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[ORIGINAL ARTICLE]

Effect of Mat Pilates Exercises on Cardiometabolic Parameters to Improve Cardiovascular Fitness in Postmenopausal Diabetic Women

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ABSTRACT :

To determine cardiovascular fitness levels in postmenopausal Diabetic women, to determine how mat Pilates exercises help improve cardiovascular fitness in postmenopausal Diabetic women. Patients were approached with the study proposal. A total of 48 postmenopausal women with diabetes were screened based on inclusion and exclusion criteria and were randomly divided into two groups. Each group consisted of 24 subjects. Group – A Mat Pilates exercises and Group - B Only medications. Borgs rate of perceived exertion, 3-minute step test, waist hip ratio, systolic and diastolic blood pressures, and BMI were used as outcome measures. The intervention was given 3 times per week for 8 weeks. Each session lasts for about 60 minutes. After 8 weeks, post assessment was done. The present study shows that Mat Pilates exercises helped in improving cardiovascular fitness in postmenopausal diabetic women.

Key Words : *Mat Pilates, Cardiovascular fitness, cardiometabolic parameters, diabetes, menopause, BMI.*

Introcuction:

Diabetes mellitus is a complex and heterogeneous group of chronic metabolic diseases that are characterized by hyperglycemia; type 2 diabetes is a progressive metabolic disease that is characterized by insulin resistance and eventual functional failure of pancreatic beta cells. Hyperglycaemia is the major risk factor for microvascular complications in patients with Type 2 Diabetes (T2D). However, lowering HbA1c has only a modest effect on reducing CVD risk and mortality. People with T2DM have approximately a 2-4-fold increase in the risk for coronary heart disease, stroke, and death from vascular causes compared to those without T2DM1

Prevention of diabetes requires the identification of individuals who have prediabetes and intervention with lifestyle modifications (weight loss and exercise) plus antidiabetic and anti-obesity medications. The American Diabetes Association (ADA) Consensus Conference10 Recommended that high-risk individuals (HbA1c >6.5%; BMI ≥ 30 kg per m2; age ≤ 60 years) with IGT or IFG levels be treated with metformin [2].

Menopause is the permanent cessation of menses due to oocyte depletion. The result is an abrupt decrease in endogenous oestradiol (E2). During the transition to menopause, women undergo phenotypical, metabolic, and biochemical changes which increase the risk of T2DM

Beyond the metabolic changes triggered by menopause, experimental studies suggest that decreased E2 concentrations, as well as decreased oestrogen receptor α (ERα) activity, can cause insulin resistance in peripheral tissues. Pancreatic β-cells have to compensate for insulin resistance to maintain glucose homeostasis; only when β-cell dysfunction coexists with insulin resistance does T2DM ultimately develop.[3]

Pilates is one of the training methods which are very popular; they have lower intensity compared to aerobic exercises and have very positive effects on

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health, such as decreasing cardiovascular risk, the practice of Pilates showed an improvement in body composition in healthy people.[2]

Pilates is a method of body / mental training that involves various types of exercise (e.g., balance, endurance, strength and flexibility, muscle control, posture, and respiration). Pilates is a resistance training form (based on isometric exercises) that has a low joint impact and may be very attractive for obese postmenopausal women.[4]

Materials And Methods

- Borgs rate of perceived exertion (RPE) scale
- Inch tape and Weighing machine
- Stadiometer and Sphygmomanometer
- Stethoscope, Step stool, Stopwatch, Metronome
- Informed Consent form
- Data collection sheets and patient information sheet

Inclusion Criteria

- women diagnosed with diabetes [2-3 years]
- women in their post-menopause phase

Exclusion Criteria

- Patients with any neuropsychiatric conditions
- Patients with orthopaedic or neurological problems that interfere with exercises
- Patients with diabetic microvascular complications

Outcome Measures

1. Rate of Perceived Exertion: Borg rates of perceived exertion are used to know the exercise intensity and used in monitoring progress and mode of exercise in cardiac patients. Modified Borg RPE scale consists of 10 grades
2. The three-minute step test: To measure the aerobic fitness level and cardiovascular fitness. A 12-inch step and stopwatch are required. Subjects are asked to step/march up and down a 12-inch step consecutively for 3 minutes. After 3 minutes, they are allowed to sit, and their pulse is counted for a minute
3. Body mass index: weight [kg] / height [m]2
4. Waist hip ratio: waist circumference/hip circumference
5. Systolic blood pressure and diastolic blood pressure

Group A - Mat Pilates (Study Group)

Pilates exercises are the form of low-intensity aerobic exercises.

In this study, beginners' Pilates exercises were selected. These exercises have low intensity compared to other forms of aerobic exercises and can be easily performed by the subjects. The participants were not doing any form of exercise before the study. So, beginner form of Pilates exercises were selected as they can be easily performed without fatigue. Exercise training was done three times per week for eight weeks. The intensity of the exercise is measured by the Rate of perceived exertion [RPE] using the Borg RPE scale. The session is of 60 minutes. Each session includes three phases: 1. warm-up phase [10 min] 2. Pilates session [35 min] 3. cool down phase [15 min]

Table 1 : Exercises prescription for cardiovascular fitness

Warm-up [10 minutes]	**Pilates session[35 minutes]**	**Cool down [15 minutes]**
Breathing	Shoulder bridge	Neck stretch
Toe waves	Bent knee	Knee stretch
Wrist rolls	Side kick front	Breathing
Arm circles	Side kick back	
Tiptoe stand	Single leg circle	
Hip rolls	Swimming	
Calf stretch	Mermaid stretch	
Hamstring stretch	Chest lift	
Quadriceps stretch	Single leg stretch	
	Bird dog exercise	

Group – B Regular Medications (Control Group)

Patients in this group received only their medications

Results

Table 2: Mean Comparison among group A & B

Mean Comparison	Group A		Group B	
	pre-test	post-test	pre-test	post-test
BMI	29.95 ± 1.92	28.74 ± 2.02	30.53 ± 1.32	30.44 ± 1.32
Waist hip ratio	0.85 ± 0.06	0.82 ± 0.06	0.87 ± 0.06	0.86 ± 0.06
3-minute step test	148.15 ± 6.53	137.95 ± 6.45	146.4 ± 7.03	143.25 ± 7.35
Borg RPE Scale	4.6 ± 0.5	3.6 ± 0.5	4.5 ± 0.51	4.3 ± 0.57
Systolic blood pressure	132.25 ± 3.63	124.4 ± 3.05	132 ± 3.61	130.25 ± 3.8
Diastolic blood pressure	84.75 ± 1.86	81.05 ± 1.28	84.65 ± 1.84	83.25 ± 1.97

Table 3: Pairwise comparison of group A among pre and post-test.

Group A		Mean difference	t-test	95% Confidence Interval		p-value
				Lower	Upper	
BMI	**pre-post**	1.21 ± 0.27	20.09	1.08	1.33	0.000***
Waist hip ratio	**pre-post**	0.03 ± 0.02	6.86	0.02	0.04	0.000***
3-minute step test	**pre-post**	10.2 ± 2.76	16.5	8.91	11.49	0.000***
Borg RPE Scale	**pre-post**	0.7 ± 0.1	5.8	0.5	1.5	0.000***
Systolic blood pressure	**pre-post**	7.85 ±2.77	12.64	6.55	9.15	0.000***
Diastolic blood pressure	**pre-post**	3.7 ± 1.86	8.86	2.82	4.57	0.000***

*Note: p-value is given by paired t-test and *, **, *** refer to <0.05, <0.01 and <0.001 level of significance*

Table 3 shows the mean difference ± SD values of the pre & post-test of group A for BMI, Waist hip ratio, 3 min Harvard test, Borg RPE Scale and Systolic/ Diastolic blood pressure, which were 1.21 ± 0.27, 0.03 ± 0.02, 10.2 ± 2.76, 0.7 ± 0.1, 7.85 ± 2.77 and 3.7 ± 1.86

respectively. Pre & post-tests of group A were highly statistically significant, with a 95% of the level of significance (p-value < 0.05).

Table 4: Pairwise comparison of group B among pre and post-test.

Group B		Mean difference	t-test	95% Confidence Interval		p-value
				Lower	Upper	
BMI	**pre-post**	0.08 ± 0.11	3.34	0.031	0.14	0.003**
Waist hip ratio	**pre-post**	0.01 ± 0.01	6.28	0.01	0.01	0.000***
3-minute step test	**pre-post**	3.15 ± 1.38	10.15	2.5	3.79	0.000***
Borg RPE Scale	**pre-post**	0.2 ± 0.41	2.17	0.01	0.39	0.042*
Systolic blood pressure	**pre-post**	1.75 ± 1.45	5.41	1.07	2.42	0.000***
Diastolic blood pressure	**pre-post**	1.4 ± 1.27	4.91	0.8	1.99	0.000***

*Note: p-value is given by paired t-test and *, **, *** refer to <0.05, <0.01 and <0.001 level of significance*

Table 4 shows the mean difference ± SD values of the pre & post-test of group B for BMI, waist-hip ratio, 3 min Harvard test, Borg RPE Scale and Systolic/ Diastolic blood pressure;

which were 0.08 ± 0.11, 0.01 ± 0.01, 3.15 ± 1.38, 0.2 ± 0.41, 1.75 ± 1.45, and 1.4 ± 1.27

respectively. Pre & post-test of group B were highly statistically significant with a 95% of the level of significance (p-value < 0.05).

Table 5: ANOVA of Pre-test among group A & B

Pre-test		Sum of Squares	df	Mean Square	F-test	p-value
BMI	**BetweenGroups**	3.364	1	3.364	1.236	0.273
	Within Groups	103.407	38	2.721		
	Total	106.771	39			
Waist hipratio	**Betwee Groups**	0.004	1	0.004	1.247	0.271
	Within Groups	0.134	38	0.004		
	Total	0.139	39			
3-minute steptest	**Between Groups**	30.625	1	30.625	0.665	0.42
	Within Groups	1749.35	38	46.036		
	Total	1779.975	39			
Borg RPE Scale	**Between Groups**	0.1	1	0.1	0.388	0.537
	Within Groups	9.8	38	0.258		
	Total	9.9	39			
Systolic blood pressure	**BetweenGroups**	0.625	1	0.625	0.048	0.828
	Within Groups	497.75	38	13.099		
	Total	498.375	39			
Diastolic blood pressure	**BetweenGroups**	0.1	1	0.1	0.029	0.865
	Within Groups	130.3	38	3.429		
	Total	130.4	39			

*Note: *, **, *** refer to <0.05, <0.01 and <0.001 level of significance*

Table 5 shows the output of the ANOVA analysis and whether there is a statistically significant difference between our groups A & B means of pre-test. We can see that there are no variables of pre-test among groups A & B are below 0.05 (p-value < 0.05) and, which means there is no statistically significant difference in the mean of BMI, Waist hip ratio, 3 min Harvard test, Borg RPE Scale and Systolic/ Diastolic blood pressure of pre-test between groups A & B.

Table 6: ANOVA of Post-test among group A & B

Post-test		Sum of Squares	df	Mean Square	F-test	p-value
BMI	**Between Groups**	29.07	1	29.07	9.994	0.003**
	Within Groups	110.534	38	2.909		
	Total	139.604	39			
Waist hip ratio	**Between Groups**	0.018	1	0.018	5.055	0.03*
	Within Groups	0.136	38	0.004		
	Total	0.154	39			
3-minute step test	**Between Groups**	280.9	1	280.9	5.876	0.02*
	Within Groups	1816.7	38	47.808		
	Total	2097.6	39			
Borg RPE Scale	**Between Groups**	4.9	1	4.9	16.927	0.000***
	Within Groups	11	38	0.289		
	Total	15.9	39			
Systolic blood pressure	**Between Groups**	342.225	1	342.225	28.864	0.000***
	Within Groups	450.55	38	11.857		
	Total	792.775	39			
Diastolic blood pressure	**Between Groups**	48.4	1	48.4	17.566	0.000***
	Within Groups	104.7	38	2.755		
	Total	153.1	39			

*Note: *, **, *** refer to <0.05, <0.01 and <0.001 level of significance*

Table 6 shows the output of the ANOVA analysis and whether there is a statistically significant difference between our groups A & B means of post-test. We can see that there are all variables of the post-test among groups A & B are below 0.05 (p-value < 0.05) and, which means there is a statistically significant difference in the mean of BMI, Waist hip ratio, 3 min Harvard test, Borg RPE Scale and Systolic/ Diastolic blood pressure of post-test between groups A & B.

Discussion

The study was made on the effect of Mat Pilates exercises on cardiometabolic parameters to improve cardiovascular fitness in postmenopausal diabetic women, with 20 subjects in each group. The main findings were BMI, waist hip ratio, 3-minute Harvard step test, Borg RPE scale, and systolic and diastolic blood pressure.

The results from this study shows that the data regarding the effect of Mat Pilates intervention on cardiometabolic parameters in postmenopausal women with diabetes showed that regular exercise significantly improved cardiovascular fitness. The results also showed that Mat Pilates exercises also helped in maintaining systolic and diastolic blood pressures

Within normal ranges. The sub-analysis suggests that the Mat Pilates exercises have a significant effect on cardiometabolic parameters and cardiovascular fitness in subjects compared to subjects with only medications

Conclusion

It was seen that mat Pilates exercises helped reduce BMI, waist hip ratio, improving cardiovascular fitness, and maintaining blood pressure in normal ranges. BMI, waist-hip ratio, 3 min Harvard test,

Borg RPE Scale, and Systolic/ Diastolic blood pressure in pre- and post-test of group A were highly statistically significant with a 95% level of significance (p value < 0.05).

There is no statistically significant difference in the mean of BMI, Waist hip ratio, 3 min Harvard test, Borg RPE Scale, and Systolic/ Diastolic blood pressure of pre-test between groups A and B. There is a statistically significant difference in the mean of BMI, Waist hip ratio, 3 min Harvard test, Borg RPE Scale, and Systolic/ Diastolic blood pressure of post-test between groups A and B.

This study concluded that mat Pilates exercises showed good results in improving cardiovascular fitness in postmenopausal women with diabetes in study group compared to the control group.

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