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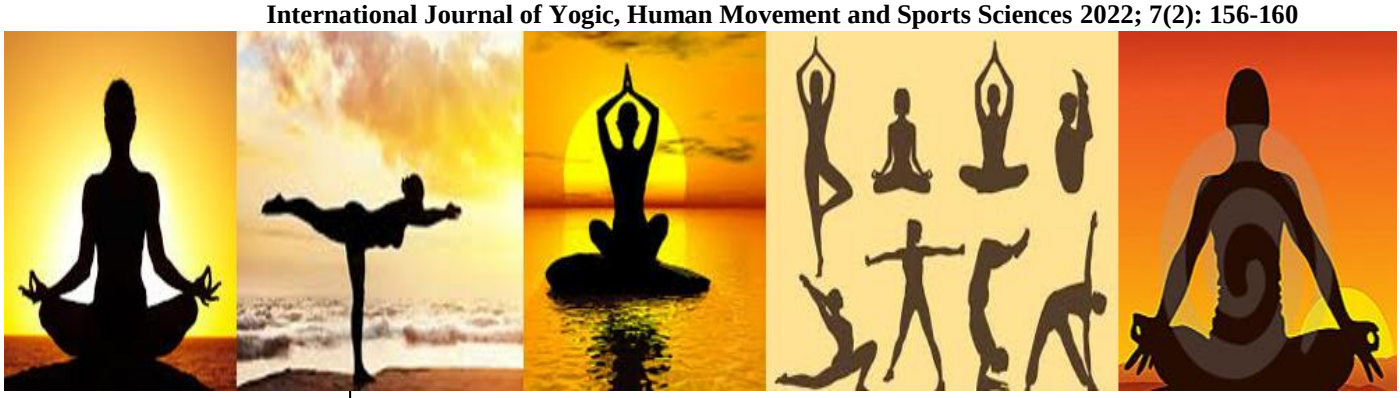

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Effect of Pilates and cable pulley exercises in work related musculoskeletal disorders on fluid status and anxiety among male medical health care professionals

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Abstract
Aim: This study aimed to do a comparative study on Pilates and cable-pulley exercises in work related musculoskeletal disorders on fluid status and anxiety level 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. Intracellular water (ICW), and Extracellular water (ECW) were measured by Bio-electrical Impedance Analysis (BIA). Anxiety level of the participants was measured by anxiety subscale of the DASS-21.
Variables: Intracellular water, extra cellular water, and Anxiety.
Result: Since in this study the researcher found that there was positive changes in the improvement in Intra cellular water percentage, extra cellular percentage, and Anxiety levels by Pilates and cable pulley exercises in the Experimental Group III when compared to Experimental Group I and II.
Conclusion: Hence it's concluded that the 12 weeks of Pilates versus cable pulley exercises shows changes in the fluid status i.e., Intracellular water percentage, Extracellular water percentage and anxiety in work related musculoskeletal disorders on male health care professionals.

Keywords: Pulley exercises, musculoskeletal disorders, anxiety

Introduction
Water comprises the majority of the human body and serves a variety of important functions. Water serves as a transporter to provide cells with nutrients via the bloodstream, as well as rids the body of wastes through urine. Water also helps with temperature regulation through sweating and respiration. In addition, it helps to maintain tissue structure and supports cell functions. Finally, water serves as a protective mechanism: it protects the brain and spinal cord by acting as a shock absorber and lubricates joints and body surfaces.
Approximately 50-70% of body weight in the human body is water [1]. Total body water (TBW) is distributed among the intracellular and extracellular body compartments. The intracellular compartment contains approximately two-thirds of TBW. It is related to the concept of body cell mass and it is metabolically active compartment [2]. The extracellular compartment comprises one-third of TBW with interstitial, vascular (plasma), and transcellular spaces. Simply, body composition can be considered as a two-compartment model, a fat-free mass compartment and fat mass compartment. As fat is anhydrous, body water is only seen in the fat free compartment. For a 70 kg adult male, total body water would be approximately 42 litres [3], of which 55% is intracellular and the remaining 45% is extracellular. Due to changes in metabolism and fluid consumption, TBW fluctuates by ± 5% daily [4]. Thus, the daily turnover of TBW is approximately 5-10%. That means, 5-10% of TBW is replenished each day [5]. Body water is mainly influenced by body composition. Therefore, an individual with more body fat contains less body water, compared with a person of equal body size but with more muscle mass [6].
Although the effect of exercise on body composition has been extensively studied, only few studies have examined the effects of different exercise programs on body water. Most of the studies that assessed changes in body water, used only short bouts of exercise [7].

The other studies which examined changes in body water compartment over a longer duration, found increases in ICW and was positively correlated with strength of the subjects [8]. Various exercise interventions have been used to examine their effects on fluid status, but no study used Pilates exercises. Pilates has become a popular method that can also be used to improve physical fitness as well as body composition [9]. Pilates method offers a gentle but powerful approach in achieving optimal health. It is a body conditioning therapy based on repeated performance of low-intensity strengthening and flexibility exercises that can effectively improves body composition and fluid status. The effectiveness of Pilates over other types of exercises remains unclear.

The health care workers may be exposed to a number of workplace hazards that include physical, chemical, biological and psychosocial hazards [10]. These industrial hazards may cause a variety of health problems including disturbances in fluid status in the workers. The hospital workers also exposed to psychological problems, of which anxiety is the most important one. Therefore, this study was carried out to compare the effects of Pilates with those of cable-pulley apparatus exercises on fluid status and psychological status among male health care professionals.

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 fluid status in the body levels of the professionals.

Selection of the Variables

Intracellular water percentage, extracellular water percentage and Anxiety.

Experimental Design

The study involved 60 male health care professionals working for at least one year in respective field, between the ages of 20 to 44 years. The study was conducted after obtaining approval from the 'Department Research Committee' (DRC) of the 'Tamilnadu Physical Education and Sports University', Chennai.

Training schedule

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 fallowing variables

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

Table 1: Computation of analysis of covariance of intracellular water percentage

TEST	EXP-I	EXP-II	EXP-III	Control	SV	SS	DF	MS	OF	TF
Pre-test	64.31	64.34	64.34	64.42	B	0.09	3	0.03	0.19	2.72
					W	9.21	56	0.16		
Post-test	64.53	65.01	64.8	64.39	B	3.43	3	1.14	8.31	2.72
					W	7.72	56	0.13		
Adjusted	64.56	65.02	64.81	64.34	B	3.90	3	1.30	43.24	2.72
					W	1.65	55	0.03		
Mean Gain	0.22	0.66	0.46	0.02						

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

Results of the Intracellular Water Percentage

Table I shows analyzed data on Intracellular water percentage. The Pre-test means of Intracellular water percentage were 64.42 for Control Group, 64.31 for Experimental Group I, 64.34 For Experimental Group II and 64.34 For Experimental Group III. The 'OF' ratio 0.19 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 64.8 for Control Group, 64.53 for

Experimental Group I Group, 65.01 for Experimental Group II and for 64.8 Experimental Group III. The 'OF' ratio 8.31 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 64.34 for Control Group, 64.56 for Experimental Group I, 65.02 for Experimental Group II and 64.81 for Experimental Group III. The 'OF' ratio 43.24 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 0.02 for Control group, 0.22 for Experimental Group I, 0.66 for Experimental Group II and 0.46 for Experimental Group III.

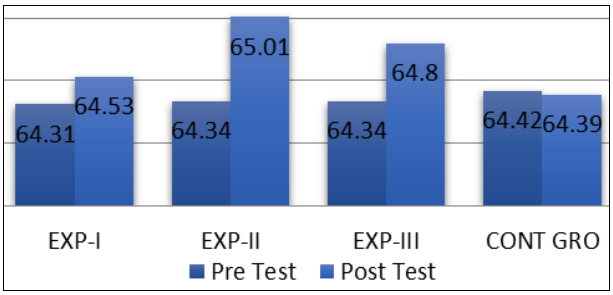

Fig 1: Intra cellular water

It is interesting to note that the results obtained from Experimental Group II had a more significant effect than Experimental Group III and I on the decreased level of Intracellular water percentage. Further, the results obtained from Experimental Group I and III had a significant influence on Intracellular water percentage than the Control Group, but there is much difference between Experimental Group I and III. Among three Experimental Groups, the Experimental Group II has tremendous change in Intracellular water percentage 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 Intracellular water percentage. During the training period, the pattern of exercises are meaningfully influenced in fluid status due to Pilates, Cable pulley and combined exercises. Intracellular fluid is approximately 40% of the total body weight. It is the total space with cells primarily termed as the cytoplasm of cells. Due to resistance training water levels in the body will be raised followed by absorption of water in Intracellular cell leading to increase in the quantity that helps in heat stress, maintain normal body function, and maintain performance levels.

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

Table 2: Computation of analysis of covariance of extracellular percentage:

TEST	EXP-I	EXP-II	EXP-III	Control	SV	SS	DF	MS	OF	TF
Pre-test	35.68	35.65	35.66	35.58	B	0.09	3	0.03	0.19	2.72
					W	9.21	56	0.16		
Post-test	35.46	34.98	35.60	35.60	B	3.43	3	1.14	8.31	2.72
					W	7.72	56	0.13		
Adjusted	35.43	34.97	35.18	35.65	B	3.90	3	1.30	43.24	2.72
					W	1.65	55	0.03		
Mean Gain	0.22	0.66	0.46	0.026						

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

Results of the extracellular water percentage

Table II shows analyzed data on Extracellular water percentage. The Pre-test means of Extracellular water percentage were 35.58 for Control Group, 35.68 for Experimental Group I, 35.65 For Experimental Group II and 35.66 For Experimental Group III. The 'OF' ratio 0.19 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 35.65 for Control Group, 35.46 for Experimental Group I Group, 34.98 for Experimental Group II and for 35.60 Experimental Group III. The 'TF' ratio 8.31 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 35.65 for Control Group, 35.43 for Experimental Group I, 34.97 for Experimental Group II and 35.18 for Experimental Group III. The 'OF' ratio 43.24 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 0.026 for Control group, 0.22 for Experimental Group I, 0.66 for Experimental Group II and 0.46 for Experimental Group III.

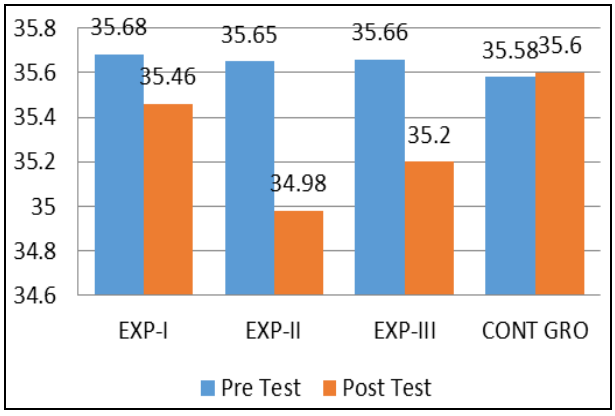

Fig 2: Extra cellular water

It is interesting to note that the results obtained from Experimental Group II had a more significant effect than Experimental Group I and III on the decreased level of Extracellular Water Percentage. Further, the results obtained from Experimental Group I and III had a significant influence on Extracellular Water Percentage than the Control Group, but there is no much difference between Experimental Group I and III. Among three Experimental Groups, the Experimental Group II has tremendous change in

Extracellular Water Percentage reduction 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 reduction of Extracellular Water Percentage. During the training period, the pattern of exercises are meaningfully influenced in fluid status changes due to Pilates, Cable pulley and combined exercises. Extracellular fluid is approximately 1/3 of your fluid and found in interstitial fluid, transcellular fluid, and blood plasma. As intracellular water increases due to increase in total body water after post work out extra cellular water decreases due to exchange of fluid from interstitial layer by movement of electrolytes, allows oxygen delivery to the cells, and clears debris from metabolic process.

Once the Extracellular values are decreased, automatically the changes are seen in the subjects. So it was found that the given exercises significantly reduced the Extracellular water percentage ta the end of 12 weeks of training period was significantly balanced Extracellular water percentage.

Table 3: Analysis of covariance of anxiety:

Test	EXP-I	EXP-II	EXP-III	Control	SV	SS	DF	MS	OF	TF
Pre-test	15.66	14.33	13.73	13.6	B	40.13	3	13.37	0.97	2.72
					W	775.2	56	13.84		
Post-test	11.6	12.33	9.33	13.6.6	B	144.31	3	48.10	4.02	2.72
					W	669.86	56	11.96		
Adjusted	10.43	12.33	9.85	14.23	B	175.91	3	58.63	39.50	2.72
					W	81.65	55	1.48		
Mean Gain	4.06	2	4.4	0						

Results of the Anxiety

Table III shows analyzed data on Anxiety. The Pre-test means of anxiety were 13.6 for Control Group, 15.66 for Experimental Group I, 14.33 For Experimental Group II and 13.73 For Experimental Group III. The 'OF' ratio 0.97 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 13.6 for Control Group, 11.6 for Experimental Group I Group, 12.33 for Experimental Group II and for 9.33 Experimental Group III. The 'OF' ratio 4.02 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 14.23 for Control Group, 10.43 for Experimental Group I, 12.33 for Experimental Group II and 9.33 for Experimental Group III. The 'OF' ratio 39.50 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.

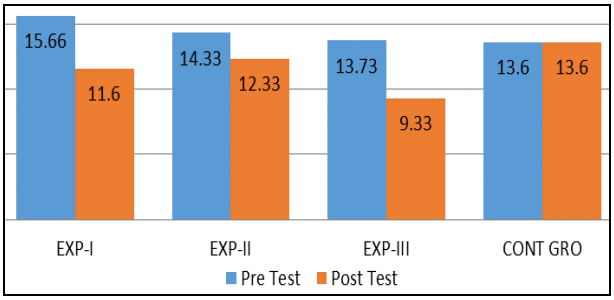

Fig 3: Anxiety

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 Anxiety. Further, the results obtained from Experimental Group II and I had a significant influence on Anxiety 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 Anxiety 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 decreased in Anxiety. Due to Pilates and cable pulley exercise training the following changes are noted in anxiety subjects. By our exercise there will be activation of trigger resulting release of dopamine and serotonin, which improves mood level of the subjects and leading to the reduction of anxiety levels.

Discussion on findings of study

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

The findings of Atakan Yilmaz, *et al*., (2022) investigated a study on the effect of equipment based Pilates (Reformer) exercises on body composition, some physical parameters, and body blood parameters of medical interns. The experimental group consists of 22 healthy internship students of medical faculty performed Pilates reformer for nine weeks. The control group consists of 18 students who did not engage in any exercise program. The baseline and final parameters of all the participants were measured. However a significant positive difference was noted only between the waist pre-test and post-test in the body composition measurements along with Intracellular water percentage.

Ina Shaw, *et al*., (2021) conducted a 12 week study on resistance training and weight management by Cable pulleys. A group of working professionals has been chosen for the study and divided into experimental group and control group. Pre and post-test reading has been recorded. After the exercise, in general, has been marketed as a way to maintain a healthy body weight, it shouldn't be viewed as the gold standard for doing so. This is due to the fact that resistance training (RT) has an unrivalled capacity to increase lean mass while concurrently improving a number of other aspects of body composition.(Extra cellular water) is of moderate intensity, which lowers the risk of injury and promotes adherence, resistance training is particularly helpful in the general population for weight management.

The findings of A. Byrne, *et al*., (1993) conducted a study on the effect of cable pulley exercises on depression, anxiety and

other mood states. The current literature focused on link between exercise treatments and depression, anxiety and other mood state by supportive cable pulley exercise programs, proved that cable pulley exercise programs acts like anti-depressant, anti-anxiety and mood enhancing effects.
From these analyses, it is found that the results obtained from the experimental groups had significantly shown that they were improved their BMI and anxiety due to work related musculoskeletal disorder after the training, resulted in balance of fluid status in the tissue level and mental stability in male health care professionals.

Conclusion

Work related musculoskeletal disorders leads to various complications in that weight related issues leads imbalance in the fluid status, leading to imbalance in intracellular water percentage and extracellular water percentage. Twelve weeks of training by Pilates and cable pulley exercises shows balance of fluid status. Experimental group III showed significantly balance in intracellular water percentage and extracellular water percentage. It is concluded that balance of weight is important in related to maintain fluid status and Anxiety also found to be reduced with Pilates alone compared to other Experimental groups and control group didn't turned any positive results due to lack of training.

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