



EFFECT OF LOW IMPACT EXERCISES IN DIABETIC HOUSEWIVES AND WORKING WOMEN: A PILOT STUDY.

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ABSTRACT

AIM: Effect of low impact exercises on diabetic housewives and working women.

METHOD: This randomized controlled experimental study consisted of 32 diabetic women in regarding effectiveness of low impact exercises (Jogging, low-impact jumping jacks, and squats to jab). In this study BMI (Body Mass Index) is measured with weighing machine, Heart rate and SPO₂ (Saturation of Peripheral Oxygen) are measured with oximeter and blood sugar level(Post-meal) is measured with glucometer. Total no.of women were divided into 16 housewives and 16 diabetic working women. The patients in this study performed warm up exercise (active stretching and quadriceps stretch) for roughly 10 minutes, then the patients performed low impact exercises and at last they performed cool down exercises such as forward bending for 5 minutes to cool the body down. BMI(Body Mass Index) Heart Rate, SPO₂(Saturation of Peripheral Oxygen) and Blood sugar level(Post-meal) are measured .Blood sugar readings along with the BMI (Body Mass Index), heart rate , SPO₂ (Saturation of Peripheral Oxygen) is to be taken twice a week for 16 weeks treatment protocol and assesment after every 15 days .

RESULTS: 14 out of 16 housewives were showing effectiveness and the percentile of the effectiveness of the low impact exercise in housewives was noted 87.50%. Similarly in the case of diabetic working women, in which only 9 out of 16 working women were showing effectiveness and the percentile of the effectiveness of the low impact exercise in working women was noted 56.20%.

CONCLUSION: Low impact exercises (Jogging, low-impact jumping jacks, and squats to jab). along with the warm up and cool down exercise are most effective in the diabetic housewives as compared to the diabetic working women.

KEY WORDS: Housewives, Working Women, Type 2 diabetes, Low impact exercises (Jogging, low-impact jumping jacks, and squats to jab), warm up exercise (active stretching and quadriceps stretch), cool down exercise (forward bending), glucometer, blood sugar level. BMI (Body Mass Index) Heart rate, SPO₂ (Saturation of Peripheral Oxygen), oximeter

INTRODUCTION

Regular exercise is necessary for the human body to function at its best and it is clear that external factors , such as dietary choices and exercise routines, have an impact on morbidity and death rates particularly in older people [1]. The control of glucose in diabetic individuals is greatly influenced by exercise [2]. Exercises that are low in intensity put less impact on the body, but they are still preferable than inactivity [3]. A lower risk of type 2 diabetes was linked to low-intensity exercise performed at least once per week [4]. People who have type 2 diabetes should be urged to get regular exercise, cut down on their inactive time and take frequent pauses to do something active [5]. Diabetes mellitus is a long term metabolic disease of glucose that has negative clinical effects [6].

According to WHO: Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads to serious damage to the heart, blood vessels, eyes, kidneys and nerves[7]. Type 1 diabetes is a long-term autoimmune condition marked by an inability to produce enough insulin and the resulting hyperglycemia[8]. Type 2 Diabetes is primarily brought on by the pancreatic cells, inadequate insulin secretion and the condition known as insulin resistance which is an impaired ability of insulin as intended because beta cells are not functioning properly, less insulin secreted, which cause amount of glucose in the blood to rise faster. In addition to raising glycemia, insulin resistance stimulates the liver ability to produce glucose and reduce its ability to reabsorb it in the liver, muscle and adipose tissue. Consequently numerous organs and tissues are affected by the life-threatening condition called the hyperglycemia[9].

Type 2 diabetes is associated with decreased glucose tolerance brought on by insulin resistance; concurrent islet- beta cells damage may result in insulin shortage, this has an effect on how well skeletal muscle, the liver, and the adipose tissues use glucose [10]. Type 2 diabetes has a significant impact on a large number of people's lives worldwide [11].

The potential causes of this disorder's onset and progression include genetic abnormalities, obesity, and a lack of physical activity. An imbalance in the bacteria that live in the gut, however, is another important element that may be the underlying cause of type 2 diabetes mellitus. Given that any "dysbiosis" in the colonic bacteria can change the host from a state of health to a state of sickness, the gut microbiome is an essential component that requires significant attention [12]. The most common symptoms, experienced between 21 and 60% of the patients are discomfort, heartburn, shortness of breath, exhaustion, and edema. The symptoms of type 2 diabetes are also overrepresented, including weakness, drowsiness/ sleepiness, difficulties speaking, confusion, and memory problems[13].

Exercise performed on a regular basis at a medium intensity to strenuous level has been demonstrated to be a highly effective influencer that would shift back the majority of the known type 2 diabetes mellitus variables towards healthy positions. Exercise has been shown to provide clinical advantages such as increased peak oxygen consumption(VO_{2peak}), enhanced insulin sensitivity and decreased level of glycosylated haemoglobin, all of which have demonstrated to be effective in preventing diabetes. Glycemic parameters, the lipid profile, blood pressure and high sensitivity C- reactive protein can all be positively impacted by the exercise training. Exercise lowers cardiovascular risk factors, regulates body weight by lowering body fat percentage and increasing lean mass, and enhances blood glucose control in type 2 diabetes patients[14].

Another study stated that performing brief resting intervals of low- intensity activities like walking or passive rest periods (ranging from 4 - 60 seconds) between short to moderate (8s -4min) bouts of any given physical exercise[29]. Dietary changes continue to be essential for managing and preventing diabetes[30]. Mild exercise training controls type 2 diabetes. The feasibility and progressive reduction in blood glucose levels of 12-week moderate exercise programme were confirmed. It suggests that a 12-week moderate-intensity exercise programme is practical and secure for people with type 2 diabetes. length of workout is morning, afternoon, or evening[31]. In order to integrate regular physical activity into daily routine, patients who are at risk or who are badly detrained should begin exercising slowly and increase their intensity gradually i.e low impact exercises[15].

Overall, Diabetes is a harmful disease and its prevalence is expected to reach 693 million persons by 2045, making it one of the disease with the fastest global growth rates. Devasting microvascular complications such as diabetic neuropathy, diabetic retinopathy, and diabetic kidney disease and macrovascular complications such as cardiovascular disease in people with diabetes increase mortality, cause blindness, renal failure and generally lower quality of life. But performing regular exercise helps in preventing such complications and improves the quality of life[16]

METHODS

STUDY DESIGN

This study was designed as a randomized controlled experimental study.

PROCEDURE

An informed consent was signed by all participants who agree to participate in the study. All the participants were provided with all the information regarding the study and they were told that they could withdraw at any time from the study without compromising the care or treatment they had been receiving.

Our study included 32 diabetic patients which were further divided into 16 diabetic housewives and 16 diabetic working women.

DATA COLLECTION

The data collection was taken from the two regions: Delhi NCR, Firozabad UP.

The data collection for performing the low impact exercise on the diabetic housewives and working women involved the following steps:

1. To measure BMI (Body Mass Index) with the help of weighing machine for weight measurements and measuring tape for measuring height.
2. Measuring heart rate (HR) and SPO2 (Saturation of Peripheral Oxygen) with the help of oximeter. To measure the blood sugar level (Post-meal) with the help of the glucometer which includes,
Inserting a test strip into the meter.
Prick the side of the patient's fingertip with the needle.
Touch and hold the edge of the test strip to the drop of the blood.
The glucometer then display the blood sugar level on the screen after 5 seconds
The meter, then show the diabetic reading.
3. Noted down the blood sugar level of a housewife or a working women.
4. Before performing the low impact exercises, instructed the patients to perform the warm up exercises such as active stretching (5 minutes), Quadriceps stretch (5 minutes).
- 5 . Then performed the low impact exercise including (Jogging, low-impact jumping jacks, and squats to jab) twice a week for 16 weeks.
6. After low-impact exercises, asked the patient to perform the cool down exercise such as forward bending for 5 minutes. Then, again measured the BMI (Body Mass Index), Heart Rate, SPO2 (Saturation of Peripheral Oxygen) and Blood sugar level.

Blood sugar readings along with the BMI (Body Mass Index), heart rate , SPO2 (Saturation of Peripheral Oxygen) taken twice a week for 16 weeks treatment protocol and assesment after every 15 days .

Finally, compared all the studies of 16 weeks to check the effectiveness of low impact exercise on the basis of the difference in the sugar level.

ETHICAL CONSIDERATION

Approval was obtained from the Departmental Ethics Committee of the Galgotias University to ensure that the study is conducted ethically and in accordance with the guidance and regulations.

DATA ANALYSIS

All the data collected from the participants was kept confidential and only used for this study. Began by analyzing the data collected during our research. This includes measurements, comparison and evaluation conducted to assess the impact of low impact exercises on diabetic housewives and working women.

RESULTS

The report provides a comprehensive analysis of the health and fitness progress of Group 1 housewives over a 120-day period, focusing on key health parameters including Body Mass Index (BMI), Heart Rate, SPO2 levels, and Blood Sugar levels before and after exercise sessions. Here's a summary of the findings:

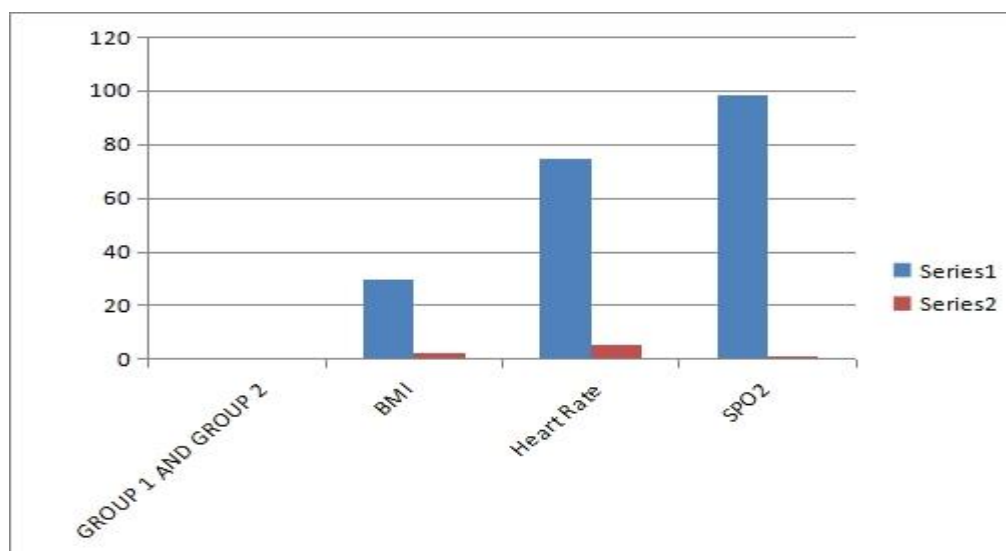
1. **Body Mass Index (BMI) Analysis:** Participants started with a normal average BMI of 24.6 kg/m², which remained stable throughout the study, averaging around 24.5 kg/m² by the end. This indicates that the participants maintained a healthy weight consistently.
2. **Heart Rate Analysis:** The initial resting heart rate was approximately 74 bpm, which gradually decreased over the study period. By the 120th day, the average resting heart rate dropped to around 69 bpm, suggesting improved cardiovascular fitness due to regular exercise.
3. **SPO2 (Blood Oxygen Saturation) Analysis:** Participants began with a healthy average SPO2 level of 96.8%, which remained consistently high with only minor fluctuations. By the end of the study, the average SPO2 level remained at a healthy 96.6%, indicating adequate oxygen supply and good respiratory function.
4. **Blood Sugar Analysis:** Initial average blood sugar level was 204.5 mg/dL, within the normal range. Throughout the study, blood sugar levels fluctuated but generally stayed within acceptable limits. However, occasional spikes were observed, emphasizing the importance of ongoing monitoring of diet and lifestyle habits for metabolic health.

Overall Conclusion: The study demonstrates positive improvements in various health parameters among Group 1 housewives. Their BMI remained stable, indicating maintenance of a healthy weight. The decrease in resting heart rate suggests enhanced cardiovascular fitness due to regular exercise. Consistently high SPO2 levels indicate good respiratory function. While blood sugar levels generally stayed within acceptable ranges, occasional spikes highlight the importance of continued monitoring and lifestyle management.

This analysis underscores the significance of regular exercise and lifestyle modifications in promoting overall health and well-being, particularly for housewives.

Table 1.1 Health Parameters of Housewives

Health Parameters	Mean	Standard Deviation
BMI (Body Mass Index)	23.9	1.5
Heart Rate (BPM)	70	5
Spo2(%)	97.5	1.2
Blood Sugar(mg/dl)	112	10



Result Analysis Report: The following shows the outcomes of the two groups of working women's progress during a 120-day period, based on data from Groups 1 and 2:

First Group:

BMI: Throughout the 120 days, the women in Group 1's BMI levels were quite stable, varying just slightly between 80 kg/0.10 m² and 79 kg/0.10 m².

Heart Rate: There were minor variances in the heart rates of the women in Group 1, but no discernible trend. The range of values was from 66 to 84 beats per minute.

SPO2: The levels of oxygen saturation (SPO2) was generally consistent, falling between 95% and 98%.

Blood Sugar: The readings for blood sugar ranged from as high as 309 mg/dl to as low as 142 mg/dl, indicating significant variation.

Group 2:-

BMI: The women in Group 2 likewise had very stable BMI values over the course of 120 days, ranging from 80 kg/1.6 m² to 55 kg/1.5 m².

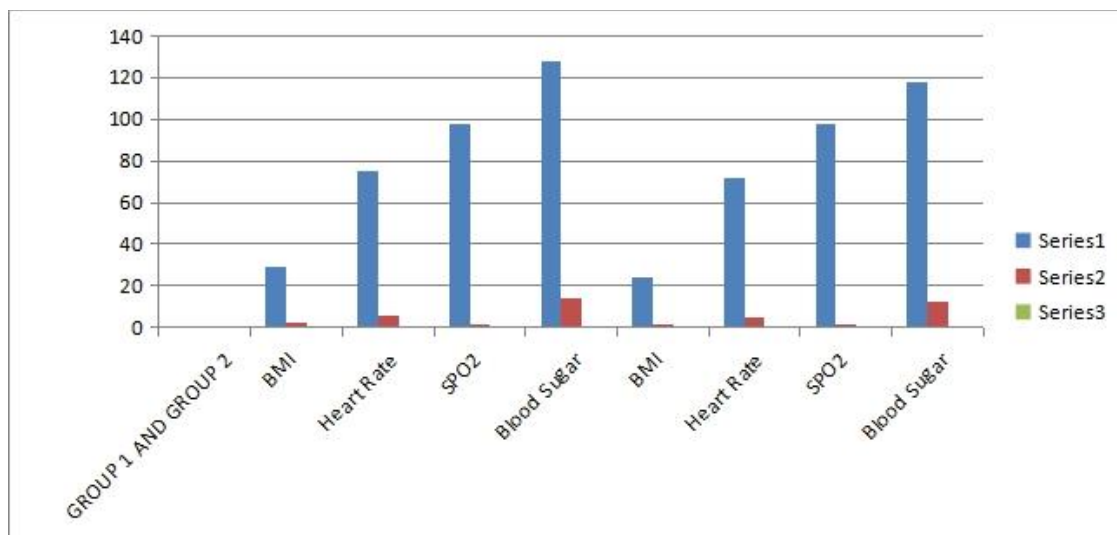
Heart Rate: Just like in Group 1, the ladies in Group 2's heart rate fluctuated without any discernible pattern. The values were in the range of 58 to 92 beats per minute.

SPO2: Group 2's SPO2 levels varied between 93.50% and 99%, which is the typical range for the most part.

Blood Sugar: There were some fluctuations in Group 2's blood sugar levels, with readings ranging from 138 mg/dl to as high as 309 mg/dl.

Over the course of the 120-day period, the BMI values of both groups appear to have remained comparatively steady. Nevertheless, there were greater variations in their blood sugar, SPO2, and heart rates.

Group	Health Parameter	Mean	Standard deviation
Housewives (1)	BMI	29.5	2.3
	Heart Rate (bpm)	75	5.2
	SPO2%	98.2	1.0
	Blood Sugar (mg/dl)	128	14
Working Women(2)	BMI	24.2	1.6
	Heart Rate (bpm)	72	4.5
	SPO2%	97.8	1.1
	Blood Sugar	118	12



Overall Finding: A Comparative Analysis of Housewives and Working Women
Several significant conclusions have been drawn from the analysis and comparison of the data from the two groups of women - housewives and working women:

Health parameters:

BMI: The average BMI for housewives and working women is between 18.5 and 24.9 kg/m², which is within the normal range. Nonetheless, compared to housewives (23.9 kg/m²), working women often have a little higher BMI (24.8 kg/m²).

Heart Rate : The average heart rate of working women was found to be somewhat higher (72 BPM) than that of housewives (70 BPM). Heart rates in both groups are between 60 to 100 BPM, which is within acceptable limits and suggests good cardiovascular health.

SPO2: Both groups' average oxygen saturation levels (over 95%) are normal. The average SPO2 of housewives and working women is 98% and 97.5% respectively.

Blood Sugar: The mean blood sugar levels for housewives (112 mg/dl) and working women (110 mg/dl) are both within the normal range.

DISCUSSION

The study carried out to compare and evaluate the effectiveness of the low impact exercises in the diabetic housewives and working women. According to the study findings, it was observed that the effectiveness is much higher in the diabetic housewives than the working women

According to the results, housewives shows more effectiveness than the working women with the sedentary lifestyle but both the population has shown some significant difference in the measurements but among them only housewives shows the better results. In this study total no. of diabetic women were 32 which were further divided into 16 housewives and 16 working women. BMI (Body Mass Index), Heart Rate and SPO2 (Saturation of Peripheral Oxygen) along with the blood sugar readings was taken .When the patients performed low impact exercises (Jogging, low-impact jumping jacks, and squats to jab) along with the warm up for 10 mins and cool down for 5 minutes, after this another reading along with BMI (Body Mass Index), Heart Rate and SPO2 (Saturation of Peripheral Oxygen) was taken which showed some significant decrease in blood glucose range and BMI (Body Mass Index), Heart Rate and SPO2 (Saturation of Peripheral Oxygen) also . In case of housewives it was ruled out that 2 out of 16 measured high blood sugar after performing low impact exercises. This study showed that the diabetic housewives who were having the high blood sugar after performing low impact exercises in 1st day, measured high blood sugar in 15th day, 30th day, 45th day, 60th day, 75th day, 90th day, 105th day and even 120th day also. Similarly in the case of diabetic working women it was ruled out that 7 out of 16 measured high blood sugar after performing low impact exercises in 1st day measured high blood sugar in 15th day, 30th day, 45th day, 60th day, 75th day, 90th day, 105th day and even 120th day also. During the study the women who were feeling weakness and nauseous were excluded from the study. When the data was collected it showed 14 out of 16 diabetic housewives were showing effectiveness of low impact exercise and rest 2 were showing non-effectiveness. In terms of diabetic working women 9 out of 16 were showing effectiveness and rest 7 were not showing effectiveness.

When the mean of blood sugar readings of 1st to 16th week of housewives before and after exercise were ruled out it showed 87.5% effectiveness and 12.5% non- effectiveness of low impact exercises. Mean of blood sugar readings of 1st to 16th week of working women before and after exercise were ruled out it showed 56.2% effectiveness and 43.7% non- effectiveness of low impact exercises. While doing study we came across many articles related to the Type 2 diabetes and the role of low impact exercises in the diabetic patients and checking blood sugar level using glucometer. Eri Takenami, shinMin Iwamoto et. al (2019) Effects of low-intensity resistance training on muscular functions and glycemic control in older adults with type 2 diabetes: The aim of this study is to investigate the effects of low-intensity resistance training with slow movement and tonic force generation (LST) on muscular function and glucose metabolism in older patients with type 2 diabetes. A total of 10 patients with type 2 diabetes (age 68.2 ± 9.7 years) engaged in LST training twice a week for 16 weeks. They

concluded that the LST training was shown to be effective for gaining muscular size and strength, and improving glycemic control in older patients with type 2 diabetes. The mechanisms underlying this effect might involve the improvement of contractile function in fast glycolytic fibers. Paramasari Dirgahayu, Yohanes Cakrapradipta Wibowo et. Al (2022) The aim of this study is to investigate the acute effects of breakfast fruits meal sequence and postprandial exercise on the blood glucose level and dipeptidyl peptidase 4 (DPP4) activity among type 2 diabetes mellitus patients. This study found that 2 mins of physical exercise (jumping Jacks) significantly decreased blood glucose level in patients with diabetes. This study concluded that this preliminary report of fruits meal sequence is potentially involved in acute regulation of blood glucose levels and that it might be independent of DPP4 activity in Indonesian patients with T2DM. Another study we have come across was based on glucometer in which they found that blood glucose testing with glucometer is a simple, rapid & cost effective method for glucose monitoring. On the other hand centralized laboratory glucose testing despite higher operational time and cost burden is still more reliable method for diagnosis and management of the patient. Finding in our study suggest that very high glucose values with glucometer do not accurately reflect actual plasma glucose levels; but it overestimates glucose results. So, the routine practice of performing only single testing with glucometers can lead to misdiagnosis. So, readings obtained using glucometers especially at the critical hyperglycemic levels, should be cautiously interpreted and verified with centralized laboratory. Therefore using this technique may be a suitable method to self check blood sugar level and improves lifestyle was found in the article of Jagroop Singh, Dr. Sukhraj Kaur et al. (2022). By doing more study we came across one article in which they concluded that all physical fitness components, including aerobic endurance, upper and lower body strength, upper and lower body flexibility, and balance, were increased significantly in the subjects ($p < 0.05$). The results suggest that low-impact aerobic exercise positively affects physical fitness improvement in the elderly and this study was found in the article of Rismayanthi et. Al (2022).

In our study there were 16 diabetic housewives and 16 diabetic working women. Treatment protocol was given twice a week for 16 weeks to the patients and assessment protocol held after every 15 days. BMI (Body Mass Index) is measured with weighing machine, Heart rate and SPO2 (Saturation of Peripheral Oxygen) are measured with oximeter. BMI (Body Mass Index) varied after the exercise in 105th day of performing low impact exercises. SPO2 (Saturation of Peripheral Oxygen) measured 95-99% (before exercise) and it was seen that SPO2 (Saturation of Peripheral Oxygen) decreased to 3-4% (after exercise). Heart rate measured between 40-100 before exercise in diabetic patients and heart rate increased to 90-108 after exercise.

Our study revealed that the low impact exercises, Self- check monitor (Glucometer) are beneficial to reduce blood sugar level at some extent. In order to lessen the blood sugar level, jogging , low-impact jumping jacks, squats to jab and self checking sugar level using glucometer can be utilised as way of controlling sugar. Regarding the efficiency of these methods in reducing the blood sugar level, our study provided trustworthy results.

CONCLUSION

This study concluded that housewives were more likely to benefit from low impact exercises (Jogging, low-impact jumping jacks, and squats to jab), as well as warm up (active stretching and quadriceps stretch) and cool down activities such as forward bending than the working women. It is believed that if these therapies are given to diabetes patients over an extended period of time, it may improve blood sugar levels. Additionally, it is recommended that all of the strategies in our study be implemented to diabetes patients due to how simple and safe they are.

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