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Short term and long term effects of a eight week mat Pilates exercise program in patients with nonspecific chronic low back pain

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Abstract
Aim & Objective Of The Study: To find out the short term and long term effects of Mat Pilates exercise program on reducing pain, disability and improving recovery in individuals with non-specific chronic low back pain.
Background: A previous studies suggest to identify the ability of Mat Pilates exercise program in maintain improvements of non-specific chronic low back pain. Mat Pilates exercise program also give emphasize on core strengthening, coordination, posture, and of breathing with movement.
Subject: In this study, 30 subjects aged 20-45 years were purposively selected and there met by the inclusion criteria.
Methodology: This quasi experimental study was conducted among a total of 30 subjects in Asia Metropolitan University, Cheras, Selangor within 8 weeks. The subjects of 30 individual who meets the inclusion criteria were selected. The concern form given to subjects before start assessed the pain, disability and giving the Mat Pilates exercise program procedure and exercise protocol to each individual. The pretest reading was taken on first day of intervention and first reading of post-test was taken after completion of 4 weeks of the intervention and second reading of post-test was taken after completion of following 4 weeks of intervention. By using the numerical pain rating scale, oswestry low back pain disability questionnaire and the global perceived effect scale, the post-test reading were assessed. The Mat Pilates exercise program protocols were same throughout the duration of the training.
Results: The results shown that Mat Pilates exercise program have more significant difference effects on long term of Mat Pilates exercise program rather than the short term of Mat Pilates exercise program in help reducing pain, disability and improving recovery in patients with non-specific chronic low back pain.
Conclusion: The data analysis was done on SPSS to determine the result in paired "*t*" test. Based on all the data gained from this study, it is concluded that in short term and long term effects of an eight week Mat Pilates exercise program have a statistically significant difference in help reducing pain, disability and improving recovery in patients with non-specific chronic low back pain but more significant differences have showed in long term effects of Mat Pilates exercise program rather than the short term effects of Mat Pilates exercise program in patients with non-specific chronic low back pain.

Keywords: NPRS (Numerical pain rating scale), ODI (Oswestry disability index), GPE (global perceived effect scale).

1. Introduction
Low back or lumber spine pain is a common musculoskeletal problem throughout the world [1]. Non-specific chronic low back pain is the general term that refers to any type of back pain in the lumbar region that is not related to serious pathology and/or does not have a specific cause [2]. It has been estimated that 80% of the population will experience at least one episode of back pain at some point in their life time [3], reports showed that between 28% and 41% of persons with acute low back pain never really recovered, but will developing later into chronic low back pain [4, 5]. Chronic low back pain is a painful condition and it may cause great deal of suffering and restriction of movement. A previous study had mentioned that the incidence of low back pain in Malaysia was found around 12%, while a higher prevalence has been found in about 60% of population.

Low back pain has been recognized as one of the most common cause of work disability during the working years of life. The symptoms of Pain and disability are the most important problem to distinguish in non-specific chronic low back pain.[6]Low back pain also causes problem of muscles strength and endurance, when the changes occurs in the neuromuscular mechanisms that affects the trunk stability and movement efficiency [7, 21, 37].

Some researchers suggest that decreased spinal stability may be due to weakened muscles such as the transverse abdominals and multifidus which cause low back pain indirectly. Hence, Mat Pilates exercise program can strengthen these muscles and may be an effective exercise program for non-specific chronic low back pain [8, 9]. Pilates method aims to improve the strength and durability of the core muscles to lengthen and stretch the lumbar spine in turn to reduces the compression of the joint and may causes a change in the tilt of the pelvis then can reducing the low back pain [10, 14].

2. Methodology

The Objective of the Study was to find out the short term and long term effects of Mat Pilates exercise program on reducing pain, disability and improving recovery in individuals with non-specific chronic low back pain. The study was conducted in Asia Metropolitan University (AMU), Cheras, and Selangor. The subjects which areDiagnosed individuals with non-specific chronic low back pain more than 3months, aged between 20 to 45 years, both gender, and 3 and above of numerical pain rating scale, at least 10% and above of oswestry low back pain disability questionnaire were included in this study. The subjects which are using pain killers, history of spinal fracture, serious inflammatory diseases, rheumatic diseases, disk herniation, structural deformities, tumour or infection, severe osteoporosis, nerve root compromise or cauda equine syndrome, Pregnancy were excluded.

2.1 Procedure

30 subjects that meet the inclusion criteria were selected for the study of Mat Pilates exercise program. The concern form given to subjects before start assessed the pain and disability. The pain and disability was assessed by using the numerical pain rating scale and oswestry low back pain disability questionnaire. After the assessment the selected Mat Pilates exercise program were taught to the subjects. Mat Pilates exercise program procedure and the exercise protocol was given to each individual and demonstrates the exercises. Before begins with the Mat Pilates exercise program every subject should start with a warm up and proper breathing exercise program and then followed by abdominals, spine stretch group, swan series and side kick series. The warm up exercises of Mat Pilates exercise program which consists of mat-hundred, mat-roll up, mat-pelvic curl /skateboard action, mat-one leg circle and hamstring stretch were taught. The abdominals of Mat Pilates exercise program which consists of mat-single leg stretch, mat-double leg stretch and mat-criss cross. The spine stretch group of Mat Pilates exercise program which consists of mat-spine stretch forward and the saw. The swan series of Mat Pilates exercise program which consists of flight and mat-resting position. The sidekicks' series of Mat Pilates exercise program which consists of mat-side kick series-up & down and mat-side kick series-small circles. Each session of exercise performed in thrice a week and holds the position for 30 seconds /did for 30 repetitions. The overall exercise duration within 45-60 minutes and the exercise continued over a period of eight weeks. The exercise protocols were same throughout the period of the training. Besides that, after completed intervention of four weeks, the first reading of post-test was taken and following completed 4 weeks of the intervention, the second reading of post-test was taken. All reading was analyzed after 8 weeks. Henceforth, for the post-test reading, the participant were required to answer questionnaire and scales such as numerical pain rating scale, oswestry low back pain disability questionnaire, global perceived effect scale. The scale and questionnaire which was used to identify the effects of Mat Pilates exercise program in reducing pain and disability and thereby improving recovery in patients with non-specific chronic low back pain within longer period of time was identified. The outcome measures were Pain by using of numeric Pain Rating Scale, disability by using of Oswestry Low Back Pain Disability Questionnaire (ODI), and Global impression of recovery by using of Global Perceived Effect Scale (GPE).The primary outcome measure, the pain intensity was measured by the numeric pain rating scale which is valid and the higher score that means have worse pain. The disability associated with low back pain was measured by the oswestry low back pain disability questionnaire (ODI) which is valid and the lower percentage represents the less disability. The secondary outcome measure of the global impression of recovery was measured by using of the global perceived effect scale which is valid and the higher score means greater recovery from the condition.

2.2 Illustrations

Fig 1: Mat-hundred

Fig 2: Hamstring stretch

Fig 3: Mat-double leg Stretch

Fig 4: Mat-criss cross

Fig 5: Mat-spine stretch forward

Fig 6: The saw

Fig 7: Flight

Fig 8: Mat-side kick series-up &down

Fig 9: kick series-small circle

Fig 1: Lie on back, knee together and bent, chin to chest, lengthen spine and neck and tips of shoulder blades stay on mat. Do the mat-hundred in 30 pumps of arms.
Fig 2: Lie on back, one leg straight up to ceiling, the other leg on the mat. Grasp just below the knee on the vertical leg. Pull the knee toward the shoulder and hold the position in 30 seconds.
Fig 3: Chin to chest and lengthen spine and neck, eyes on belly button, maintain shoulder tips lightly touching the mat and both knees slightly apart and bring into chest. Do in 30 repetitions.
Fig 4: Do 30 repetitions. Stack hands under head and elbow out wide. Knee bent and feet on floor. Curl up then criss to the left and cross to the right. While, arm and shoulder remain wide and shoulder blades remain off the mat.
Fig 5: Do hold in 30 seconds. Sit tall with legs slightly wider than hip width, arms straight out and palms down, roll shoulder blades down back and relax shoulder wider. Deepen into sternum to initiate curl of spine and keep arms at shoulder height.
Fig 6: Open legs a little wider than your shoulders and reach arms out to the sides in line with your shoulders. Sit tall, twist spine and lower the back arm and look at it as you reach pinky finger past the little toe. Repeat on the opposite side. Do in 30 repetitions.
Fig 7: Lie on stomach, hands by sides, palms up. Raise your arms, shoulder, head and finally your legs. Hold the position in 30 seconds.
Fig 8: Maintain side position and lift the leg and straight up to the side and lower slowly. Each side do in 30 repetitions.
Fig 9: Maintain side position and reach the leg longer. Deepen the abdominals and maintain the legs parallel. Circle leg equally around front and back. Each side did in 30 repetitions.

3. Data analysis & Interpretation: As for this study, data analysis was done on SPSS 23 to determine the results. Paired "*t*" test were used.

Table 1

Numerical Pain Rating Scale	Paired Differences			't' Value	Sig (2-tailed) (*P*<0.05)
	Mean	Mean Difference	Standard deviation		
Pre test	5.03	1.200	.809	6.595	0.000
Posttest (4)	3.83		1.315		

Table 1 - The (NPRS) - Pre-test and Post-test (4 weeks) - The above table 1 showed the significant differences between the pre-test and post-test (4 weeks) result in the numerical pain rating scale. The pre-test mean value 5.03 which was more than the post-test (4 weeks) mean value in 3.83. There was an extremely statistically significant difference between the two mean values with the p value 0.000.

Table 2

Numerical Pain Rating Scale	Paired Differences			't' Value	Sig (2-tailed) (*P*<0.05)
	Mean	Mean Difference	Standard deviation		
Pre test	5.03	2.067	.809	8.632	0.000
Posttest (8)	2.97		1.299		

Table 2 - The (NPRS) - Pre-test and Post-test (8 weeks) - The above table 2 showed that the significant differences between the pre-test and post-test (8 weeks) result in the numerical pain rating scale. The pre-test mean value 5.03 which is more than the post-test (8 weeks) mean value in 2.97. There was an extremely statistically significant difference between the two mean values with the p value 0.000.

Table 3

Numerical Pain Rating Scale	Paired Differences			't' Value	Sig (2-tailed) (*P*<0.05)
	Mean	Mean Difference	Standard deviation		
Posttest (4)	3.83	0.87	1.315	4.557	0.000
Posttest (8)	2.967		1.299		

Table 3 - The (NPRS) - Post-test (4 weeks) and Post-test (8 weeks) - The above table 3 showed that the significant differences between the post-test (4 weeks) and post-test (8 weeks) result in the numerical pain rating scale. The post-test (4 weeks) mean value 3.83 which is less than the post-test (8 weeks) mean value in 2.97. Meanwhile when I observed the numerical pain rating scale, there was much more differences occurred in the results. There was an extremely statistically significant difference between the two mean values with the p value 0.000.

Table 4

Oswestry Disability Index (ODI)	Paired Differences			't' Value	Sig (2-tailed) (*P*<0.05)
	Mean	Mean Difference	Standard deviation		
Pre test	26.50	4.433	4.337	5.039	0.000
Posttest (4)	22.07		4.093		

Table 4 - The (ODI) - Pre-test and Post-test (4 weeks) - The table 4 showed that the significant differences between the pre-test and post-test (4 weeks) result in the oswestry disability index. The pre-test mean value is 26.50 and the post-test (4 weeks) mean value is 22.07. The statistically significant differences between the two mean values with the p value 0.000.

Table 5

Oswestry Disability Index	Paired Differences			't' Value	Sig (2-tailed) (*P*<0.05)
	Mean	Mean Difference	Standard deviation		
Pre test	26.50	6.967	4.337	6.854	0.000
Posttest (8)	19.53		4.041		

Table 5 - The (ODI) - Pre-test and Post-test (8 weeks) - The table 5 showed that the significant differences between the pre-test and post-test (8 weeks) result in the oswestry disability index. The pre-test mean value is 26.50 and the post-test (8 weeks) mean value is 19.53. The statistically significant differences between the two mean values with the p value 0.000.

Table 6

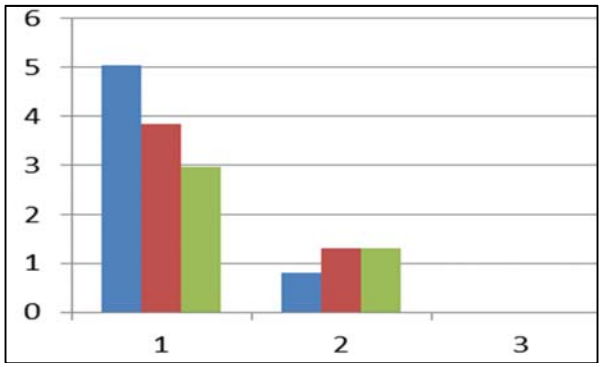
Oswestry Disability Index	Paired Differences			't' Value	Sig (2-tailed) (*P*<0.05)
	Mean	Mean Difference	Standard deviation		
Posttest (4)	22.07	2.533	4.093	3.525	0.001
Posttest (8)	19.53		4.041		

Table 6 - The (ODI) - Post-test (4 weeks) and Post-test (8 weeks) -The above table 6 showed that the significant differences between the post-test (4 weeks) and post-test (8 weeks) result in the oswestry disability index. The post-test (4 weeks) mean value is 22.07 and the post-test (8 weeks) mean value is 19.53. When compare the oswestry disability index with the post-test (4 weeks) and post-test (8 weeks), in post-test (8 weeks) have much significant differences obtained compared to post-test (4 weeks). There was also an extremely statistically significant DIFFERENCE between the two mean values with the p value 0.001.

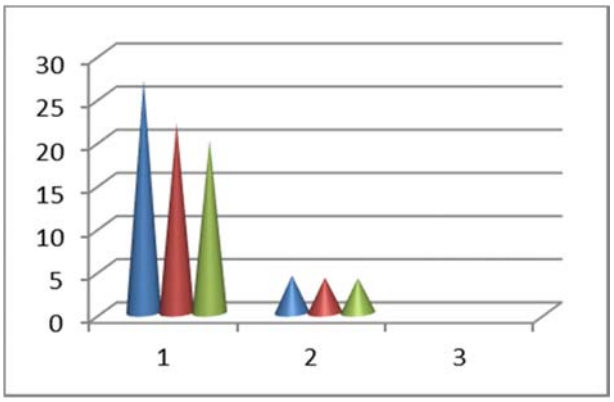
Table 7

Global Perceived Effect Scale (GPES)	Paired Differences			't' Value	Sig (2-tailed) (*P*<0.05)
	Mean	Mean Difference	Standard deviation		
Posttest (4)	1.30	-1.133	2.020	-3.225	0.003
Posttest (8)	2.43		2.192		

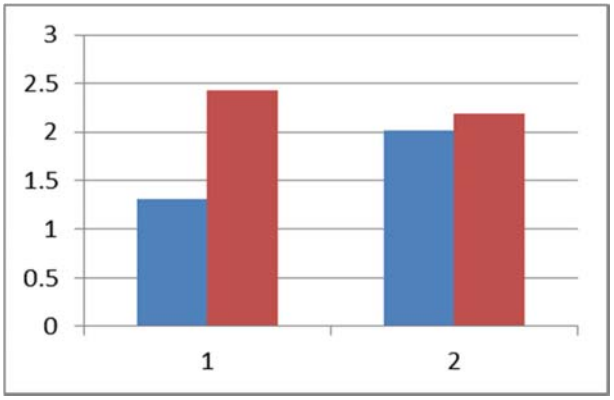
Table 7 - The (GPE) scale - Post-test (4 weeks) & (8 weeks) - The table 7 showed about the global perceived effect. There wasa significant differences appeared from post-test (4 weeks) to post-test (8 weeks) after intervention of Mat Pilates exercise program. The post-test (4 weeks) mean value is 1.30 and it's increased in the post-test (8 weeks) with the mean value is 2.43. However, In p values of global perceived effect showed in 0.003 which is less than p value of 0.005, it means that results showed significant differences between the results when compared with the post-test (4 weeks) of Mat Pilates exercise program and post-test (8 weeks) of Mat Pilates exercise program.



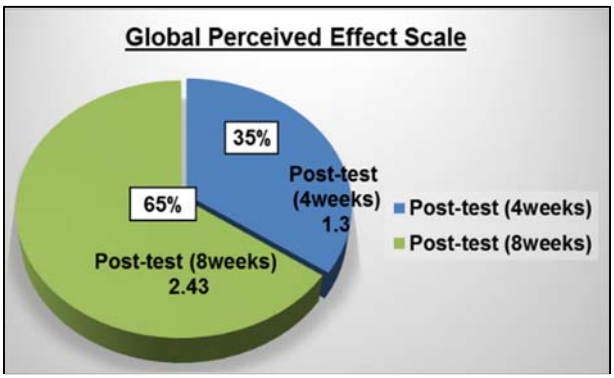
Graph 1: Numerical Pain Rating Scale (NPRS) Pretest / Posttest (4weeks) / Posttest (8 weeks) Mean & SD



Graph 2: Oswestry Disability Index (ODI) Pretest / Posttest (4weeks) / Posttest (8 weeks) Mean & SD



Graph 3: Global Perceived Effect Scale (GPES) – Posttest (4 weeks) & (8 weeks)



Graph 4

Graph 4 - The (GPE) scale - Post-test (4 weeks) & (8 weeks) - The (GPE) scale - Post-test (4 weeks) & (8 weeks) -The Chart 8 showed about the global perceived effect scale in improving recovering. There was showed a significant differences between post-test (4 weeks) and post-test (8 weeks). The post-test (4 weeks) mean values is 1.3 in 35% with the standard deviation in 2.020 and the post-test (8 weeks) mean values is 2.43 in 65% with the standard deviation in 2.192. Paired "*t*" test was used for determine the significant differences between pre-test and post-test (4 weeks) and post-test (8 weeks).

4. Results

The primary aim of this study is to determine whether in short-term and long-term effects of Mat Pilates excise program which one have shown a significant differences in help reducing pain, disability and improving recovery in patients with non-specific chronic low back pain. This results demonstrate that the Mat Pilates exercise program have shown an effects in reducing pain, disability and improving recovery within short-term and long-term duration, but in long-term duration of Mat Pilates exercise shown that more effects rather than in short-term duration with the significant differences between the post-test readings in the 4 weeks at short-term follow-up and 8 weeks at long-term follow-up of Mat Pilates exercise program.

5. Discussion

The data analysis was done on SPSS 23 to determine the results in paired "*t*" test. There was a significant difference obtained in the results of numerical pain rating scale. The pre-test and post-test (4 weeks) results shows the significant differences with the pre-test mean values is 5.03 with the standard deviation in 0.809 and post-test (4 weeks) mean values is 3.83 with the standard deviation in 1.315 and the post-test (8 weeks) mean values is 2.97 with the standard deviation in 1.299. Therefore, there was an extremely statistically significant difference obtained with the p value 0.000. Hence, when compared the oswestry disability index with the pre-test and post-test (4 weeks) and post-test (8 weeks) also shown the significant differences obtained in the results with the p value 0.000. The pre-test oswestry disability index mean values are 26.50 with the standard deviation in 4.337 and the post-test (4 weeks) mean values is 22.07 with the standard deviation in 4.093 and the post-test (8 weeks) mean values is 19.53 with the standard deviation in 4.041.

In the global perceived effect scale, the p values showed in 0.003 which is less than p value of 0.005, it means that results showed significant differences between the results when compared with the post-test (4 weeks) of Mat Pilates exercise program and post-test (8 weeks) of Mat Pilates exercise program. The post-test (4 weeks) mean values is 1.30 with the standard deviation in 2.020 and it's increased in the post-test (8 weeks) with the mean values is 2.43 and the standard deviation in 2.192.In the study done by Antonino Patti *et al*. stated that the effects of Mat Pilates exercise program for help in reducing pain, disability and improving recovery were proved in the short term effects and not in the long term effects of Mat Pilates exercise program for patients with non-specific chronic low back pain. Therefore, in the current study found that Mat Pilates exercise program were shows positive effects in short term and long term. But, more significant difference in reducing pain, disability and improving recovery were found in the long term effects rather than short term effects of Mat

Pilates exercise program which can found through the methods of the numerical pain rating scale, oswestry disability index and global perceived effect scale after the post-test value in 8 weeks while it means that at the end of intervention Mat Pilates exercise program. Based on the results and obtained values of the study, the alternative hypothesis is accepted and the null hypothesis is rejected.

6. Conclusion

Based on all the data gained from this study, it was concluded that in short term and long term effects of Mat Pilates exercise program have a statistically significant difference in help reducing pain, disability and improving recovery in patients with non-specific chronic low back pain but more significant differences have shown in long term effects of Mat Pilates exercise program rather than the short term effects of Mat Pilates exercise program in patients with non-specific chronic low back pain. The Limitation of this study was inability to blind the subjects and the researches with regard to treatment allocation, home exercise program were not supervised, lack of sources with inconsistent reporting, the number of subjects limited only 30. For future recommendation are Divide the gender into male and female can be conducted in future studies, increase the subjects to participant in Mat Pilates exercise program and also longer the duration of the exercise program more than 8 weeks can be done in future studies, the number of subjects also can increase to find the better results.

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