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## Effect of Pilates and Cable pulley exercises in work related musculoskeletal disorders on core stability and stress among male health care professionals

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### Abstract

**Aim:** This study aimed to do a comparative study on Pilates versus Cable pulley exercises in WRMSDs on core stability and stress status among male health care professionals.

**Method of the Subject:** Male health care professionals between 20-44 years were selected for the study. A Comparative experimental design with 60 subjects randomly divided into four equal groups with experimental group I, II, III and a control group. The groups performed either Pilates and/or cable pulley exercises for 3 times a week for 12 weeks.

**Variables:** Upper body endurance, lower body endurance and stress

**Result:** Since in this study the researcher found that there was positive changes in the improvement in upper body endurance, lower body endurance, and stress by Pilates and cable pulley exercises in the Experimental Group III when compared to Experimental Group I and II.

**Conclusion:** Hence it is concluded that significant improvement was seen in core stability of all the experimental groups. Additionally, Pilates exercises promote psychological benefit showing decreased in stress level after 12 weeks of training. No improvement was seen in any of the variables in the control group.

**Keywords:** Pilates, endurance and stress, additionally

### Introduction

Health care professionals provide services at various levels ranging from primary to tertiary health care services. The health care workers may be exposed to a number of workplace hazards that include physical, chemical, biological and psychosocial hazards [1]. Work-related musculoskeletal disorders (WMSD) have been recognized to be associated with psychosocial status of the workers [2]. The psychosocial status and working lives of hospital workers are severely affected by musculoskeletal disorders due to decrease in productivity and job satisfaction [3]. Occupational stress is one of the major reasons behind Psychological problems among different professionals. Evidences suggest that levels of stress in medical professionals are increasing world-wide [2, 3].

One of the widespread and most disabling issues in the workplace is low back pain (LBP). Among various musculoskeletal symptoms, LBP has higher prevalence in medical professionals [4]. Previous studies [5, 6] recommended various exercise interventions targeting core strength, trunk flexibility and endurance of upper and lower body which are crucial in the treatment and recurrence of low back pain. Of those, pilates has become a popular method that can also be used to improve physical fitness as well as musculoskeletal health [7]. Pilates method offers a gentle but powerful approach in achieving optimal strength, endurance and flexibility. It is a body conditioning therapy that targets deep postural muscles and improves muscle balance.

Despite the strong evidences of the positive effects of pilates, there is controversy in the literature whether specific exercise like pilates is needed or general strengthening exercises are equally effective in the treatment of low back pain. Some previous studies reported that Pilates exercises are superior to other types of exercises [8] while other studies showed similar benefits [9]. Thus, the effectiveness of Pilates over other types of exercises remains unclear.

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Therefore, this study was carried out to compare the effects of Pilates with those of cable-pulley apparatus exercises on core strength and stress.

**Statement of the Problem:** The researcher has decided to take up different combination of training using Pilates and Cable pulleys in work related musculoskeletal disorders among male health care professionals. Hence the investigator is very much intent to adopt the concept to find out the core stability and stress levels of the professionals.

**Selection of the Variables:** upper body endurance, lower body endurance, core group muscle group, trunk flexibility and stress

**Experimental Design:** The present study is a single blinded, comparative experimental study undertaken to assess the combined and individual effect of Pilates and cable-pulley apparatus exercises on core strength, trunk flexibility and endurance of upper, lower body and stress among male health care professionals. Individuals were included in the study if they had experienced non-specific mechanical LBP at least once in last 4 weeks for more than 3 weeks and having stress. They were not undergoing physical therapy or medical treatment for their LBP at the time of testing. The study involved 60 male health care professionals working for at least one year in respective field, between the age of 20 to 44 years. Individuals with congenital deformities, traumatic conditions and neuromuscular conditions were excluded from the study. The study was conducted after obtaining approval from the 'Department Research Committee' (DRC) of the 'Tamilnadu Physical Education and Sports University', Chennai.

**Data collection**

A written informed consent was obtained from the subjects included in the study. Subjects were randomly divided into four groups using cards in unmarked envelopes by an independent researcher. Fifteen subjects were recruited in each group. The groups were assigned as Groups I, II, III and IV with exercises interventions as under,

- **Group-I:** Pilates exercises
- **Group-II:** Cable-pulley apparatus exercises.
- **Group-III:** Combined Pilates and Cable-pulley apparatus exercises
- **Group-IV:** Control group with no exercises.

Subject's demographics and all the general characteristics (Height, weight and BMI) were recorded. The outcome measures were recorded at baseline. Subjects were asked not to participate in other physical activities or change their daily. The groups participated in their respective Pilates or/and cable-pulley apparatus exercises. The control group did not receive any intervention. Pilates and cable pulley apparatus exercise aims to improving general fitness and wellbeing with particular emphasis on fluid status. Exercises were performed 3 times a week for 12 weeks. Warm-up and cool down exercises were performed 10 minutes each before and after the exercise interventions respectively. Outcome measures were again tested at 12 weeks. Exercise intensity in both programs was based on the Borg Perceived Exertion Scale (PRE). The intensity was set at 5 on the scale. Subjects were instructed to report any discomfort immediately.

**Statistical Technique:** Analysis of covariance statistical technique was used, to test the significant difference among the treatment groups. Thirumalaisamy R. (2004).

**Computation of Analysis of Covariance:** The following tables illustrate the statistical results of Effects Of exercise protocols among male health care professionals having musculoskeletal disorders and ordered adjusted means and the difference between the means of the groups under study.

**Results of the study: The results of the study showed for the following variables**

The following tables illustrated the statistical results of the Upper body endurance in Effect of Pilates and Cable Pulley Exercises in Work Related Musculo Skeletal Disorders on Upper body endurance Variable among Male Health Care Professionals and ordered adjusted means of the groups under study.

**Table 1:** Computation of Analysis of Covariance of Upper Body Endurance

TEST	EXP-I	EXP-II	EXP-III	Control	SV	SS	DF	MS	OF	TF
Pre Test	23.53	23.06	21.80	23.80	B	35.38	3	11.79	0.20	2.72
					W	3327.46	56	59.41		
Post Test	28.20	28.66	33.13	23.73	B	664.33	3	221.44	7.33	2.72
					W	1692.4	56	30.22		
Adjusted	27.97	28.65	33.70	23.38	B	795.31	3	265.10	14.72	2.72
					W	990.42	55	18.00		
Mean Gain	4.66	5.60	11.33	0.06						

\*Significant at 0.05 level of confidence for 3 and 56 (df) =2.72 and 55(df) = 2.72

**Results of the Upper Body Endurance**

Table I shows analyzed data on Upper body endurance. The Pre Test means of Upper body endurance were 23.8 for Control Group, 23.53 for Experimental Group I, 23.06 For Experimental Group II and 21.8 For Experimental Group III. The 'OF' ratio 0.20 was lesser than the 'TF' ratio 2.72. Hence, the pre test was not significant at 0.05 level of confidence for degrees of freedom 3 and 56.

The Post Test means were 23.73 for Control Group, 28.2 for Experimental Group I Group, 28.66 for Experimental Group II and for 33.13 Experimental Group III. The 'OF' ratio 7.33 was higher than the 'TF' ratio 2.72. Hence Post Test was

significant at 0.05 level of confidence for the degrees of freedom 3 and 56.

The adjusted Post Test means were 23.38 for Control Group, 27.978 for Experimental Group I, 28.65 for Experimental Group II and 33.70 for Experimental Group III. The 'OF' ratio 14.72 was higher than the 'TF' ratio 2.72. Hence, the adjusted post test was significant at 0.05 level for the degrees of freedom 3 and 56.

The Mean gain values were 0.06 for Control group, 4.66 for Experimental Group I, 5.60 for Experimental Group II and 11.33 for Experimental Group III.

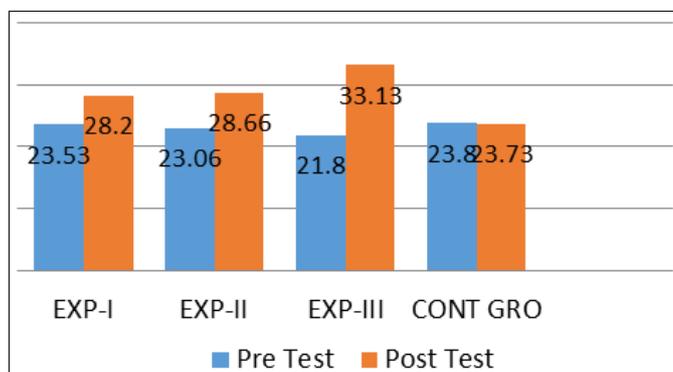


Fig 1: Upper body endurance

It is interesting to note that the results obtained from Experimental Group III had a more significant effect than Experimental Group II and I on the increased level of Upper Body Endurance. Further, the results obtained from Experimental Group II and I had a significant influence on Upper Body Endurance than the Control Group, but there is much difference between Experimental Group II comparing to I. Among three Experimental Groups, the Experimental Group III has tremendous change in Upper Body Endurance increase due to influence of 12 weeks combined training influenced better than other groups.

Once the Upper body endurance values are improved, automatically the changes are seen in the subjects. So it was found that the given exercises significantly increased the Upper body endurance at the end of 12 weeks of training period. Due to Pilates and cable pulley exercise it has been observed that physiological changes occur in the muscle glycogen and blood glucose, a fat oxidation and less lactate production of a given intensity due to post exercises. By Pilates and cable pulleys in upper body muscle following changes has been noticed like flexibility, mobility, improved glycemic control, insulin sensitivity, strength and endurance levels in our experimental groups.

Table 2: Computation of Analysis of Covariance of Lower Body Endurance

TEST	EXP-I	EXP-II	EXP-III	Control	SV	SS	DF	MS	OF	TF
Pre Test	25.2	24.33	23.4	24.33	B 24.31 W 1362.66	3 8.10 56 24.33			0.33	2.72
Post Test	29.26	25.73	25.86	24.26	B 201.65 W 1294.53	3 67.21 56 23.11			2.91	2.72
Adjusted	28.44	25.71	26.72	24.25	B 139.16 W 105.30	3 46.38 55 1.91			24.23	2.72
Mean Gain	4.6	1.4	2.46	0.06						

\*Significant at 0.05 level of confidence for 3 and 56 (df) =2.72 and 55(df)= 2.72

**Results of lower body endurance**

Table II shows analyzed data on lower body endurance. The Pre Test means of Lower body endurance were 24.33 for Control Group, 25.2 for Experimental Group I, 24.33 For Experimental Group II and 23.4 For Experimental Group III. The ‘OF’ ratio 0.95 was lesser than the ‘TF’ ratio 0.33. Hence, the pretest was not significant at 0.05 level of confidence for degrees of freedom 3 and 56.

The Post Test means were 24.26 for Control Group, 29.26 for Experimental Group I Group, 25.73 for Experimental Group II and for 25.86 Experimental Group III. The ‘OF’ ratio 2.91 was higher than the ‘TF’ ratio 2.72. Hence Post Test was significant at 0.05 level of confidence for the degrees of

freedom 3 and 56.

The adjusted Post Test means were 24.25 for Control Group, 28.44 for Experimental Group I, 25.71 for Experimental Group II and 26.72 for Experimental Group III. The ‘OF’ ratio 24.23 was higher than the ‘TF’ ratio 2.72. Hence, the adjusted post test was significant at 0.05 level for the degrees of freedom 3 and 55.

The Mean gain values were 0.06 for Control group, 4.6 for Experimental Group I, 1.4 for Experimental Group II and 2.46 for Experimental Group III.

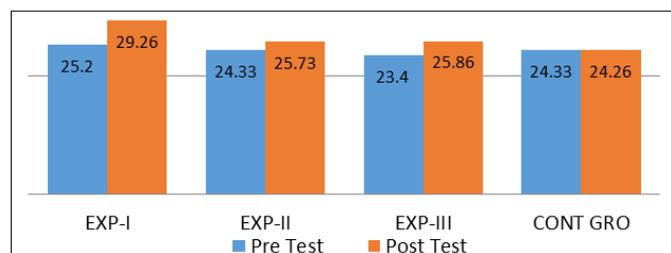


Fig 2: Lower Body Endurance

It is interesting to note that the results obtained from Experimental Group I had a more significant effect than Experimental Group II and III on the increased level of Lower Body Endurance. Further, the results obtained from Experimental Group II and III had a significant influence on Lower Body Endurance than the Control Group, but there is much difference between Experimental Group I comparing to III. Among three Experimental Groups, the Experimental Group I has tremendous change in Lower Body Endurance increase due to influence of 12 weeks combined training influenced better than other groups.

During the 12 weeks of training period, it was noted that the post test score was greater increase of Lower Body Endurance. Due to Pilates and cable pulley exercise it has been observed that physiological changes occur in the muscle glycogen and blood glucose, a fat oxidation and less lactate production of a given intensity due to post exercises. By Pilates and cable pulleys in lower body muscle following changes has been noticed like flexibility, mobility, improved glycemic control, insulin sensitivity, strength and endurance levels in our experimental groups.

Once the lower body endurance values are improved, automatically the changes are seen in the subjects. So it was found that the given exercises significantly increase the lower body endurance at the end of 12 weeks of training period.

Table 3: Computation of Analysis of Covariance of Stress

TEST	EXP-I	EXP-II	EXP-III	Control	SV	SS	DF	MS	OF	TF
Pre Test	20.86	21.4	22.06	22.6	B 25.86 W 1869.86	3 8.62 56 33.39			0.26	2.72
Post Test	16	18.26	16.8	22.4	B 365 W 1168.93	3 121.66 56 20.87			5.83	2.72
Adjusted	16.63	18.51	16.55	21.76	B 265.40 W 150.46	3 88.46 55 2.73			32.34	2.72
Mean Gain	4.06	2	4.4	0						

\*Significant at 0.05 level of confidence for 3 and 56 (df) =2.72 and 55(df)= 2.72

**Results of stress**

Table III shows analyzed data on Stress. The Pre Test means of stress were 22.6 for Control Group, 20.86 for Experimental Group I, 21.4 For Experimental Group II and 22.06 For

Experimental Group III. The 'OF' ratio 0.26 was lesser than the 'TF' ratio 2.72. Hence, the pretest was not significant at 0.05 level of confidence for degrees of freedom 3 and 56.

The Post Test means were 22.4 for Control Group, 16 for Experimental Group I Group, 18.26 for Experimental Group II and for 16.55 Experimental Group III. The 'OF' ratio 5.83 was higher than the 'TF' ratio 2.72. Hence Post Test was significant at 0.05 level of confidence for the degrees of freedom 3 and 56.

The adjusted Post Test means were 21.76 for Control Group, 16.63 for Experimental Group I, 18.51 for Experimental Group II and 16.55 for Experimental Group III. The 'OF' ratio 32.34 was higher than the 'TF' ratio 2.72. Hence, the adjusted post test was significant at 0.05 level for the degrees of freedom 3 and 55.

The Mean gain values were 0 for Control group, 4.06 for Experimental Group I, 2 for Experimental Group II and 4.4 for Experimental Group III.

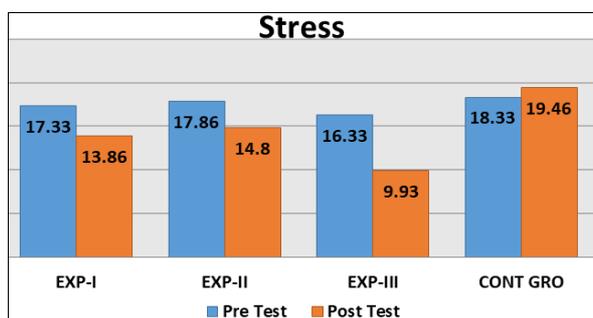


Fig 3: Stress

It is interesting to note that the results obtained from Experimental Group III had a more significant effect than Experimental Group II and I on the decreased level of Stress. Further, the results obtained from Experimental Group II and I had a significant influence on Stress than the Control Group, but there is much difference between Experimental Group I comparing to II. Among three Experimental Groups, the Experimental Group III has tremendous change in Stress decrease due to influence of 12 weeks combined training influenced better than other groups.

During the 12 weeks of training period, it was noted that the post test score was greater decrease of Stress. During the training period, the pattern of exercises are meaningfully influenced in reduction of stress levels due to Pilates, Cable pulley and combined exercises. Glucocorticoids have predominantly catabolic effects in the context of the adaptive stress response as part of a broad effort to use every energy source available against the imposed stressor. In order to produce amino acids that can be used as an additional substrate for oxidative pathways, glucocorticoids stimulate protein degradation at many tissues, such as skeletal muscles, bone, and skin. They also induce lipolysis (although they favor abdominal and dorso cervical fat storage). Along with their direct catabolic effects, glucocorticoids also counteract the anabolic effects of GH, insulin, and sex hormones on the organs and tissues they target. The Hypothalamic Pituitary Adrenal axis's activation of the catabolic state of the metabolism often reverses when the stressor is removed (s). Chronic stimulation of the Hypothalamic Pituitary Adrenal axis, however, can lead to a number of negative outcomes, such as elevated visceral adiposity, suppressed osteoblastic activity, decreased lean body mass (decreased muscle and bone mass leading to sarcopenia and osteopenia), and insulin resistance.

### Discussion on findings of study

Work related musculoskeletal disorders among health care professionals' leads to various health related issues in the core stability and stress plays an important role in the internal body. Present study, Pilates and cable pulley exercises proves how core stability and stress is maintained in the internal tissues.

The findings of Kate Rogers, et al., (2013) investigated a study on eight week Pilates training program on health care professionals. Study conducted made for 8 weeks in one hour per day three times per week, divided into two groups experimental (n=9) and control group (n=13). Pre and post results were noted, after the baseline scores study revealed that body composition, upper body endurance, and flexibility significantly improved after 8 weeks Pilates training program in health care professionals.

Erika Zemkova, et al., (2019) investigated a study on reliability of a novel method assessing muscle power and flexibility during seated trunk rotation by cable pulleys. 32 physically active men performed 5 trunk rotations each side with cable pulleys for 3times in a week for 12 weeks. Squats for lower body endurance, push-ups for upper body endurance and sit and reach test for measuring trunk flexibility were assessed pre and post value. However based on the mean values obtained from the study it proved that cable pulleys shows tremendous results in increasing the strength and trunk flexibility.

A. Saeterbakken, et al., (2015) conducted a study on the effect of performing Bi and Unilateral row exercises on core muscle activation by cable pulleys. The purpose of the study was to compare core muscle activation in 3 different row exercises (free weight bent over row, seated cable row and machine row) performed unilaterally and bilaterally, at matched effort levels.

Fernanda T D V, et al., (2013) investigated a study on the influence of Pilates method in quality of life of practitioners. Aim of the study to obtain physical and mental health, including flexibility, in a secure and balanced way. 74 Pilates practitioners divided into 3 groups, for 3 months, for more than one year and ex practitioners. Self-administered questionnaire used as a variable, the comparison between groups was made by ANOVA one way, then an analysis by post-hoc Scheffe, with a significance level of  $p < 0.05$ . Results showed difference in physical function, general health and mental health of quality of life, finally study concluded Pilates was associated with the improvement of quality of life.

### Conclusion

From the above findings, it is concluded that Pilates is an effective intervention strategy in the treatment of work related musculoskeletal disorders in related to upper body, lower body strength and stress. Experimental group III showed satisfactory results when compared to other experimental groups at the end of twelve weeks of training. The control group did not change in any of the variables.

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