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Effectiveness of Ergonomic Advices Along with Conventional Therapy on Low Back Pain Aspect of Work-Related Musculoskeletal Disorders in School Teachers

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ABSTRACT

BACKGROUND: Work-related musculoskeletal disorders have achieved second position as highest occupational diseases following the occupational mental diseases. There have been increased concern with prevalence of WMSDs in education sector as prevalence raised from 45% to 91% in school teachers in comparison to other occupational groups. Ergonomic advices help to improve pain, functional disability and combined ergonomic advices and conventional therapy may have positive effects on low back pain in school teachers. **OBJECTIVE**: The main aim of this clinical study is to determine the effect of Ergonomic advices along with the conventional therapy on Low Back Pain aspect of work-related musculoskeletal disorders in school teachers. **SETTINGS & STUDY DESIGN**: A comparative study conducted on school teachers having low back pain selected from three different schools of Indore M.P. **MATERIAL & METHODS**: 100 teachers participated in the experimental study, underwent treatment duration for 4 weeks after giving their informed consent. They were evaluated and randomized into experimental group receiving ergonomic advices along with conventional therapy and control group receiving only conventional therapy. The Pre and Post values of NPRS and RMDQ were recorded at the start of the treatment and consecutively after the end of the treatment **DATA ANALYSIS**: This was done by using parametric 't' test to identify the significance of mean difference of score of NPRS, RMDQ at degree of freedom 98 at 0.05 level of significance. **RESULT**: After 4 weeks of treatment, there was significant improvement in pain and pain related disability in both the groups, but more improved results in values of NPRS and RMDQ were seen in group B which received combined treatment of Ergonomic advices with conventional therapy.

DISCUSSION & CONCLUSION: Ergonomic advices along with the conventional therapy were found to be more effective in decreasing pain and disability in patients with Low Back Pain aspect of work-related musculoskeletal disorders in school teachers.

Keywords- Low back pain, NPRS, WMDs, RMDQ, ergonomic advices

1. INTRODUCTION

Work-related Musculoskeletal disorders (WMSDs) are referred to as ailments presenting in various components of the body such as muscle-tendon, vascular system, and peripheral nerves which are produced due to repetitive and overuse, as per definition by world health organisation. According to the National Institute of Occupational Safety and Health (NIOSH),

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work-related musculoskeletal disorders are any sensation of pain, spasticity, burning or tingling present in one or more segments of body such as hand, wrist, elbow, shoulder, or neck which may continue to appear for at-least one week or more, or present in once a month in each year**1**.

According to various researches WMSDs are most common and prevalent causes for leaves from workdays, raised cost and various occupational disorders amongst the developing and developed countries across the globe**2**. According to various researches WMSDs require physical demands such as monotonous postures, forced exhaustion and repetition of same mechanisms at regular basis. These disorders occur as consequence of biomechanical stresses provoked predominantly by high work organisational demands**3**.

Similarly, amongst the all WMSDs, the incidence of low back disorders ranged from 40% to 80% amongst numerous researches conducted across various occupational institutions. Low back pain (LBP) is disorder characterized by pain, stiffness, or tension in the muscle present around the regions between costal margins and gluteal folds, which may or may not be associated with leg pain**2, 4**.

LBP can be classified as Specific and Non-Specific. The non-specific types represent disorders of unidentified causes and account for about 90% of the total LBP cases. The remaining 10% have definitive causes which may be because of fractures, infections, cauda equina syndrome and others. Furthermore, LBP can also be divided as Acute and Chronic types. The acute LBP last for shorter periods of time lasting less than 12 weeks while the chronic LBP stays for more than 12 weeks**4**.

LBP has been demonstrated to be one of the most frequent contributors to disability and huge global strain enforcer. In 2016 according to Years lived with disability (YLDs), LBP remain on the apex of the list and at sixth spot for Disability adjusted life years (DALYs) since 2010. LBP has also been a global concern with it's' prevalence around the world and high incidence in individuals with age group ranging between 40 to 80 years and, in females**5**.

Work-related musculoskeletal disorders have achieved second position as highest occupational diseases following the occupational mental diseases at first position. There has been increased concern with prevalence of WMSDs in education sector as prevalence raised from 45% to 91% in school teachers in comparison to other occupational groups**6**.

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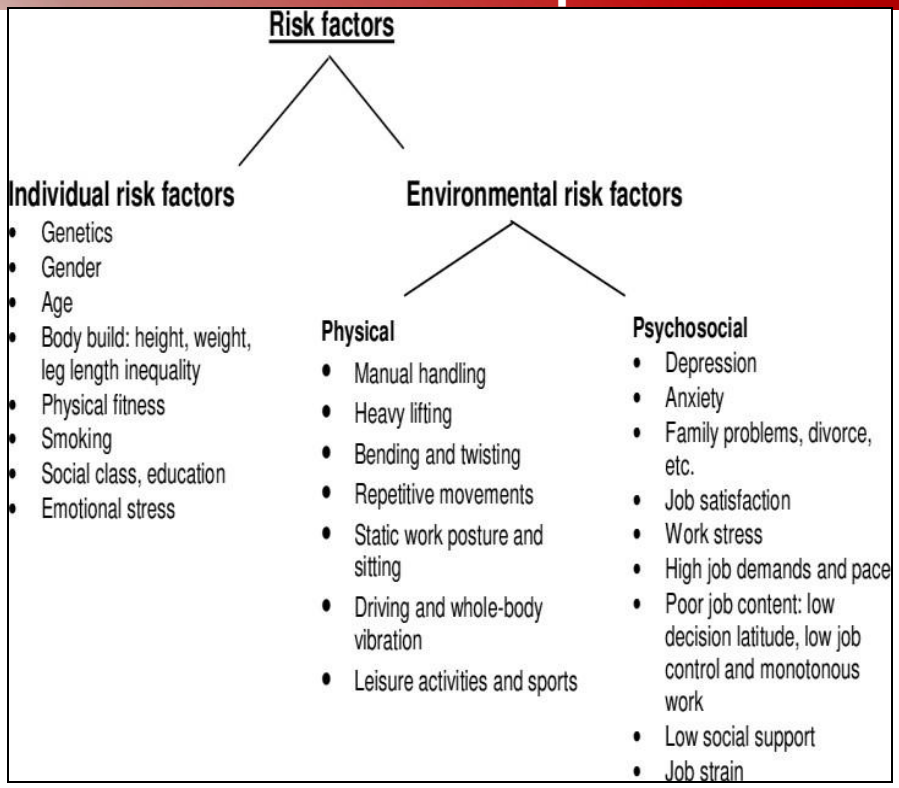

Figure 1.1: Risk factors associated with occupation3.

A teacher not only works as an instructor but is actively involved in preparing curriculum plans, student assessment and coordinator in various extracurricular activities of the school such as cultural and sports events. Therefore, the job of a teacher requires prolonged hours of stressful and uncomfortable postures. Teachers are more prone to get affected by WMSDs involving upper limbs, neck, and lower back. LBP represents as a global issue with occurrence in more than 70% of developed countries and much terrifying situation in developing countries with absence of ergonomic awareness and under optimal working standards**7**.

Education of individuals with muscle relaxation, joint and muscle strengthening exercises is the usual course followed to avoid WMSDs presently. The person is advised to avoid incorporating in the task which require extreme physical load leading ultimately to these disorders. This indicates that there is requirement of some other measures as well to prevent the strain and aggravation of the symptoms and the basic course of action which has been followed till now. A Singular model or technique pertaining to prevention would not be sufficient in depreciating

The risk factors associated with LBP. Therefore, more comprehensive methodologies are need to be incorporated**1**.

LBP is a multifactorial disorder the determination of the risk factors becomes a tedious task. The factors may be majorly divided into- individual, occupational, and psychological. The individual factors represent socio-demographic variables such as age, gender, level education,

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habits like smoking and general health.

	Occurrence	Chronicity
Individual	Age	Obesity
	Gender	Educational level
	Smoking	High levels of pain/disability
	General health	Health care provider attitudes
	High birth weight (males)	Unemployment
Psychosocial factors	Stress	Distress
	Pain behavior	Depressive mood
	Depressive mood	Somatization
	Cognitive functioning	Baseline long duration of pain
		Fear-avoidance behavior
Occupational factors	Manual handling of materials	Job dissatisfaction
	Monotonous tasks	Unavailability of light duty
	Control at work	Lifting for more than three fourths of the day
	Job dissatisfaction	
	Social support/work relations	
	Night shifts	
	Bending and twisting	
	Whole-body vibration	

Figure 1.2: The various risk factors correlated with occurrence and chronicity41.

The Psychological factors consist of stress, mood, emotions, and cognitive functioning. These factors directly do not result in LBP, but presence of distress and other emotions for longer period result in aggregation or disability. The occupational factors include physical load demands of job, work station designs or long durations of static postures as in case of desk job workers, postures adopted while bending, standing, or working in different occupations**6, 7**.

Therefore, for proper management of the LBP the other models which were adopted are environmental and ergonomic interventions along with existing models of muscular relaxation, postural correction, joint and muscular strengthening programs**2,6,7**.

Ergonomics is term derived from Greek words, “ergos” meaning work, and “nomos” meaning, “laws of” therefore in simple terms, it is “the laws

Of the work”. It can be defined as study of human behavioral patterns and biological interactions for determining appropriate design of the living and working environment. It also involves strategies and methods to make the human interactions with work environment with minimal possible strain and maximal output**8, 9**.

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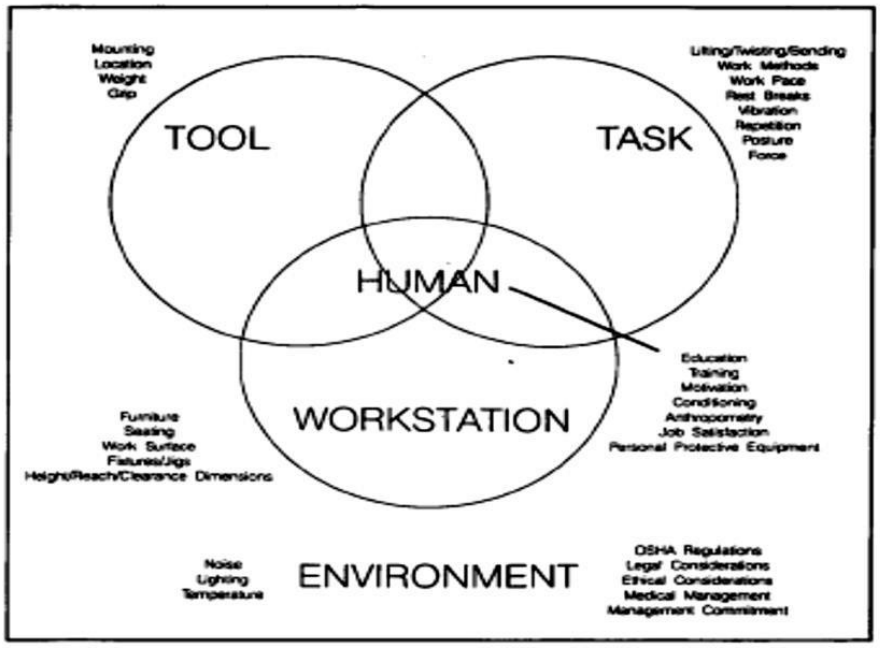

Figure 1.3 Ergonomics- Human body and its interaction with work environment8.

Ergonomic training involves formulating effective methods and strategies for prevention and control of musculoskeletal injuries. It provides knowledge regarding correct biomechanical postures in work environment for reducing stress placed over various body structures such as neck, shoulder, and wrist. It also involves designing the work-related furniture to minimize efforts placed on body for example desk height, desktop screen inclination, chair height and backrest**10, 11**.

2. AIM:

This study aims to investigate the Effectiveness of Ergonomic Advices Along with Conventional Therapy on Low Back Pain Aspect of Work Related Musculoskeletal Disorders in School Teachers

3. PRIMARY OBJECTIVE-

To find the effects of Ergonomic advices along with Conventional Therapy on Low Back Pain in School Teachers.

4. SECONDARY OBJECTIVE -

To find the effects of Conventional Therapy on Low Back Pain in School Teachers.

5. HYPOTHESIS

NULL HYPOTHESIS (Ho)-

There will be no significant difference in the effect of conventional therapy with ergonomic advices on Low Back Pain aspect of work related musculoskeletal disorders in School Teachers.

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ALTERNATIVE HYPOTHESIS (H1)-

There will be significant difference in the effect of conventional therapy with ergonomic advices on Low Back Pain aspect of work related musculoskeletal disorders in School Teachers.

6. METHODOLOGY

RESEARCH STUDY DESIGN: Interventional multicentric study

STUDY SETUP: The study was conducted at three Schools of Indore (M.P.)

PLACE OF DATA COLLECTION:

1. Kalyan vidhya niketan school- Ahead of dev guradiya temple, Kampel road, Indore MP, Pin code-452014
2. Adarsh shishu vihar school - Anjali Awas behind Shiv Shakti nagar, bicholi mardana, Indore MP, Pin code-452016
3. Tagore public school - Bicholi hapsi road, Vaibhav nagar, Indore MP, Pin code-452016

TYPE OF SAMPLING: Multistage Random sampling

STUDY TOOLS:

1. Questionnaires- NPRS, RMDQ
2. Paper and pencil

INCLUSION CRITERIA:

1. Both male and female.
2. Age group of 25 to 55 years.
3. School teachers into this profession for more than 2 years.
4. School teachers suffering from low back pain since 3 months.

EXCLUSION CRITERIA:

1. Any comorbidities or any kind of injuries or accidents
2. Pregnancy
3. Cancers
4. Subjects if undergone any surgeries or fracture recently

SAMPLE SIZE: N=100 Subjects

STUDY DURATION: 6 Months

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VARIABLES:

INDEPENDENT – Ergonomic advice, conventional therapy DEPENDENT – Numeric pain rating scale, Roland Morris disability questionnaire.

OUTCOME MEASURES:

1. **Numerical Pain Rating Scale (NPRS)** - The NPRS is a segmented numeric version of the visual analogue scale (VAS) in which a respondent selects a whole number (0–10 integers). It assesses the subjective intensity of pain. The NPRS is a single 11 – point numeric scale. An 11-point numeric scale (NPRS 11) with 0 (no pain) and 11 (worst imaginable pain). Reliability – 0.95 – 0.96. Validity – 0.86 – 0.95. 242**43**.

2. ***Roland Morris disability questionnaire (RMDQ)- The RMQ is a 24-item patient-reported outcome measure that inquiries about pain-related disability resulting from LBP.1 Items are scored 0 if left blank or 1 if endorsed, for a total RMQ score ranging from 0 to 24; higher scores represent higher levels of pain-related disability. Typical RMQ test–retest estimates are in the range of 0.79 to 0.88 points for relative reliability (intra-class correlation) and 1.7 to 2.0 points for absolute reliability (SEM).***

   Test-retest reliability 24-item: intraclass correlation (ICC) ranges from 0.42 – 0.91**44**.

100 participants were included in the study by means of multistage sampling and were divided into interventional and control group, each group consist of 50 participants. In interventional group conventional exercises with ergonomic advices were given and in Control group only conventional exercises were given. The participants were asked to fill Questionnaire before and after completion of exercise protocol for both the groups. Pre and post interventional data was collected such that the NPRS and RMDQ. Then, participants were asked to follow the rehabilitation program for a period of four weeks

Conventional Exercises were given for both groups included:

- Cobra pose – 10 rep, 1 set, 2 times, 5 min
- Bridging – 10 rep, 1 set, 2 times, 5 min
- SLR- 10 rep, 1 set, 2 times, 5 min
- Cat and camel- 10 rep, 1 set, 2 times, 5min
- Abdominal crunches- 5 rep, 2 set, 2 times, 5 min
- Trunk rotation- 10 rep, 1 set, 2 times, 5 min
- Prone SLR- 10 rep, 1 set, 2 times, 5 min

Session time- 30-45 minutes per session for all the exercises. Frequency- 2 times per day for 5 days a week

Duration- 4 weeks

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COBRA POSE-

Patient position- The subject was in prone position well supported on couch.

Therapist position- Therapist standing by the side of patient.

The subject now starts slowly extending the back with thighs and legs together close to each other and in contact with the couch. The position is maintained with help of arm with full elbow extension. Two sets of 10 repetitions are performed for 5 minutes.

Figure 6.1: Cobra-pose

BRIDGING-

Patient position-The subject was in supine position.

Therapist position- Therapist standing by the side of the couch.

The subject now flexes both knees and hips to 45 degrees, with back supported on couch and arms by the side. The subject now lifts the back and then bring it back in contact with ground. Same procedure is repeated for 10 times and 2 sets are performed with rest for 5 minutes.

Figure 6.2: Bridging

STRAIGHT LEG RAISING

Patient position- The subject was in supine lying on couch.

Therapist position- Therapist standing by the side near the end of couch. The subject now slowly lifts and take leg in 70-80 degrees of hip flexion. Same process is repeated for 10 times for 2 sets and 5 minutes with rest in between.

Journal of East-West Thought
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Figure 6.3: SLR

CAT AND CAMEL EXERCISE-

Patient position- The patient lies in quadruped position. Therapist position- standing by the side of couch.

The subject attains a well-supported posture on the couch and the performs cat and camel poses.

Cat- sink back down towards the floor and lift head up at the same time sticking the tailbone out to make a curve with spine

Figure 6.4: Cat-pose Exercise

Camel- tuck head and tailbone in, arching through spine as to mimic a camel hump.

ABDOMINAL CRUNCHES-

Patient position- Lying supine well supported on couch. Therapist position- Standing by the side of couch.

The subject Fold arms on chest and tightens abdominal muscles. Then Raise head and shoulders off the floor. Hold for three deep breaths, then return to starting position. By this subject can feel tension in the muscles of abdomen.

TRUNK ROTATIONS-

Patient position- The patient was in standing position. Therapist position- Therapist on the side of the patient.

The subject in standing position moves trunk and upper body in rotation while keeping the

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lower body stable over the supporting surface.

PRONE SLR-

Patient position- patient was in prone position on couch. Therapist position- The therapist lies on the side.

The subject now slowly lifts and take leg in hip extension. Same process is repeated for 10 times for 2 sets and 5 minutes with rest in between.

Ergonomic advices included-

1) LIFTING TECHNIQUE-

Subjects were taught to use both back and knees while lifting objects from ground. Avoid bending forwards directly with extended-knees.

7. DATA ANALYSIS AND RESULTS

Table no. 7.1: Effect of conventional therapy on NPRS in group A.

Condition	N	Mean	S.D.	t-value	p-value
Pre	50	6.32	0.91	18.34	<0.05
Post	50	3.20	0.78		

Above table no. 7.1 shows the result of "Effect of conventional therapy on (NPRS) of control group in school teachers having low back pain". Mean values of NPRS in pre and post condition of GROUP A is 6.32 and

3.20. There is a significant difference between mean of NPRS. Calculated t-value is 18.34 which is significant at the degree of freedom 98 at 0.05 level of significant because calculated t-value is greater than (2.00) minimum value at 0.05 significant level.So we can say that there is a significant effect of conventional therapy on NPRS pre and post values of Group A in school teachers having low back pain.

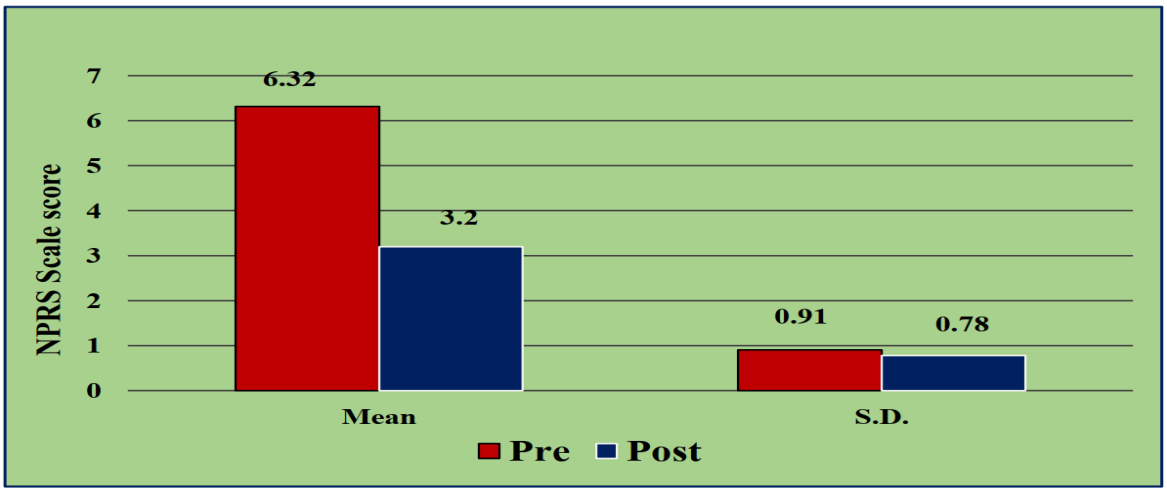

Figure 7.1: Effect of conventional therapy on NPRS in group A.

Journal of East-West Thought
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Table no. 7.2: Effect of conventional therapy on RMDQ in group A.

Condition	N	Mean	S.D.	t-value	p-value
Pre	50	15.54	2.63	15.83	<0.05
Post	50	8.1	2.03		

Above table no. 7.2 shows the result of "Effect of conventional therapy on RMDQ of control group in school teachers having low back pain".

Mean values of RMDQ scale in pre and post condition of GROUP A is

15.54 And 8.10. There is a significant difference between mean of RMDQ scale. Calculated t-value is 15.83 which is significant at the degree of freedom 98 at 0.05 level of significant because calculated t-value is greater than (2.00) minimum value at 0.05 significant level.

So, we can say that there is a significant effect of conventional therapy on RMDQ pre and post values of Group A in school teachers having low back pain.

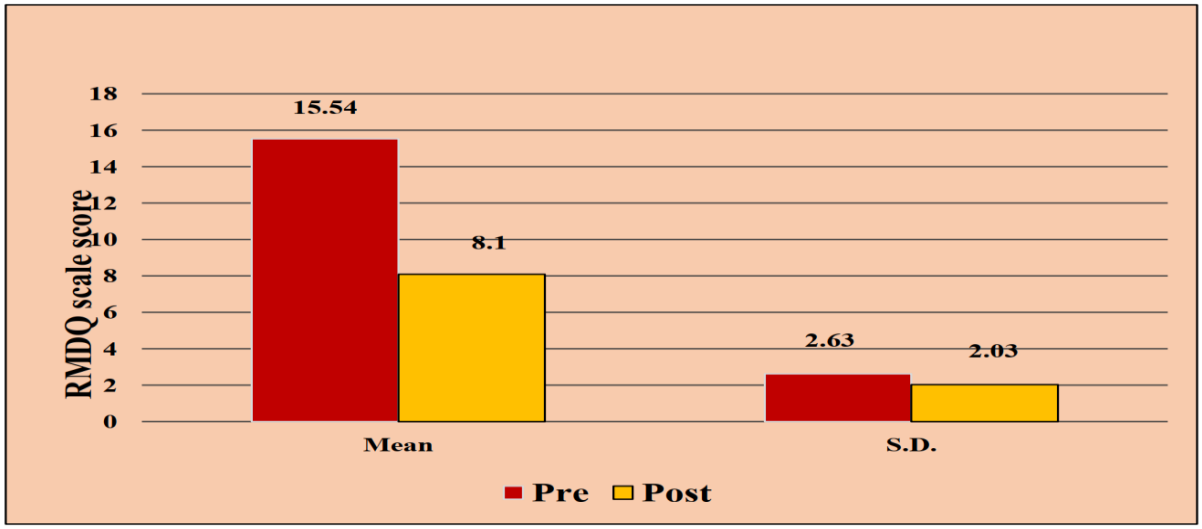

Figure 7.2: Effect of conventional therapy on RMDQ in group A.

Table no. 7.3: Effect of Conventional Therapy with Ergonomic on NPRS for group B.

Condition	N	Mean	S.D.	t-value	p-value
Pre	50	6.28	0.90	24.17	<0.05
Post	50	2.66	0.82		

Above table no. 7.3 shows the result of "Effect of Conventional Therapy with Ergonomic Advices on NPRS of experimental group in school teachers having Low Back Pain"

Mean values of NPRS in pre and post condition of GROUP B are 6.28 and 2.66. There is a significant difference between mean of NPRS. Calculated t-value is 24.17 which is significant

Journal of East-West Thought
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at the degree of freedom 98 at 0.05 level of significant because calculated t-value is greater than (2.00) minimum value at 0.05 significant level.

So, we can say that there is a significant effect of experimental group on NPRS pre and post values in school teachers having low back pain.

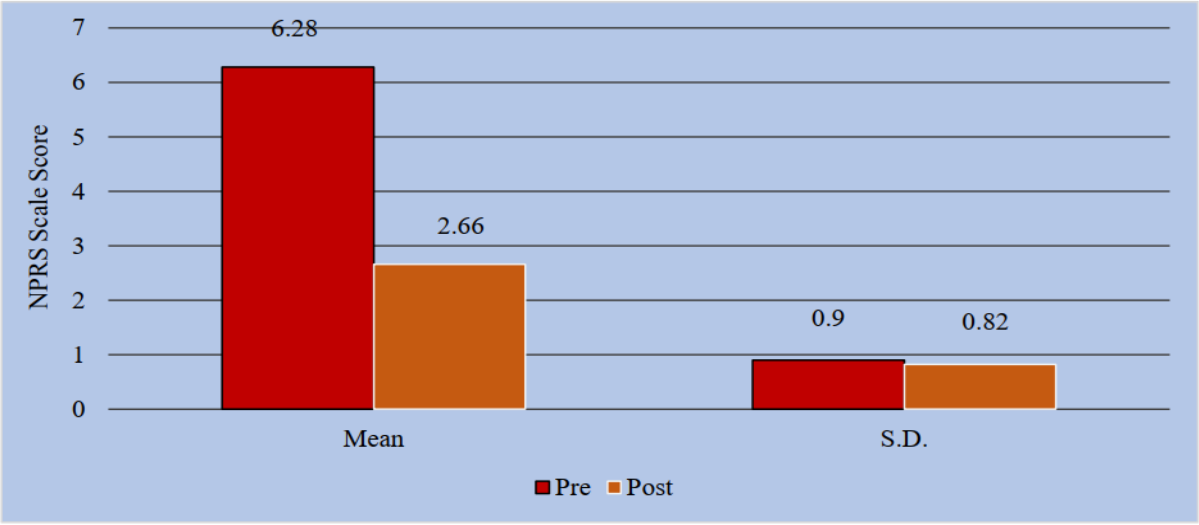

Figure 7.3: Effect of Conventional Therapy with Ergonomic on NPRS for group B.

Table no. 7.4: Effect of Conventional Therapy with Ergonomic Advices on RMDQ in group B.

Condition	N	Mean	S.D.	t-value	p-value
Pre	50	14.76	2.15	30.79	<0.05
Post	50	4.06	1.18		

Above table no. 7.4 shows the result of "Effect of Conventional Therapy with Ergonomic Advices on RMDQ of experimental group in school teachers having from Low Back Pain.".

Mean values of RMDQ scale in pre and post condition of GROUP B are

14.76 and 4.06. There is a significant difference between mean of RMDQ scale. Calculated t-value is 30.79 which is significant at the degree of freedom 98 at 0.05 level of significant because calculated t-value is greater than (2.00) minimum value at 0.05 significant level.

So we can say that there is a significant effect of experimental group on RMDQ pre and post values in school teachers having low back pain.

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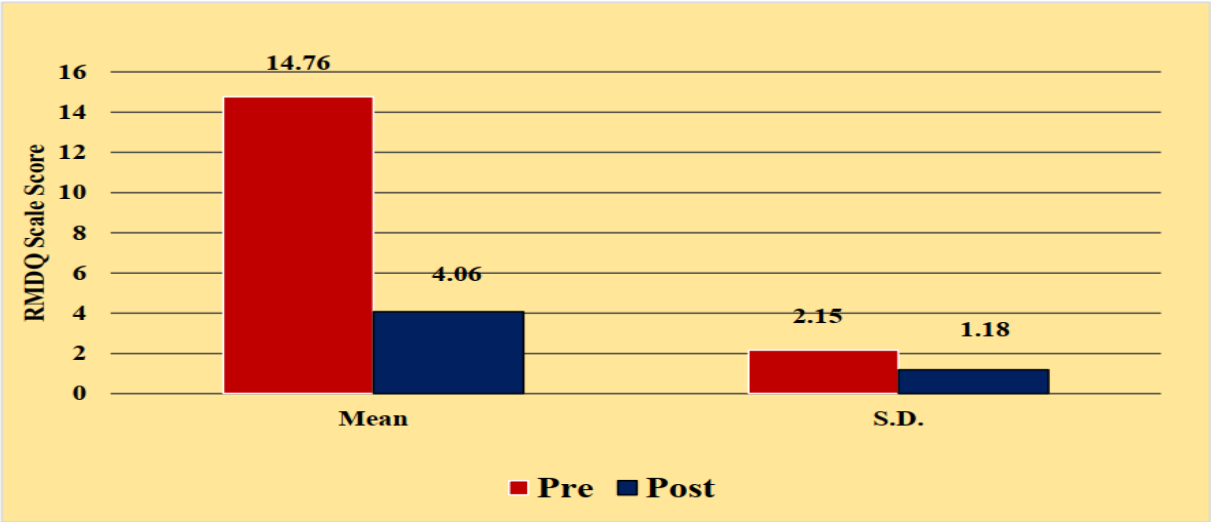

Figure 7.4: Effect of Conventional Therapy with Ergonomic on RMDQ for group B.

Table no. 7.5: Comparison between effect of Conventional Therapy with Ergonomic Advices along with conventional therapy on NPRS in Group A and Group B.

	GROUP A		GROUP B			
	MEAN	**S.D.**	**MEAN**	**S.D.**	**T-VALUE**	**P-VALUE**
NPRS PRE	6.32	0.91	6.28	0.90	3.36	<0.05
NPRS POST	3.20	0.78	2.66	0.82		

Above table no. 7.5 shows the result of "Comparison between effects of Conventional Therapy with Ergonomic Advices along with conventional NPRS in school teachers having Low Back Pain.".

Mean values of NPRS in pre and post condition of Control group are 6.32 and 3.20. The mean difference between the pre intervention and post intervention NPRS is -3.12 [p value is <0.05] which is statistically significant.

Mean values of NPRS in pre and post condition of experimental group are 6.28 and 2.66. The mean difference between the pre intervention and post intervention NPRS is -3.62 [p value is <0.05] which is statistically significant. Calculated t-value is 3.36 which is significant at the degree of freedom 98 at 0.05 level of significant because calculated t-value is greater than (2.00) minimum value at 0.05 significant level.

So, we can say that there is a significant mean difference in NPRS values of experimental group compared to control group. There is a significant effect of conventional therapy with ergonomic advices on NPRS values in school teachers having low back pain

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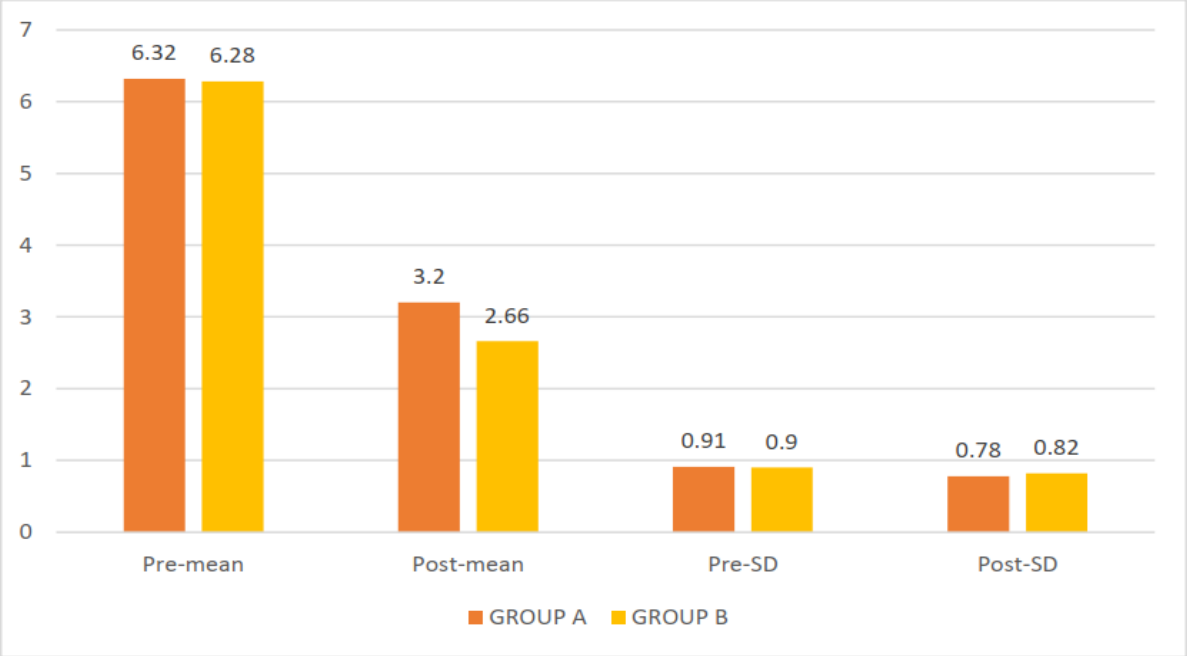

Figure 7.5: Comparison between effect of Conventional Therapy with Ergonomic Advices along with conventional therapy on NPRS in Group A and Group B.

Table no. 7.6: Comparison between effect of Conventional Therapy with Ergonomic Advices along with conventional therapy on RMDQ in group A and Group B.

	GROUP A		GROUP B			
	MEAN	**S.D.**	**MEAN**	**S.D.**	**T-VALUE**	**P-VALUE**
RMDQ PRE	15.54	2.63	14.76	2.15	12.14	<0.05
RMDQ POST	8.10	2.03	4.06	1.18		

Above table no. 7.6 shows the result of "Comparison between effects of Conventional Therapy with Ergonomic Advices along with conventional therapy on RMDQ in school teachers having Low Back Pain.".

Mean values of RMDQ in pre and post condition of Control group are 15.54 and 8.10. The mean difference between the pre intervention and post intervention RMDQ is -7.44 [p value is <0.05] which is statistically significant.

Mean values of RMDQ in pre and post condition of experimental group are 14.76 and 4.06. The mean difference between the pre intervention and post intervention NPRS is -10.7[p value is <0.05] which is statistically significant. Calculated t-value is 12.14 which is significant at the degree of freedom 98 at 0.05 level of significant because calculated t-value

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is greater than (2.00) minimum value at 0.05 significant level.

So we can say that there is a significant mean difference in RMDQ values of experimental group compared to control group. There is a significant effect of conventional therapy with ergonomic advices on RMDQ values in school teachers having low back pain

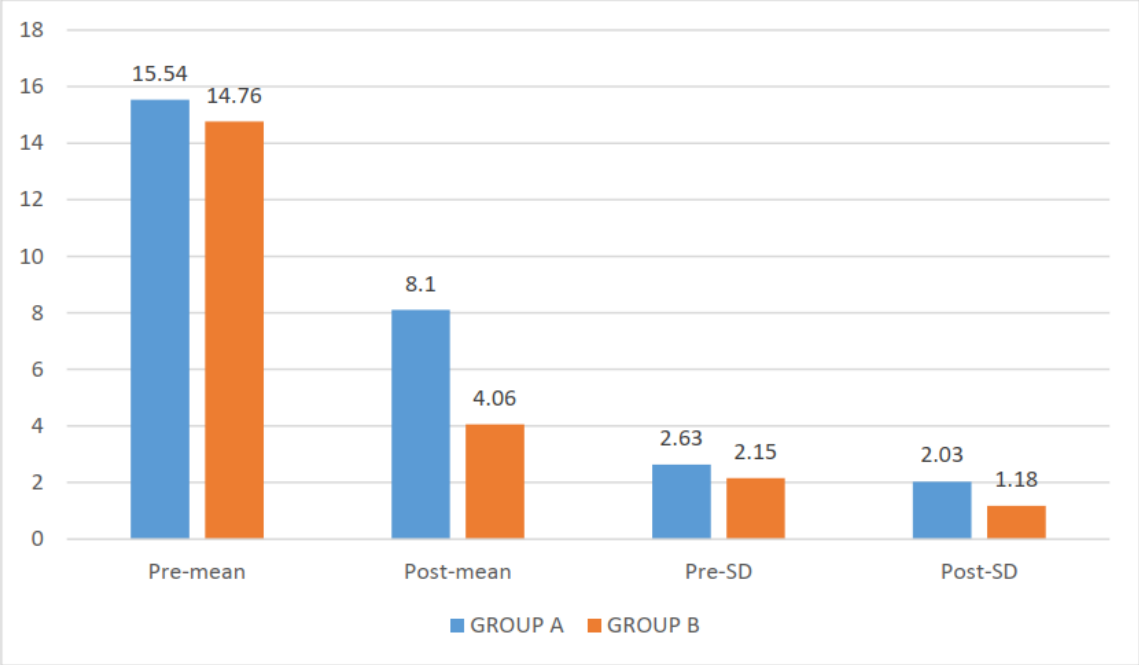

Figure 7.6: Comparison between effect of Conventional Therapy with Ergonomic Advices along with conventional therapy on RMDQ in group A and Group B.

Finally, the above all statements, table, graphical presentations and inferences indicated the rejection of null hypothesis. Therefore, the alternate hypothesis which stated that '**There will be significant effect of conventional therapy with ergonomic advices on Low Back Pain aspect of work-related musculoskeletal disorders in School Teachers'** has been accepted, impacted the achievement of the entire selected objectives followed with aim of the proposed titled **'Effectiveness of Ergonomic Advices Along with Conventional Therapy on Low Back Pain Aspect of Work Related Musculoskeletal Disorders In School Teachers'**

8. CONCLUSION

According to results of the study, both groups A and B showed significant improvement in values of NPRS and RMDQ but group B which received conventional therapy along with ergonomic advices showed better results.

Therefore, we conclude that Conventional Therapy with Ergonomic Advices was more effective to reduce Low Back Pain Aspect of Work-Related Musculoskeletal Disorders in School

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