

EFFICACY OF PILATES BASED MAT EXERCISE ON QUALITY OF LIFE, QUALITY OF SLEEP AND SATISFACTION WITH LIFE IN TYPE 2 DIABETES MELLITUS

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received: March 12, 2018 accepted: June 02, 2018

available online: June 15, 2018

Abstract

Background and Aims: Diabetes Mellitus may affect the patient's quality of life and sleep that lead to reduced satisfaction of life. Aim of study was to improve quality of life and sleep along with satisfaction of life by giving physical therapy (pilates based on mat exercise) intervention. **Material and Methods:** Study design: experimental study, same subject design (pre-post). Sample size: 30 individuals (13 males, 17 females) with mean age 46.05 ± 9.01 , mean weight 70.48 ± 12.11 and mean duration of diabetes mellitus 7.88 ± 4.49 . Intervention: Pilates based mat exercises were given in experimental group. Duration of treatment: 30-40 minutes. Number of session: 5 sessions/week. Total duration: 4 weeks. Outcomes measures: Final Qolid Questionnaire, Pittsburgh Sleep Quality Index and Satisfaction with Life Scale. Statistics: descriptive statistics used to measure mean \pm standard deviation and inferential statistics related t-test used to compare pre and post reading. **Results:** The results showed highly significant effect of exercise on quality of life and quality of sleep and significant result was found on satisfaction with life. **Conclusion:** Pilates based mat exercises shows positive effect on all parameters (quality of life, quality of sleep and satisfaction with life) of patients having type 2 diabetes mellitus.

key words: sedentarism, obesity, aging, hypoglycaemia, exercise

Background and aims

In today's era there are so many diseases or disorder which occurs due to sedentary life style or more dependency on gadgets [1]. Diabetes mellitus is one of them which become a common disorder now a day. Diabetes is a chronic metabolic disorder characterized by elevation of blood glucose level due to either impaired insulin secretion or increase insulin resistance

and pancreatic beta cell failure. Type 2 diabetes mellitus is the most common among all types of diabetes and it is caused by genetic (multiple gene involvement) and environmental factors (i.e. obesity, overeating, lack of exercise, stress, aging) [2-4].

There are so many factors which increases the prevalence of diabetes. According to Wang et al peoples who are having less active and take unhealthy diet were more prone to have longer

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duration of diabetes with poor glycaemic control [5]. According to WHO every year there was 6% increase in incidence of diabetes mellitus [6]. Diabetes became the top most major problem in India. India becomes the diabetes capital of the world, every 5th diabetic in the world being an Indian [7]. According to Wild et al. India got the first rank all over the world and 31.7 million people have diabetes in India being estimated that it will lead to 79.4 million patients in 2030 [8]. As per IDF (International Diabetes Federation) data in India there were 41 million persons with diabetes in 2006 [6]. Diabetes is the 7th leading cause of death [9]. According to WHO it was the 8th leading cause of death in 2012 and there were 1.5 million deaths worldwide in 2012 due to diabetes. The numbers of patients are rising around 4 times from 1980 to 2014. Globally there are 422 million adults have diabetes over 18 years in 2014. From the past 3 decades the prevalence of diabetes increases rapidly in low and middle income countries [10].

Peoples who are having type 2 diabetes mellitus have lower quality of life as compared to non-diabetic people. The exact cause for this was unknown but it may be estimated that some variables interfere this such as use of insulin, age, social level, psychological factor, ethnicity, education, knowledge of disease and several conditions or complications eg lower limb amputation, kidney failure or blindness, that effect quality of life [10,11].

The incidence of type 2 diabetes mellitus was increased due to poor sleep quality and this alter the social and work activities and also reduces the quality of life, in all places a great burden to society. Sleep restriction affects the cortisol level which leads to increased abdominal adiposity and decreased insulin sensitivity hence more chance for having diabetes mellitus [12,13].

There are several factors which causes psychological distress and cognitive dysfunctions in patients who are having type 2 diabetes mellitus such as complex medical regimens, worries about hypoglycaemia, complication of diabetes, unfavourable living environment, lack of social support. This whole will lead to mentally disturb the patient and reduces its quality of life and self-care and self-satisfaction with life and reduces the patient's work efficiency [14,15].

All these three parameters: quality of life, quality of sleep and satisfaction with life are playing a major role in patients who are having type 2 diabetes mellitus. They all are interlinked and all these lead to decrease work efficiency and productivity and a huge amount of cost spent on to reduce these parameters by patient or government bodies but still they are persisting. There are several pharmacological and non-pharmacological treatment (eg physical therapy, aerobic exercises) approaches to relieve them but there is no study on effect of mat based pilates techniques on these parameters. Literature shows effect of pilates exercise on quality of life, quality of sleep and satisfaction with life [16-18] on other conditions not on diabetes mellitus. So our aim of this study was to find out the effect of mat based pilates exercises on type 2 diabetes mellitus.

Material and Methods:

Study design and recruitment of participants

In the study, thirty participants aged 35-65, diagnosed with type 2 diabetes mellitus were enrolled between May 2017 and July 2017 in the University Health Centre and Out Patient Department (OPD) of physiotherapy department, Guru Jambheshwar University of Science & Technology (GJU S&T), Hisar, Haryana, India. The participants who fulfilling the inclusion and exclusion criteria were included in the study.

Inclusion criteria: medically diagnosed patients with type 2 diabetes mellitus, patients who complaint sleep abnormality.

Exclusion criteria: any medical problem which deny the moderate exercise protocol such as any cardiovascular, neurological and musculoskeletal problems and patients with foot ulcers.

Baseline characteristics of study group

A total of 30 individuals 13 males and 17 females were selected by convenient sampling method who agreed to participate completely. But 10 patients due to some reasons did not complete the exercise session. After satisfying the inclusion and exclusion criteria the therapist informed the aim and activity of the study, research instrument and general approach of data analyses after that the informed consent was taken from every patient.

Intervention

After the baseline evaluation was done by using questionnaire on quality of life, quality of sleep and satisfaction with life. Patients in experimental group were asked to come regularly for the session for 4 weeks on alternate days. Pre intervention training were given to experimental group for one week so that patients could be well versed with the technique and get adapted to the exercise rules like how to engage “B-line” or breathing patterns. The exercise protocol started with 5 min warm up on treadmill then exercise protocol (Table 1) was given ended with cool down session. After completion of 4th week post intervention data were collected.

Pilates is a form of body/ mind training in which many types of exercises (balance, endurance, strength and flexibility) are included in order to maintain posture, breathing and muscular control [16].

Table 1. Mat based Pilates exercise protocol for intervention group [19]

Basic routine	Intermediate routine	Advanced routine
Hundreds Basic	The Hundreds:	Corkscrew:
Percussion	alternating legs	advanced
Breathing	Coordination	The Saw
Single Leg	The roll up	Side kick 1
Stretch	The roll over	Side leg lifts
Single Leg	Single leg circles	Pelvic curl
Circles 1	Rolling like a ball	Pelvic lift
Side to Side	Crisscross	Leg pull prone
Stomach Stretch	Single leg kick	Side kick 2
The Perfect	Double leg kick	The Hundreds:
Abdominal Curl	Spine rotation	lower and raise
Ankle Weight:	Spine stretch	pendulum
outer thigh	Corkscrew: basic	
(abductors)		
Ankle Weight:		
inner thigh		
(adductors)		
Ankle weight:		
outer thigh		
flexion		
(abductors)		
Back of Thigh:		
Hamstring/		
Buttocks		
Opening Arms		

Outcome measures/ research instruments

The project included three main research instruments. Two questionnaires and one scale applied face to face to each patient. Final QOLID Questionnaire for Quality of Life [20] which contains 8 domains with 34 items which cover all aspect of quality of life like physical health (PH), physical endurance (PE), general health (GH), treatment satisfaction (TS), symptom irritability (SB), financial worries (FW), emotional/ mental health (EMH) and diet satisfaction (DS). Pittsburgh Sleep Quality Index for quality of sleep [21]. It is a self-rated questionnaire designed to measure the poor or good sleep quality by generating 7 components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication and daytime dysfunction over the last month. and Satisfaction with Life Scale [22] for satisfaction with life which is a 5 item scale designed to

measure global cognitive judgement of one's life satisfaction (not a measure of either positive or negative affect). Participants indicate how much they agree or disagree with each of the 5 items using a 7-point scale that ranges from 7 strongly agree to 1 strongly disagree.

Statistical analysis

The data have been analysed using the SPSS version 20 (Statistical Package for Social Sciences). Descriptive statistical was used to measure the mean and standard deviation of the

groups and interferential statistics was used to analyse the pre and post data of the group by using t-test.

Results

Analysis of variables

Quality of life: the data of quality of life was gathered using QOLID questionnaire specifically for Indian population ([Tables 2, 3](#), [Figure 1](#)).

Table 2. Descriptive table of experimental group pre and post data for quality of life.

Experimental pre and post data		N	Mean	Std. Deviation	Std. Error mean
PH	Pre	20	3.35	.57	.12
	post	20	4.25	.68	.21
PE	Pre	20	3.13	.72	.16
	Post	20	4.26	.82	.26
GH	Pre	20	3.03	.77	.17
	Post	20	4.11	.90	.28
TS	Pre	20	2.82	.70	.15
	Post	20	3.82	.65	.20
SB	Pre	20	3.06	.72	.16
	Post	20	4.08	.75	.23
FW	Pre	20	3.16	.66	.14
	Post	20	4.16	.64	.20
EMH	Pre	20	3.26	.68	.15
	Post	20	4.15	.56	.17
DS	Pre	20	2.08	.65	.14
	post	20	3.98	.66	.20

Table 3. T-test table for quality of life.

Domains	Variance	T value	Mean difference	Significance (two tailed)
PH	Equal variances assumed	4.93	.74	.000
	Equal variances not assumed	3.78	.74	.004
PE	Equal variances assumed	5.72	1.03	.000
	Equal variances not assumed	4.41	1.03	.001
GH	Equal variances assumed	5.12	.85	.000
	Equal variancesnot assumed	3.70	.85	.004
TS	Equal variances assumed	4.57	.77	.000
	Equal variances not assumed	3.54	.77	.005

Table 3. Conitnued.

Domains	Variance	T value	Mean difference	Significance (two tailed)
SB	Equal variances assumed	6.29	1.08	.000
	Equal variances not assumed	4.50	1.08	.001
FW	Equal variances assumed	6.00	1.01	.000
	Equal variances not assumed	4.72	1.01	.001
EMH	Equal variances assumed	4.28	.57	.000
	Equal variances not assumed	3.15	.57	.011
DS	Equal variances assumed	8.62	1.71	.000
	Equal variances not assumed	7.4	1.71	.000

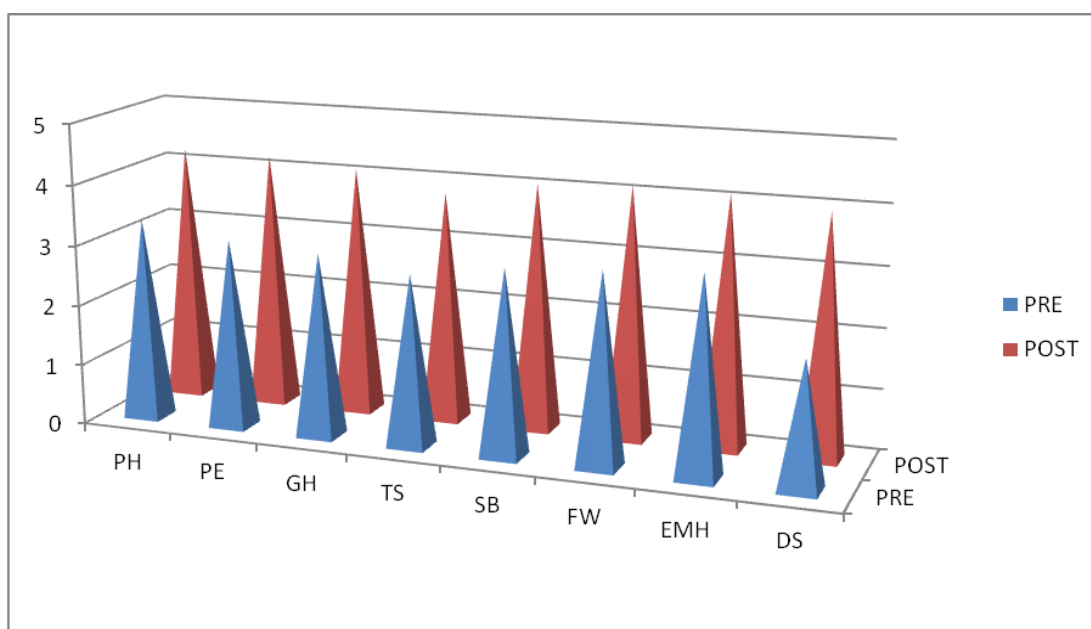


Figure 1. Graph showing experimental pre and post data for quality of life (QOLID).

Table 4. Descriptive table for pre- and post- data for quality of sleep

Experimental and post	pre	mean	N	Std. Deviation	Std. Error mean
Pre		5.50	20	2.74	.61
Post		1.75	20	1.71	.38

After the analysis means of 8 domains the significance level was extremely high i.e. $p < 0.001$ which means that Pilates was extremely effective in improving quality of life. It was also observed that although there was improvement in all domains but three domains PH (physical

health), GH (general health), EMH (emotional and mental health) showed high improvement level. Quality of sleep: the data was gathered using Pittsburgh Sleep Quality Index. (Tables 4,5, Figure 2).

Table 5. T-test table.

Groups	Variance	t value	Mean difference	Significance (2 tailed)
Pre	Equal variances assumed	1.12	1.10	.269
	Equal variances not assumed	1.26	1.10	.219
Post	Equal variances assumed	-3.54	-2.45	.001
	Equal variances not assumed	-3.39	-2.45	.004

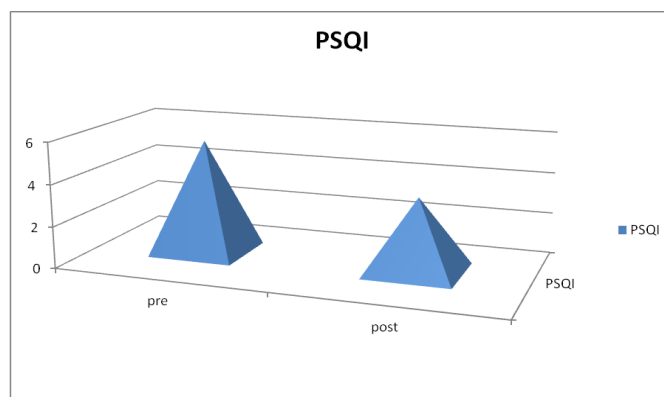


Figure 2. Graph showing pre and post data of quality of sleep (PSQI).

After analysing mean of both groups using PSQI the significance level was extremely high i.e. $p < 0.001$ which means the Pilates was extremely effective in improving quality of sleep.

Satisfaction with life scale

Data was gathered using satisfaction with life scale ([Tables 6, 7](#)).

Table 6. Pre data for satisfaction with life scale in experimental group.

Statement	Strongly agree (7)	Agree (6)	Slightly agree (5)	Neither agree nor disagree (4)	Slightly disagree (3)	Disagree (2)	Strongly disagree (1)
1	3	6	3	3	3	2	
2		6	8	4	2		
3	3	4	6	4	3		
4		2	5	4	3	3	
5	2	4	2	5	2	2	3

Table 7. Post data for satisfaction with life scale in experimental group.

Statement	Strongly agree (7)	Agree (6)	Slightly agree (5)	Neither agree nor disagree (4)	Slightly disagree (3)	Disagree (2)	Strongly disagree (1)
1	11	7	2				
2	6	7	4	5			
3	4	8	5	1	1		
4	3	9	4	4			
5	5	10	2	3	1		

After analysing values of both groups using table calculation, there was improvement in statement 1,2 and 5 in post intervention data as compare to pre intervention data in experimental group.

Discussions

The present study aims to show the efficacy of Pilates based mat exercise program on parameters of quality of life, quality of sleep and satisfaction with life scale in patients suffering from type 2 diabetes mellitus. The result of the study concluded that Pilates based mat exercise have significant role in improving these parameters after 4-week training program.

Various studies have been done on effect of exercises on diabetes by using various parameters which includes blood glucose, HbA1c, anxiety etc. and very few studies was found on quality of life, quality of sleep and satisfaction with life. But there was no study on effect of Pilates based mat exercises on diabetic patients. There are some studies which shows relationship between the parameters included in the study and type 2 diabetes. According to Correa et al (2017) people with diabetes mellitus have lower quality of life due to insulin use and complications of diabetes mellitus [11]. According to Fontele et al (2015) [12] patients who are having type 2 diabetes mellitus shows sleep disturbances but Lee et al (2016) affirmed that poor sleep quality increases the risk and incidence of diabetes mellitus [13]. As the study of Chew et al (2017) demonstrated, diabetes related stress reduces the self-care and disease control [14]. And Munshi (2017) done a study on older adults he stated that cognitive distress plays a great impact on self-care and quality of life [15].

The study done by Yucel et al (2016) found that Pilates based mat exercise has positive effect on quality of life in women with type 2

diabetes mellitus and has recommended it as a part of treatment program [23]. Curi et al (2018) found that mat based Pilates training improves health status and quality of sleep in elderly women. And Vincini et al (2017) reported the effect of Pilates and aerobic training on quality of life, depression and anxiety on obese patients.

From all these above studies we concluded that Pilates has a great impact on all these three parameters and it may become an effective treatment strategy for diabetic individuals who are affecting from all these three parameters that is why we are applying this technique on diabetic patient in order to find out its effect on diabetic population.

Limitation of the study

Duration of diabetes was not assessed and the intervention time and duration was short.

Future perspectives

Patients may be included with specific duration of diabetes mellitus. Also, to see the role of Pilates exercise on pain in patients with diabetes mellitus and to see the electromyographical (EMG) changes on muscles in patients with diabetes mellitus.

Conclusions

The present study reports the positive effect of Pilates based mat exercise program on quality of life, quality of sleep and satisfaction with life. Therefore, it is recommended that Pilates should be prescribed as mandatory exercise program to all the diabetic patients so that the quality of life, quality of sleep and satisfaction with life were improved.

Acknowledgements. We are thankful to all the patients who participated in the study.

Conflict of interest. There was no conflict of interest among authors.

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