type 2 diabetic subjects and those with impaired glucose tolerance have also shown improvements following resistance exercise. Van Dijk et al. conducted a study using individuals with impaired glucose tolerance, type 2 diabetics treated with insulin, and type 2 diabetics treated with oral medications. 18 hours) and morning periods (18-24 hours) following the exercise when consuming a standardized diet. Data suggest that an acute bout of resistance type exercise improves insulin sensitivity and glucose clearance. The effects of kettlebell exercise on cardiovascular stress and fitness have been the subject of a few studies.[24]

MATERIAL AND METHODOLOGY

Design of this study is experimental study with sample size 120 subjects . This study is conducted in Krishna college of physiotherapy karad for 6 months .Simple random sampling is used in this method. Inclusion criteria for study individual with sedentary life style .Age (40 to 60 year) with type 2 diabetes mellitus decreased in cardiorespiratory fitness. Exclusive criteria subjects having complaints of cough, sputum, or dyspnea and also subjects with cardiorespiratory illness or major disease and age factor above 60 year old was not included.

PROCEDURE

The study protocol was approved by the protocol committee and ethical clearance obtained from institutional ethical committee , Krishna institute of medical sciences deemed university , karad. Patient with type 2 diabetes mellitus were recruited and according to the inclusive and exclusive criteria was done. The patient who agreed to participate were randomly assigned to control and experimental group by the research guide and patient were assigned randomly into 2 groups .consent was taken from all the patients. After assignment data collection was started 45 to 60 mints of exercise was going on.
In this study there were dropouts in which 4 dropouts due to age and 6 dropped outs as they were not able to continue intervention . Pre test and post test was done using the outcome measures .All the patients received education and care .For group 1 control group free resistance training exercise protocol will be given for duration of 6 months and Group 2 kettlebell exercise protocol will be given duration 6 months .

Patient were encourage to find individual methods of overcoming the barrier to regular exercise.written materials were provided to encourage each patient to increase their exercise tolerance and increase their cardiorespiratory fitness.
The outcome measures were evaluated at baseline and 6 months. Followed by statistical analysis will be done.

DATA ANALYSIS

Table no.1 Comparison within groups of type 2 diabetes mellitus patients parameters.

PARAMETERS	CONTROL GROUP	EXPERIMENTAL GROUP	P VALUE	T VALUE
HEARTRATE	81.08 + 2.664	77.6 + 1.968	8.148	0.0215
BLOODPRESSURE	SYSTOLIC 147 + 5.69	SYSTOLIC 134.8 + 5.416	11.964	0.7066
	DYSTOLIC 77.25 + 6.105	DYSTOLIC 72.4 + 4.051	5.127	0.0020
PFT	82.3 + 1.266	84.1 + 1.069	8.414	0.1959
FBS	153.37 + 8.026	138.66 +11.042	8.299	0.0161

DISCUSSION

This study is to estimate the effect of aerobic training with kettlebell exercise on cardiorespiratory fitness in type 2 diabetes mellitus .this study evaluated the effect of kettlebell exercise which will increase the cardiorespiratory fitness in type 2 diabetes patients various parameters are taken like blood pressure, heartrate, pulmonary function test and fasting blood sugar.
In previous study Freese et al. (2013), cardiorespiratory responsiveness was examined during SIC with participants performing 4 succeeding 30 second sprints, each followed by a 4-minute active recovery. Oxygen consumption (VO2) increased from the first sprint to the second, but was similar in the succeeding sprints and was above 80% of the estimated maximal value. Respiratory exchange ratio (RER) also was observed to decline from the first to the last sprint. The findings of this previous study demonstrate the extent to which aerobic metabolism is used during this type of HIIT and suggests that metabolic and cardiorespiratory adaptations can occur through SIC.[25]
Modes of resistance training are often integrated with interval-based exercise training. One popular mode is the use of kettlebells (KBs). Kettlebells not only have been shown to be effective in improving muscular strength but also have been seen to elicit strong cardiorespiratory responses and can be adjusted to be performed continuously so in this study kettlebell training is effective increases the functional vital capacity. In a study by Farrar et al. (2010), continuous KB swings for a total of 12 minutes were observed to elicit an average of 65.3% of maximal oxygen consumption (VO2max) and an average of 86.8% of maximal heart rate (HRmax) responses, which meet ACSM recommendations for optimal intensity for improving cardiorespiratory fitness.[26] Study by Falatic et al. (2015), 20 minutes of KB snatching performed 3 days per week for 4 weeks was found to significantly increase aerobic capacity more than circuit-weight training of the same training duration and frequency . Therefore, existing research suggests that KB training may influence a greater response by the cardiorespiratory system than traditional resistance exercise. Thus, this form of training may be used as an effective mode of training for maintaining or improving aerobic conditioning .comparably our study parameters which we took like pulmonary function test (FVC) was increased and the level of fasting blood sugar (FBS) was decreased in experimental group as compared to control group.[27]
As per mentioned above parameters blood pressure , heart rate, pulmonary function test and fasting blood sugar were the outcome measures of the study .effect of kettlebell exercise in type 2 diabetes mellitus shown results in improving the cardiorespiratory fitness and increasing their function vital capacity. Such an approach should be utilized to increase cardiorespiratory fitness and more studies can be done on effect of kettlebell training.

CONCLUSION

Our result concludes that aerobic training with kettlebell exercise improves pulmonary functions, vital capacity is increased, fasting blood sugar is controlled which concludes that there is a increase in cardiorespiratory fitness in type 2 diabetes patients.

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