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COMPARISON OF ACTIVE AND PASSIVE STATIC STRETCHING IN DELAYED ONSET MUSCLE SRENESS OF RECREACTIONAL BODY BUILDERS

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Abstract

Background: *Delayed Onset Muscle Soreness (DOMS) frequently occurs after unaccustomed or eccentric exercise, leading to micro tears in muscle myofibrils, localized inflammation, and a temporary reduction in athletic performance.*

Objective: *This study aimed to determine and compare the effects of active static stretching versus passive static stretching on managing DOMS and range of motion (ROM) among recreational bodybuilders.*

Methodology: *A Randomized Controlled Trial was designed involving 144 male recreational bodybuilders aged 18–40 in Rawalpindi and Islamabad (pp. 10-11). Participants were equally allocated into two groups via the envelope randomization method (pp. 10-11). Group 1 received passive static stretching administered by a physiotherapist, while Group 2 performed active static stretching under guidance (p. 11). Outcome measures including the Numeric Rating Pain Scale (NPRS), Likert Muscle Soreness Scale, and goniometric ROM (shoulder, elbow, wrist) were assessed before the intervention, immediately after, and at 24, 48, 72, 96, and 120 hours post-exercise.*

Results: *Data analysis using non-parametric statistical tests (Mann-Whitney U and Wilcoxon tests) showed a significant gradual reduction in pain scores over 120 hours for both intervention groups (pp. 17-18, 43). Both active and passive stretching methods demonstrated similar overall effectiveness in improving upper extremity range of motion, with minor specific variations noted in shoulder extension at 72 and 96 hours favoring the passive group.*

Conclusion: *Both active and passive static stretching are equally effective treatment strategies for accelerating recovery, mitigating pain, and improving range of motion in recreational bodybuilders experiencing DOMS (p. 43).*

INTRODUCTION

1.2 Definition:

Pain monitored by exercises can be recognized to a number of reasons. Infrequently the pain is experienced through the exercise and recovers quickly later. But in certain cases particularly after uncommon or eccentric exercises there is no pain throughout or instant post exercise periods and the pain starts after 8-24 hours is a dissimilar kind of pain this kind of state of matter is referred as delayed onset muscle soreness. An extensor contraction exercises for example the downward phase of a bicep curl extends the muscle though it concurrently contracts. This causes micro tears in

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the myofibrils of the muscle. Sothe inflammatory process begins whereby blood is moved to the area of injury permitting white blood cells (WBCs) to phagocytize and dispose of injured tissue.(1)

1.3 Foam Rolling and delayed onset Muscle soreness:

Foam rolling in relation to alleviating delayed onset muscle soreness is to use one's personal weight on a froth roller to apply tension on one's delicate tissue. The moving movements place immediate and full tension on the delicate tissue, which extends it and produces grating among it and the froth roller. Therefore it is believed that foam rolling decreases muscle soreness. Additionally unreliable accounts claim that foam rolling corrects muscular imbalances increases muscle soreness and increases ROM.

1.4 Eccentric Exercise can cause muscle injury

The most common type of exercise to persuade this type of muscle injury is eccentric exercise. Eccentric exercise also serves as the mechanical stressor causing the primary injury that triggers the inflammation and repair process.(3) Our knowledge of the dose-response connection among dissimilar protocols and the magnitude of their effect on delayed onset muscle soreness, fatigue, muscle injury, and inflammatory markers has extremely increased for every of the recovery methods and certain evidence-based references are now available. (4)Uncommon forceful physical training leads to type I muscle strain injury evidenced by muscle soreness 9 decreased muscle strength 3 limited ROM (ROM) increased muscle thickness 10 aching 4 stiffness, tenderness1 and decreased functional movements.11 These symptoms formed by extensor muscle exercises are known as delayed onset muscle soreness. Usually it begins within 12 hours of the uncommon or strenuous activity (5)

Extensor withdrawal controls muscle through development of the body by permitting the development to decelerate and furthermore gathers the versatile force energy of the muscle. Through extensor preparing solid development behaves like shock permeable constructions the length of the muscle expands and this expansion causes a negative responsibility (6) Cooling the body to speed up the recovery of execution is presently extensively utilized by mentors and competitors. One of the hypothetical bases of cooling the body to speed up recovery is abatement in aggravation because of revelation to the chilly climate. Irritation happens quickly following activity convinced muscle injury and is stretched out over the long haul. At the point when this fiery reaction is essential to mend muscle injury a lessening of this irritation might effectsly affect recovery of muscle execution. (7)

1.5 Kinesiotaping

Kinesiology Taping (KT) is a method of physiotherapy which purposes to restore the body capacities utilizing tactile engine framework correspondence rules. Using adaptable Kinesio Tex fix (K-Active Tape) the treatment consequences for the skin surface receptors and Ruffini corpuscles. Answerable for the level of strain and stretch of the skin. Kinesiology Taping method has neighborhood and foundational impacts on the human body denied of showing any meddling. These perspectives close the fascination of procedures and its application in the states oblige by torment. (8)

1.6 Static stretching

Static stretching (SS) is a mediation verifiably proposed as a recovery strategy after exercise to forestall or diminish muscle touchiness frequently alluded to as postponed beginning muscle irritation. When acting Static extending muscles are lengthened frequently to the place of slight inconvenience where they are held for an endorsed timeframe. (9) An extensor muscle constriction alludes to a muscle action that happens when the power applied to the muscle surpasses the transient power framed by the actual muscle and results in a development activity. (10)

1.7 Stretching

Stretching is a typical method instructed to assist with expanding athletic execution. Since early on it has been prepared by guardians, actual training, mentors, and clinical experts that extending is a significant piece of activity. It has been set apart into everybody's psyche that extending won't just

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build execution, yet it will assist with diminishing muscle touchiness. (11)

An extensor muscle contraction happens however a muscle creates force when lengthening and is used to resist an external force. Eccentric actions more so than concentric or isometric contractions can result in significant structural muscle injury and soreness. (12)It is probable nearly everybody has over and above one experience of delayed-onset muscle soreness (DOMS) after, e.g., mountain climbing for the first time for a long when an uncommon baseball game or running in a once-a-year school sports meeting. It is rather a usual result of uncommon vigorous exercise, particularly exercise having extensor muscle contraction (lengthening contraction, LC), (13)

1.8 Intermittent pneumatic compression

Additional modality which has newly obtained fame and is assumed to have effects like to massage, is intermittent pneumatic compression (IPC; Normatec™, Newton Center, MA). Intermittent pneumatic compression (IPC) is frequently intended for retrieval afterward extreme exercise, specifically by individuals in the athletic people. These devices use air pumped through a nylon sleeve that surrounds the involved limb to compress and knead the tissue gradually from distal to proximal (14)

Till nowadays researchers have used several ways to assistance in the effort restoration and the delayed onset muscle soreness decline (a lot these were massages, saunas or cryotherapy).Though the research results on the efficiency of these techniques are not univocal. Kinesio taping has been broadly used in clinical practice. Although it is unfamiliar whether which type of them is more effective in specific purpose. KT technique is based on mechanical and sensory contact of tissues. (15)

1.9 Dynamic contract relax stretching

Dynamic contract relax stretching includes muscle contraction, moving a limb through its full ROM against resistance to its end range and then lengthening the muscle. Unlike static stretching and ballistic stretching, which may consequence in impaired muscle strength or performance during running and jumping, dynamic stretching has been revealed to increase running and jumping performance. (16) Uncommon exercise with extensor muscle contraction and exhaustive exercise cause muscle injury, inflammation, leakage of muscle proteins into the circulation and soreness on and numerous days afterward which is known as delayed-onset muscle soreness (17)

By bringing in mind the symptoms and its related evidence and discussion the study aimed to compare the results of vibration therapy and massage in managing DOMS, ROM, MIF, 1RM, Serum CK level and LDH level. (18)

1.10 Static Stretching and PNF stretching

According to a study in which participants performed 8 weeks of static and proprioceptive neuromuscular facilitation (PNF) stretch exercise. When intervention completed after 8 weeks it was observed that there was reduction in the exercise persuaded delay onset of muscle soreness in both stretch group. This shows that participants who perform PNF or static stretching exercise may feel reduction in the delay onset of muscle soreness if the exercise is sustained for extended time period. (19) Regardless of the debate on effect of stretching exercise, stretching of hamstring muscle most usually used as basic portion of warm up procedure to improve strength, prevention of injury, decreasing the effects of delay onset of muscle soreness. (1,2) Current studies have recommended that stretching exercise improve flexibility and performance of hamstring muscle (i.e., peak torque [PT] of eccentric and concentric). (20) Muscle damage is common in eccentric contractions during exercises, training or competitions, delay onset of muscle soreness and muscle weakness are their common symptoms. (7,8 39) Even through the symptoms of DOMS improves in a week, but the treatment approaches to reduce muscle injury and assist retrieval are significant for athletes that helps them to perform better in training and matches. (21) If the participants perform PNF exercises or static stretching for an extended time period may decrease delay onset of muscle soreness. (22) Events or programs that require sufficient endurance like long distance running, cycling

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involve athletes' extensive psychological and physical involvement during training and competition to get success. (23) Various studies have provided the evidence that after performing different eccentric exercise there is muscle injury and local inflammation (i.e. buildup of leucocytes in the muscle tissue). Reliable and valid markers are requiring for the assessment of muscle damage. (24) The exercise which produces power in extending the part of the body are called eccentric exercises. After performing heavy exercises, the level of creatin kinase also increases along with delay onset of muscle soreness in skeletal muscles that decreases ROM and muscle performance and power. (25)

The intensity of delay onset of muscle soreness felt by the participants after performing eccentric exercises depends upon the type of exercise or task performing. (26)Stretching exercise as warm up activities is a common practice among athletes for many years. It is highly recommended by the coaches to perform stretching exercises as warm up for the athletes without knowing that how much it will affect the performance in sports. It is their belief that stretching exercises not only improve performance but also prevent chances of injury and increase flexibility. (27) Stretching exercises are the part of athletes training that helps them to improve their performance in competitive and recreational activities.

Even through some researchers found that static of ballistic stretching before exercise decreases muscle strength. (1, 8, 10, 12) Some studies suggested that pre stretching exercises decreases development of muscle tension. (28) Various studies on DOMS have concentrated on the level of plasma cretinin kinasevariations, electromyography outcomes and muscle power, but the properties of delayed onset muscle soreness on other mechanisms of upper extremities such as coordination and motor performance have been rarely spoken (29)

According to a study in which participant used their non-dominant hands elbow flexors in eccentric exercise to decrease 40% isometric torque. Subjects rotates a wheel (13-30 kg) in which they moved elbow from 130-degree angle to complete extension. (30) Previously many studies have conducted to identify the most effective training strategies for enhancing physical performance. Athletes maximum exercise capacity not only depends on their training but also it depends on ideal stability between training and recovery to escape stress related to physical and psychological aspects of training. (31)

Muscle injury due to exercise is known as delayed onset of muscle soreness may result in pain and stiffness in muscles that last for many hours to days, most frequently after performing eccentric exercise like downhill running. (32)

1.11 Kinesiotaping method

Kinsiotapping mathod is now one of the most common treatment streategy to manage pain realated to delay onset of muscle soreness which was confirmed by the athletes experiencing torment after spinal pressure preparing. (33) Several examinations have explored the impacts of warm up and cool down practice a short time later downhill running and discovered significant improvement in torment. (34)

1.12 Vibration therapy

Another investigation that meant to discover the viability of vibration treatment and back rub to forestall defer beginning of muscle touchiness and its related changes like ROM, MIF, 1RM, Serum CK level and LDH level. (35) DOMS is a typical neuromuscular condition that influences people the day after they perform vivacious or strange activities. Offbeat muscle withdrawal has found to cause muscle injury. (36) Exercise-convinced muscle injury has been a typical point in practice science for a long time. Specifically, the term postponed beginning muscle irritation (DOMS) has been a common topic since the early work of Hough (37)

Bawa et al expressed that neuromuscular framework is liable for age of wide scope of power and development that reaches from artistic work development to net solid and amazing development. (38) Newham et al expresses that erratic withdrawal of muscles in creatures and people brings about muscle injury and prompts decrease in the muscle power. (39) Vibration treatment and back rub are also compelling in

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avoidance of postponed beginning muscle touchiness. (40)

1.13 Foam Rolling

Foam rolling is quite possibly the best treatment methodologies to beat defer beginning of muscle touchiness and its related changes. (41) Compression articles of clothing are powerful in expanding recovery from muscle injury. (42)
Oral curcumin likely declines torment related with postponed beginning muscle touchiness with certain proof for expanded recovery of muscle execution. (43)

1.14 Whole body vibration treatment

Utilization of whole body vibration treatment in post exercise shows less pressing factor torment limit, muscle irritation alongside less decay maximal isometric and isokinetic intentional strength and lower creatine kinase levels in the blood. (44)
Managed before extensor muscle work out, WBVT might diminish postponed beginning muscle irritation through muscle work improvement (45)
Consuming milk-based CHO-P after muscle-injurious exercise is more helpful in diminishing in muscle performance and increases in active delayed onset muscle soreness at 48 h than ingestion previous to exercise. (46)

1.15 Rational of this study

DOMS is one of the common and major contributing factor that affect every exercise program and its efficiency. This study may help to find new knowledge regarding the DOMS and its management. It will provide a better treatment option from both types of stretching which will help athletes or resistance trainers to get rid of delayed onset muscle soreness sooner.

1.16 Objectives

- Tdetermine the effect of passive static stretching in delayed onset muscle soreness of recreational body builders
- To determine the effect of active static stretching in delayed onset muscle soreness of recreational body builders
- To compare the active and passive static stretching in delayed onset muscle soreness of recreational body builders.

1.17 Hypothesis

1.17.1 Study Hypothesis

- There is difference in Comparison of Active and Passive Static Stretching in Delayed Onset of Muscle Soreness of Recreational Body Builders

1.17.2 Null Hypothesis

- There is no difference in Comparison of Active and Passive Static Stretching in Delayed Onset of Muscle Soreness of Recreational Body Builders methods

2.1 Study Design

Randomized Controlled Trial

2.2 Sampling Technique

Non-probability purposive sampling for selection, Group Randomization done by Envelop Method.

2.3 Study Duration

(06 Months)

2.4 Study Setting

Data collected from Rawalpindi and Islamabad

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2.5 Sample size: 144 sample size decreases due to pandemic situation

Start | Enter | Results | Examples | Help

Input Data

Confidence Interval (2-sided)	95%
Power	80%
Ratio of sample size (Group 2/Group 1)	1

	Group 1	Group 2	Difference*
Mean	4.2	5.4	-1.2
Standard deviation	2.77	2.34	
Variance	7.6729	5.4756	

Sample size of Group 1	72
Sample size of Group 2	72
Total sample size	144

*Difference between the means

Results from OpenEpi, Version 3, open source calculator--SSMean
Print from the browser with ctrl-P or select text to copy and paste to other programs.

2.6 Inclusion Criteria:

- Male participants
- Age between 18-40
- Recreational body builders

2.7 Exclusion Criteria:

- Participants suffering from musculoskeletal injury.
- Acute muscle soreness

2.8 Tool:

- Numeric Rating Pain Scale
- Goniometer
- Likert Muscle Soreness Scale

2.9 Ethical Consideration:

Approval will be taken from ethical review committee of Riphah College of Rehabilitation and Allied Health Sciences. All information given will be kept confidential.

2.10 Data Collection Procedure:

First we register participants then randomization was did through sealed envelope method and then we allocate both groups equally. Passive static stretching was performed on Group 1 by physiotherapist and Active static stretching was perform by participants with guidance on Group 2..All participants was assessed before the intervention through Likert muscle soreness scale for assessment of muscle soreness, numeric rating

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pain scale for assessment of pain and goniometer for ROM for shoulder, elbow and wrist. Afterward all participants was perform eccentric exhaust weight exercises in the gym of all mentioned joints, one set of 25 repetition at each joint. Before giving the intervention they was assess of all mentioned parameters. Group 1 groups were receiving passive static stretching and group 2 was received active static stretching. At the end of the intervention participants was assessed again using the same parameters. Statistical analysis will be carried out to compare the outcomes measures of both groups.

2.11 Intervention detail:



Triceps Brachii Active Static Stretching

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Biceps Brachii Active Static Stretch



Wrist flexor static stretch

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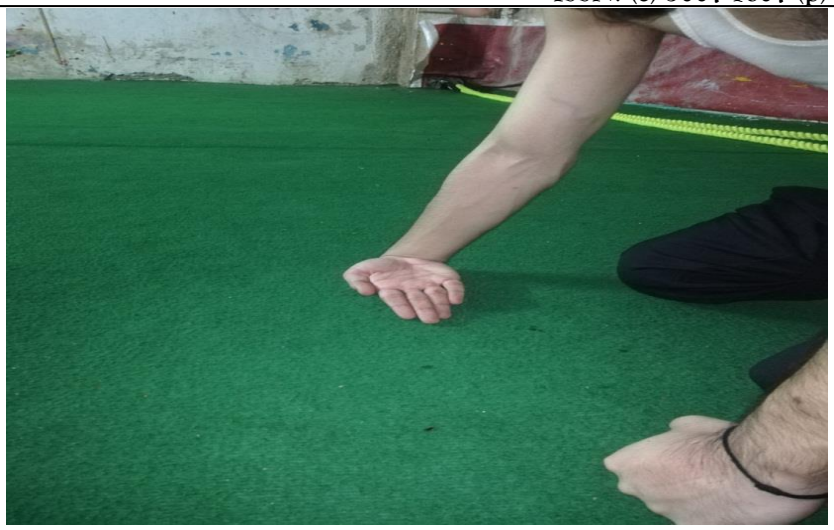

Wrist extensor stretch



Triceps passive static stretch



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Biceps passive static stretch



Wrist flexor Passive static stretch



Wrist extensor passive static stretch

2.12 Outcome measures: was taken before intervention immediate after intervention 24,48,72,96 and 120 hours.

Frequency & Intensity	Duration	Group 1 Passive	Group 2 Active
8-10 reps × 1 set with 10-30 sec Hold	Session 25-30 mints	Triceps stretch Biceps stretch Wrist extensors stretch Wrist flexors stretch	Triceps stretch Biceps stretch Wrist extensors stretch Wrist flexors stretch

Tool	Test

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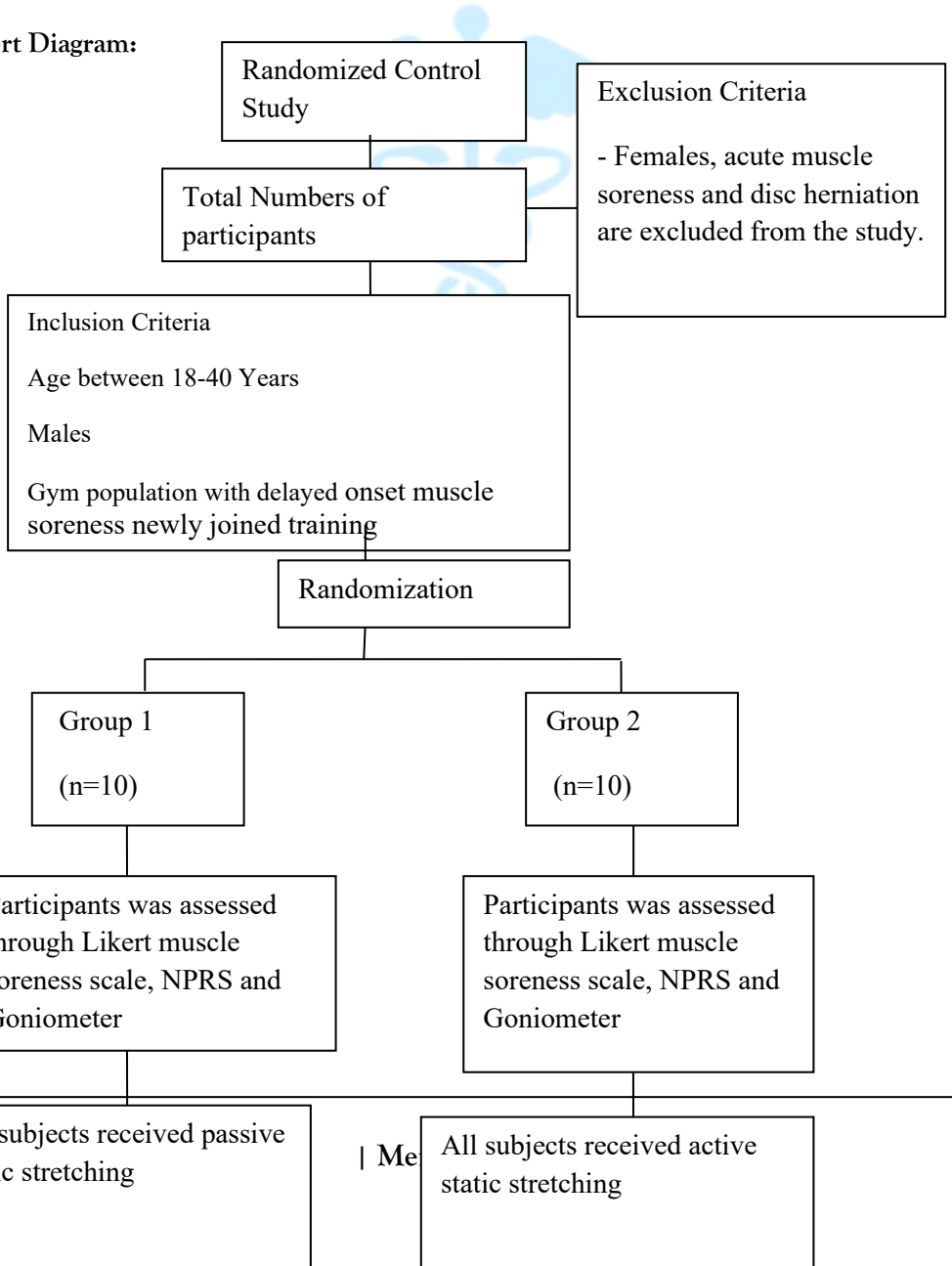
NPRS	Pain
Goniometer	ROM
Likert muscle soreness scale	Delayed onset muscle soreness

2.13 Data Analysis:
Data was analyzed by SPSS 21.

2.14 Consort Diagram:



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3. RESULTS

The data of study was analyzed in SPSS 21. The data of this study was abnormally distributed. Non parametric tests were applied to analyze the results. Mann-Whitney U test was used for between group comparisons. Wilcoxon test was used for within group comparison. The results of this study are following:

Table: 1 NPRS Group A (Passive Stretching)

	Mean	Std. Deviation	p-value
NPRS Pre-Intervention	5.40	1.07	0.005
NPRS 24 hours	3.40	1.07	
NPRS 24 hours	3.40	1.07	0.317
NPRS 48 hours	3.30	0.94	
NPRS 48 hours	3.30	0.94	0.002
NPRS 72 hours	2.30	0.94	
NPRS 72 hours	2.30	0.94	0.008
NPRS 96 hours	1.30	0.67	
NPRS 96 hours	1.30	0.67	0.004
NPRS 120 hours	0.30	0.48	
NPRS Pre-Intervention	5.40	1.07	0.005
NPRS 120 hours	0.30	0.48	

The results from above table 1 shows that Group A mean ±S.D of NPRS value Pre-Intervention is 5.40±1.07 , mean ±S.D of NPRS after 24 hours is reported to be 3.40 ±S1.07 , p value is 0.002 when comparing NPRS pre intervention and after 24 hours , mean ±S.D of NPRS after 48 hours is 3.30±0.94, p value is 0.317 when comparing NPRS value after 24 and 48 hours , mean ±S.D of NPRS after 72 hours is 2.30 ±0.94, p value is 0.002 when comparing NPRS value after 48 and 72 hours and NPRS mean ±S.D after 96 hours is 1.30 ±0.67 and NPRS mean ±S.D after 120 hours is 0.30 ±0.48

Table: 2 NPRS Group B (Active Stretching)

	Mean	Std. Deviation	p-value
NPRS Pre-Intervention	5.80	0.42	0.005
NPRS 24 hours	3.80	0.42	
NPRS 24 hours	3.80	0.42	1.000
NPRS 48 hours	3.80	0.42	
NPRS 48 hours	3.80	0.42	0.003
NPRS 72 hours	2.90	0.31	
NPRS 72 hours	2.90	0.31	0.005
NPRS 96 hours	1.80	0.63	
NPRS 96 hours	1.80	0.63	0.004
NPRS 120 hours	0.30	0.48	
NPRS Pre-Intervention	0.00	0.00	0.005
NPRS 120 hours	0.30	0.48	

The results from above table 2 shows that mean ±S.D of NPRS value Pre-Intervention is 5.80±0.42 , mean ±S.D of NPRS after 24 hours is reported to be 3.80 ±0.42 , p value is 0.002 when comparing NPRS pre intervention and after 24 hours , mean ±S.D of NPRS after 48 hours is 3.8±0.42, p value is 1.000 when comparing NPRS value after 24 and 48 hours , mean ±S.D of NPRS after 72 hours is

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2.90 ±0.31, p value is 0.003 when comparing NPRS value after 48 and 72 hours and NPRS mean ±S.D after 96 hours is 1.80 ±0.63 and NPRS mean ±S.D after 120 hours is 0.30 ±0.48

Table: 3 Comparing NPRS values of Group A (Passive Stretching) & Group B (Active Stretching)

		Mean	Std. Deviation	p-value
NPRS Pre-Intervention	Group A	5.40	1.07	0.315
	Group B	5.80	0.42	
NPRS 24 hours	Group A	3.40	1.07	0.315
	Group B	3.80	0.42	
NPRS 48 hours	Group A	3.30	0.94	0.190
	Group B	3.80	0.42	
NPRS 72 hours	Group A	2.30	0.94	0.105
	Group B	2.90	0.31	
NPRS 96 hours	Group A	1.30	0.67	0.089
	Group B	1.80	0.63	
NPRS 120 hours	Group A	0.30	0.48	1.000
	Group B	0.30	0.48	

The results from above table 3 shows s differences between both groups A and B NPRS values , Group A mean ±S.D of NPRS value Pre-Intervention is 5.40±1.07 whereas Group B mean ±S.D of NPRS value Pre-Intervention is 0.00±0.00, p value is 0.315 when comparing Group A and Group B NPRS pre intervention , Group A mean ±S.D of NPRS after 24 hours is reported to be 3.80 ±0.42 , Group B mean ±S.D of NPRS after 24 hours is reported to be 3.80 ±0.42 , p value is 0.315 when comparing Group A and Group B NPRS after 24 hours , Group A mean ±S.D of NPRS after 48 hours is 3.8±0.42, Group B mean ±S.D of NPRS after 48 hours is 3.8±0.42 p value is 0.190 when comparing Group A and Group B NPRS after 48 hours , Group B mean ±S.D of NPRS after 72 hours is 2.90 ±0.31, p value is 0.105 when comparing Group A and Group B NPRS after 72 hours and Group A NPRS mean ±S.D after 96 hours is 1.80 ±0.63 and Group B mean ±S.D after 96 hours is 1.80 ±0.NPRS , Group A mean ±S.D after 120 hours is 0.30 ±0.48 and Group B NPRS mean ±S.D after 120 hours is 0.30 ±0.48

Table: 4 Group A (Passive Stretching) Shoulder ROM Flexion

	Mean	Std. Deviation	p-value
Shoulder ROM Flexion Pre-Intervention	145	7.37	0.002
Shoulder ROM Flexion 24 hours	150	6.85	
Shoulder ROM Flexion 24 hours	150	6.85	0.317
Shoulder ROM Flexion 48 hours	151	7.37	
Shoulder ROM Flexion 48 hours	151	7.37	0.014
Shoulder ROM Flexion 72 hours	155	7.61	
Shoulder ROM Flexion 72 hours	155	7.61	0.006
Shoulder ROM Flexion 96 hours	161	7.47	
Shoulder ROM Flexion 96 hours	161	7.47	0.008
Shoulder ROM Flexion 120 hours	165	7.07	
Shoulder ROM Flexion Pre-Intervention	145	7.37	0.005
Shoulder ROM Flexion 120 hours	165	7.07	

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Table: 5 Group A Shoulder ROM Flexion

	Mean	Std. Deviation	P-value
Shoulder ROM Flexion Pre-Intervention	144	6.34	0.004
Shoulder ROM Flexion 24 hours	157	6.53	
Shoulder ROM Flexion 24 hours	157	6.53	0.154
Shoulder ROM Flexion 48 hours	158	7.20	
Shoulder ROM Flexion 48 hours	158	7.20	0.004
Shoulder ROM Flexion 72 hours	164	6.03	
Shoulder ROM Flexion 72 hours	164	6.03	0.016
Shoulder ROM Flexion 96 hours	167	6.53	
Shoulder ROM Flexion 96 hours	167	6.53	0.102
Shoulder ROM Flexion 120 hours	168	6.74	
Shoulder ROM Flexion Pre-Intervention	144	6.37	0.007
Shoulder ROM Flexion 120 hours	168	6.74	

Table 4 shows Shoulder ROM Flexion , when comparing Shoulder ROM Flexion pre after 24 hours and after 48 hours the p value is 0.317 when comparing Shoulder ROM Flexion after 48 hours and 72 hours the p value is 0.014 when comparing Shoulder ROM Flexion after 72 hours and 96 the p value is 0.006 when comparing Shoulder ROM Flexion after 96 hours and 120 hours the p value is 0.008 when comparing Shoulder ROM Flexion pre intervention and after 120 hours the p value is 0.005.

Table 5 shows Shoulder ROM Flexion , when comparing Shoulder ROM Flexion pre intervention and after 24 hours the p value is 0.002 , when comparing Shoulder ROM Flexion intervention and after 24 hours the p value is 0.004 , when comparing Shoulder ROM Flexion after 24 hours and after 48 hours the p value is 0.154 when comparing Shoulder ROM Flexion after 48 hours and 72 hours the p value is 0.004 when comparing Shoulder ROM Flexion after 72 hours and 96 the p value is 0.016 when comparing Shoulder ROM Flexion after 96 hours and 120 hours the p value is 0.102 when comparing Shoulder ROM Flexion pre intervention and after 120 hours the p value is 0.007.

Table: 6 Comparing Shoulder ROM Flexion of Group A & B

		Mean	Std. Deviation	p-value
Shoulder ROM Flexion Pre-Intervention	Group A	145	7.37	0.352
	Group B	145	6.34	
Shoulder ROM Flexion 24 hours	Group A	150	6.85	0.007
	Group B	157	6.53	
Shoulder ROM Flexion 48 hours	Group A	151	7.37	0.007
	Group B	158	7.20	
Shoulder ROM Flexion 72 hours	Group A	155	7.61	0.009
	Group B	164	6.03	
Shoulder ROM Flexion 96 hours	Group A	161	7.47	0.089
	Group B	167	6.53	
Shoulder ROM Flexion 120 hours	Group A	165	7.07	0.218
	Group B	168	6.74	

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Table 6 compare values of Group A and Group B showing Shoulder ROM Flexion , when comparing Shoulder ROM Flexion pre intervention of Group A and B the p value is 0.352 , when comparing Shoulder ROM Flexion of Group A and B after 24 hours the p value is 0.007 , when comparing Shoulder ROM Flexion og Group A and B after 48 hours the p value is 0.007 , when comparing Shoulder ROM Flexion of Group A and B after 72 hours the p value is 0.009 , when comparing Shoulder ROM Flexion of both groups after 120 hours the p value is 0.218.

Table: 7 Group A Shoulder ROM Extension

	Mean	Std. Deviation	p-value
Shoulder ROM Extension Pre-Intervention	30	8.23	0.004
Shoulder ROM Extension 24 hours	34	8.95	
Shoulder ROM Extension 24 hours	34	8.95	1.000
Shoulder ROM Extension 48 hours	34	8.95	
Shoulder ROM Extension 48 hours	34	8.95	0.005
Shoulder ROM Extension 72 hours	40	7.07	
Shoulder ROM Extension 72 hours	40	7.07	0.014
Shoulder ROM Extension 96 hours	43	8.23	
Shoulder ROM Extension 96 hours	43	8.23	0.014
Shoulder ROM Extension 120 hours	46	6.99	
Shoulder ROM Extension Pre-Intervention	30	8.23	0.014
Shoulder ROM Extension 120 hours	46	6.99	

Table 7 shows Shoulder ROM extension of Group A participants , when comparing Shoulder ROM extension pre intervention and after 24 hours the p value is 0.004 , when comparing Shoulder ROM extension after 24 hours and after 48 hours the p value is 1.000 when comparing Shoulder ROM extension after 48 hours and 72 hours the p value is 0.005 when comparing Shoulder ROM extension after 72 hours and 96 the p value is 0.014 when comparing Shoulder ROM extension after 96 hours and 120 hours the p value is 0.014 when comparing Shoulder ROM extension pre intervention and after 120 hours the p value is 0.014

Table: 8 Group B Shoulder ROM Extension

	Mean	Std. Deviation	p-value
Shoulder ROM Extension Pre-Intervention	35	4.08	0.002
Shoulder ROM Extension 24 hours	40	2.29	
Shoulder ROM Extension 24 hours	40	2.29	0.157
Shoulder ROM Extension 48 hours	41	2.82	
Shoulder ROM Extension 48 hours	41	2.82	0.002
Shoulder ROM Extension 72 hours	46	3.37	
Shoulder ROM Extension 72 hours	46	3.37	0.007
Shoulder ROM Extension 96 hours	50	3.55	
Shoulder ROM Extension 96 hours	50	3.55	0.317
Shoulder ROM Extension 120 hours	50	2.83	
Shoulder ROM Extension Pre-Intervention	35	4.08	0.017
Shoulder ROM Extension 120 hours	50	2.83	

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Table 7 shows Shoulder ROM extension of Group B participants , when comparing Shoulder ROM extension pre intervention and after 24 hours the p value is 0.002 , when comparing Shoulder ROM extension after 24 hours and after 48 hours the p value is 0.157 when comparing Shoulder ROM extension after 48 hours and 72 hours the p value is 0.002 when comparing Shoulder ROM extension after 72 hours and 96 the p value is 0.007 when comparing Shoulder ROM extension after 96 hours and 120 hours the p value is 0.317 when comparing Shoulder ROM extension pre intervention and after 120 hours the p value is 0.017

Table: 9 Comparing Group A & B Shoulder ROM Extension

		Mean	Std. Deviation	p-value
Shoulder ROM Extension Pre-Intervention	Group A	30	8.23	0.075
	Group B	35	4.08	
Shoulder ROM Extension 24 hours	Group A	34	8.95	0.165
	Group B	40	2.29	
Shoulder ROM Extension 48 hours	Group A	34	8.95	0.063
	Group B	41	2.82	
Shoulder ROM Extension 72 hours	Group A	40	7.07	0.035
	Group B	46	3.37	
Shoulder ROM Extension 96 hours	Group A	43	8.23	0.029
	Group B	50	3.55	
Shoulder ROM Extension 120 hours	Group A	46	6.99	0.032
	Group B	50	2.83	

Table 9 compare values of Group A and Group B showing Shoulder ROM Extension, when comparing Shoulder ROM Extension pre intervention of Group A and B the p value is 0.075, when comparing Shoulder ROM Extension of Group A and B after 24 hours the p value is 0.165 , when comparing Shoulder ROM Extension of Group A and B after 48 hours the p value is 0.063 , when comparing Shoulder ROM Extension of Group A and B after 72 hours the p value is 0.029 , when comparing Shoulder ROM Extension of both groups after 120 hours the p value is 0.032.

Table: 10 Group A Shoulder ROM Abduction

	Mean	Std. Deviation	p-value
Shoulder ROM Abduction Pre-Intervention	146	8.75	0.002
Shoulder ROM Abduction 24 hours	151	8.18	
Shoulder ROM Abduction 24 hours	151	8.18	1.000
Shoulder ROM Abduction 48 hours	151	8.18	
Shoulder ROM Abduction 48 hours	151	8.18	0.002
Shoulder ROM Abduction 72 hours	156	8.18	
Shoulder ROM Abduction 72 hours	156	8.18	0.002
Shoulder ROM Abduction 96 hours	162	8.23	
Shoulder ROM Abduction 96 hours	162	8.23	0.014
Shoulder ROM Abduction 120 hours	165	8.49	
Shoulder ROM Abduction Pre-Intervention	146	8.75	0.005
Shoulder ROM Abduction 120 hours	165	8.49	

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Table 10 shows Shoulder ROM Abduction of Group A , when comparing Shoulder ROM Abduction pre intervention and after 24 hours the p value is 0.002 , when comparing Shoulder ROM Abduction after 24 hours and after 48 hours the p value is 1.000 when comparing Shoulder ROM Abduction after 48 hours and 72 hours the p value is 0.002 when comparing Shoulder ROM Abduction after 72 hours and 96 the p value is 0.002 when comparing Shoulder ROM Abduction after 96 hours and 120 hours the p value is 0.014 when comparing Shoulder ROM Abduction pre intervention and after 120 hours the p value is 0.005.

Table: 11 Group B Shoulder ROM Abduction

	Mean	Std. Deviation	p-value
Shoulder ROM Abduction Pre-Intervention	160	7.16	0.064
Shoulder ROM Abduction 24 hours	165	7.00	
Shoulder ROM Abduction 24 hours	165	7.00	1.000
Shoulder ROM Abduction 48 hours	158	8.20	
Shoulder ROM Abduction 48 hours	158	8.20	0.004
Shoulder ROM Abduction 72 hours	164	7.97	
Shoulder ROM Abduction 72 hours	164	7.97	0.014
Shoulder ROM Abduction 96 hours	167	7.16	
Shoulder ROM Abduction 96 hours	167	7.16	0.180
Shoulder ROM Abduction 120 hours	168	7.52	
Shoulder ROM Abduction Pre-Intervention	160	7.16	0.057
Shoulder ROM Abduction 120 hours	168	7.52	

Table 11 shows Shoulder ROM Abduction of Group B , when comparing Shoulder ROM Abduction pre intervention and after 24 hours the p value is 0.064 , when comparing Shoulder ROM Abduction after 24 hours and after 48 hours the p value is 1.000 when comparing Shoulder ROM Abduction after 48 hours and 72 hours the p value is 0.004 when comparing Shoulder ROM Abduction after 72 hours and 96 the p value is 0.014 when comparing Shoulder ROM Abduction after 96 hours and 120 hours the p value is 0.180 when comparing Shoulder ROM Abduction pre intervention and after 120 hours the p value is 0.057.

Table: 12 Group A & B Shoulder ROM Abduction

		Mean	Std. Deviation	p-value
Shoulder ROM Abduction Pre-Intervention	Group A	146	8.75	0.143
	Group B	160	7.16	
Shoulder ROM Abduction 24 hours	Group A	151	8.18	0.075
	Group B	165	7.00	
Shoulder ROM Abduction 48 hours	Group A	151	8.18	0.052
	Group B	158	8.20	
Shoulder ROM Abduction 72 hours	Group A	156	8.18	0.089
	Group B	164	7.97	
Shoulder ROM Abduction 96 hours	Group A	162	8.23	0.165
	Group B	167	7.16	
1Shoulder ROM Abduction 120 hours	Group A	165	8.49	0.481
	Group B	168	7.52	

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Table 12 compares values of Group A and Group B showing Shoulder ROM Abduction. Comparing mean ±S.D of groups after 24 hours, 48 hours, 72 hours.96 hours and 120 hours respectively

Table: 13 Group A Shoulder ROM Internal Rotation

	Mean	Std. Deviation	p-value
Shoulder ROM Internal Rotation Pre-Intervention	48	10.12	0.004
Shoulder ROM Internal Rotation 24 hours	50	9.56	
Shoulder ROM Internal Rotation 24 hours	50	9.56	0.317
Shoulder ROM Internal Rotation 48 hours	51	9.06	
Shoulder ROM Internal Rotation 48 hours	51	9.06	0.005
Shoulder ROM Internal Rotation 72 hours	56	8.75	
Shoulder ROM Internal Rotation 72 hours	56	8.75	0.007
Shoulder ROM Internal Rotation 96 hours	59	10.27	
Shoulder ROM Internal Rotation 96 hours	59	10.27	0.003
Shoulder ROM Internal Rotation 120 hours	64	10.12	
Shoulder ROM Internal Rotation Pre-Intervention	48	10.12	0.002
Shoulder ROM Internal Rotation 120 hours	64	10.12	

Table 16 shows Shoulder ROM Internal Rotation of Group A , when comparing Shoulder ROM Internal Rotation pre intervention and after 24 hours the p value is 0.004 , when comparing Shoulder ROM Internal Rotation after 24 hours and after 48 hours the p value is 0.317 when comparing Shoulder ROM Internal Rotation after 48 hours and 72 hours the p value is 0.005 when comparing Shoulder ROM Internal Rotation after 72 hours and 96 the p value is 0.007 when comparing Shoulder ROM Internal Rotation after 96 hours and 120 hours the p value is 0.003 when comparing Shoulder ROM Internal Rotation pre intervention and after 120 hours the p value is 0.002.

Table: 14 Group B Shoulder ROM Internal Rotation

	Mean	Std. Deviation	p-value
Shoulder ROM Internal Rotation Pre-Intervention	55	6.32	0.004
Shoulder ROM Internal Rotation 24 hours	59	5.16	
Shoulder ROM Internal Rotation 24 hours	59	5.16	1.000
Shoulder ROM Internal Rotation 48 hours	59	5.16	
Shoulder ROM Internal Rotation 48 hours	59	5.16	0.003
Shoulder ROM Internal Rotation 72 hours	64	5.16	
Shoulder ROM Internal Rotation 72 hours	64	5.16	0.008
Shoulder ROM Internal Rotation 96 hours	67	5.87	
Shoulder ROM Internal Rotation 96 hours	67	5.87	0.157
Shoulder ROM Internal Rotation 120 hours	68	6.32	
Shoulder ROM Internal Rotation Pre-Intervention	55	6.32	0.050
Shoulder ROM Internal Rotation 120 hours	68	6.32	

Table 17 shows Shoulder ROM Internal Rotation of Group B , when comparing Shoulder ROM Internal Rotation pre intervention and after 24 hours the p value is 0.004 , when comparing Shoulder ROM Internal Rotation after 24 hours and after 48 hours the p value is 1.000 when

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comparing Shoulder ROM Internal Rotation after 48 hours and 72 hours the p value is 0.003 when comparing Shoulder ROM Internal Rotation after 72 hours and 96 the p value is 0.008 when comparing Shoulder ROM Internal Rotation after 96 hours and 120 hours the p value is 0.157 when comparing Shoulder ROM Internal Rotation pre intervention and after 120 hours the p value is 0.050.

Table: 15 Group A & B Shoulder ROM Internal Rotation

		Mean	Std. Deviation	p-value
Shoulder ROM Internal Rotation Pre-Intervention	Group A	48	10.12	0.052
	Group B	55	6.32	
Shoulder ROM Internal Rotation 24 hours	Group A	50	9.56	0.052
	Group B	59	5.16	
Shoulder ROM Internal Rotation 48 hours	Group A	51	9.06	0.052
	Group B	59	5.16	
Shoulder ROM Internal Rotation 72 hours	Group A	56	8.75	0.043
	Group B	64	5.16	
Shoulder ROM Internal Rotation 96 hours	Group A	59	10.27	0.089
	Group B	67	5.87	
Shoulder ROM Internal Rotation 120 hours	Group A	64	10.12	0.579
	Group B	68	6.32	

Table 18 compares values of Group A and Group B showing Shoulder ROM Internal Rotation. Comparing mean ±S.D of groups after 24 hours, 48 hours, 72 hours.96 hours and 120 hours respectively

Table: 16 Group A Shoulder ROM External Rotation

	Mean	Std. Deviation	p-value
Shoulder ROM External Rotation Pre-Intervention	50	10.33	0.004
Shoulder ROM External Rotation 24 hours	54	10.23	
Shoulder ROM External Rotation 24 hours	54	10.23	1.000
Shoulder ROM External Rotation 48 hours	54	10.23	
Shoulder ROM External Rotation 48 hours	54	10.23	0.023
Shoulder ROM External Rotation 72 hours	58	11.31	
Shoulder ROM External Rotation 72 hours	58	11.31	0.005
Shoulder ROM External Rotation 96 hours	64	11.41	
Shoulder ROM External Rotation 96 hours	64	11.41	0.007
Shoulder ROM External Rotation 120 hours	69	9.66	
Shoulder ROM External Rotation Pre-Intervention	50	10.33	0.006
Shoulder ROM External Rotation 120 hours	69	9.66	

Table 19 shows Shoulder ROM External Rotation of Group A , when comparing Shoulder ROM External Rotation pre intervention and after 24 hours the p value is 0.004 , when comparing Shoulder ROM External Rotation after 24 hours and after 48 hours the p value is 1.000 when comparing Shoulder ROM External Rotation after 48 hours and 72 hours the p value is 0.023 when comparing Shoulder ROM External Rotation after 72 hours and 96 the p value is

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0.005 when comparing Shoulder ROM External Rotation after 96 hours and 120 hours the p value is 0.007 when comparing Shoulder ROM External Rotation pre intervention and after 120 hours the p value is 0.006

Table: 17 Group B Shoulder ROM External Rotations

	Mean	Std. Deviation	p-value
Shoulder ROM External Rotation Pre-Intervention	58	4.83	0.004
Shoulder ROM External Rotation 24 hours	62	4.75	
Shoulder ROM External Rotation 24 hours	62	4.75	1.000
Shoulder ROM External Rotation 48 hours	62	4.75	
Shoulder ROM External Rotation 48 hours	62	4.75	0.004
Shoulder ROM External Rotation 72 hours	67	4.97	
Shoulder ROM External Rotation 72 hours	67	4.97	0.010
Shoulder ROM External Rotation 96 hours	71	5.75	
Shoulder ROM External Rotation 96 hours	71	5.75	0.066
Shoulder ROM External Rotation 120 hours	72	4.85	
Shoulder ROM External Rotation Pre-Intervention	58	4.83	0.317
Shoulder ROM External Rotation 120 hours	72	4.85	

Table 20 shows Shoulder ROM External Rotation of Group B , when comparing Shoulder ROM External Rotation pre intervention and after 24 hours the p value is 0.004 , when comparing Shoulder ROM External Rotation after 24 hours and after 48 hours the p value is 1.000 when comparing Shoulder ROM External Rotation after 48 hours and 72 hours the p value is 0.004 when comparing Shoulder ROM External Rotation after 72 hours and 96 the p value is 0.010 when comparing Shoulder ROM External Rotation after 96 hours and 120 hours the p value is 0.066 when comparing Shoulder ROM External Rotation pre intervention and after 120 hours the p value is 0.317

Table: 18 Group A & B Shoulder ROM External Rotation

		Mean	Std. Deviation	p-value
Shoulder ROM External Rotation Pre-Intervention	Group A	50	10.33	0.035
	Group B	58	4.83	
Shoulder ROM External Rotation 24 hours	Group A	54	10.23	0.089
	Group B	62	4.75	
Shoulder ROM External Rotation 48 hours	Group A	54	10.23	0.089
	Group B	62	4.75	
Shoulder ROM External Rotation 72 hours	Group A	58	11.31	0.089
	Group B	67	4.97	
Shoulder ROM External Rotation 96 hours	Group A	64	11.41	0.280
	Group B	71	5.75	
Shoulder ROM External Rotation 120 hours	Group A	69	9.66	0.436
	Group B	72	4.85	

Table 21 compares values of Group A and Group B showing Shoulder ROM External Rotation.

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Comparing mean ±S.D of groups after 24 hours, 48 hours, 72 hours.96 hours and 120 hours respectively

Table: 19 Group A Elbow ROM Flexion

	Mean	Std. Deviation	p-value
Elbow ROM Flexion Pre-Intervention	110	18.62	0.006
Elbow ROM Flexion 24 hours	116	16.22	
Elbow ROM Flexion 24 hours	116	16.22	1.000
Elbow ROM Flexion 48 hours	116	16.22	
Elbow ROM Flexion 48 hours	116	16.22	0.005
Elbow ROM Flexion 72 hours	121	17.80	
Elbow ROM Flexion 72 hours	121	17.80	0.004
Elbow ROM Flexion 96 hours	126	19.73	
Elbow ROM Flexion 96 hours	126	19.73	1.000
Elbow ROM Flexion 120 hours	126	18.73	
Elbow ROM Flexion Pre-Intervention	110	18.62	0.009
Elbow ROM Flexion 120 hours	126	18.73	

Table 22 shows Elbow ROM Flexion of Group A , when comparing Elbow ROM Flexion pre intervention and after 24 hours the p value is 0.006, when comparing Elbow ROM Flexion after 24 hours and after 48 hours the p value is 1.000 when comparing Elbow ROM Flexion after 48 hours and 72 hours the p value is 0.005 when comparing Elbow ROM Flexion after 72 hours and 96 the p value is 0.004 when comparing Elbow ROM Flexion after 96 hours and 120 hours the p value is 1.000 when comparing Elbow ROM Flexion pre intervention and after 120 hours the p value is 0.009

Table: 20 Group B Elbow ROM Flexion

	Mean	Std. Deviation	p-value
Elbow ROM Flexion Pre-Intervention	122	6.74	0.004
Elbow ROM Flexion 24 hours	128	5.97	
Elbow ROM Flexion 24 hours	128	5.97	1.000
Elbow ROM Flexion 48 hours	128	5.97	
Elbow ROM Flexion 48 hours	128	5.97	0.004
Elbow ROM Flexion 72 hours	134	6.85	
Elbow ROM Flexion 72 hours	134	6.85	0.034
Elbow ROM Flexion 96 hours	136	6.67	
Elbow ROM Flexion 96 hours	136	6.67	0.317
Elbow ROM Flexion 120 hours	137	6.74	
Elbow ROM Flexion Pre-Intervention	122	6.74	0.050
Elbow ROM Flexion 120 hours	137	6.74	

Table 23 shows Elbow ROM Flexion of Group B , when comparing Elbow ROM Flexion pre intervention and after 24 hours the p value is 0.004, when comparing Elbow ROM Flexion after 24 hours and after 48 hours the p value is 1.000 when comparing Elbow ROM Flexion after 48 hours and 72 hours the p value is 0.004 when comparing Elbow ROM Flexion after 72 hours and 96 the p value is 0.034 when comparing Elbow ROM Flexion after 96 hours and 120

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hours the p value is 3.17 when comparing Elbow ROM Flexion pre intervention and after 120 hours the p value is 0.050

Table: 21 Groups A & B Elbow ROM Flexion

		Mean	Std. Deviation	p-value
Elbow ROM Flexion Pre-Intervention	Group A	110	18.62	0.035
	Group B	122	6.74	
Elbow ROM Flexion 24 hours	Group A	116	16.22	0.043
	Group B	128	5.97	
Elbow ROM Flexion 48 hours	Group A	116	16.22	0.043
	Group B	128	5.97	
Elbow ROM Flexion 72 hours	Group A	121	17.80	0.023
	Group B	134	6.85	
Elbow ROM Flexion 96 hours	Group A	126	19.73	0.075
	Group B	136	6.67	
Elbow ROM Flexion 120 hours	Group A	126	18.62	0.035
	Group B	137	6.74	

Tables 24 compare values of Group A and Group B showing Elbow ROM Flexion. Comparing mean ±S.D of groups after 24 hours, 48 hours, 72 hours.96 hours and 120 hours respectively

Table: 22 Group A Wrist ROM Flexion

	Mean	Std. Deviation	p-value
Wrist ROM Flexion Pre-Intervention	40	7.77	0.004
Wrist ROM Flexion 24 hours	44	6.86	
Wrist ROM Flexion 24 hours	44	6.86	1.000
Wrist ROM Flexion 48 hours	44	6.86	
Wrist ROM Flexion 48 hours	44	6.86	0.004
Wrist ROM Flexion 72 hours	49	6.99	
Wrist ROM Flexion 72 hours	49	6.99	0.008
Wrist ROM Flexion 96 hours	53	7.46	
Wrist ROM Flexion 96 hours	53	7.46	0.014
Wrist ROM Flexion 120 hours	57	6.74	
Wrist ROM Flexion Pre-Intervention	40	7.77	0.005
Wrist ROM Flexion 120 hours	57	6.74	

Table 28 shows Wrist ROM Flexion of Group A , when comparing Wrist ROM Flexion pre intervention and after 24 hours the p value is 0.004, when comparing Wrist ROM Flexion after 24 hours and after 48 hours the p value is 1.000 when comparing Wrist ROM Flexion after 48 hours and 72 hours the p value is 0.004 when comparing Wrist ROM Flexion after 72 hours and 96 the p value is 0.008 when comparing Wrist ROM Flexion after 96 hours and 120 hours the p value is 0.014 when comparing Wrist ROM Flexion pre intervention and after 120 hours the p value is 0.005

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Table: 23 Group B Wrist ROM Flexion

	Mean	Std. Deviation	p-value
Wrist ROM Flexion Pre-Intervention	50	6.99	0.004
Wrist ROM Flexion 24 hours	57	6.58	
Wrist ROM Flexion 24 hours	57	6.58	1.000
Wrist ROM Flexion 48 hours	57	6.58	
Wrist ROM Flexion 48 hours	57	6.58	0.004
Wrist ROM Flexion 72 hours	64	9.66	
Wrist ROM Flexion 72 hours	64	9.66	0.154
Wrist ROM Flexion 96 hours	65	6.32	
Wrist ROM Flexion 96 hours	65	6.32	0.102
Wrist ROM Flexion 120 hours	65	6.77	
Wrist ROM Flexion Pre-Intervention	50	6.99	0.017
Wrist ROM Flexion 120 hours	65	6.77	

Table 29 shows Wrist ROM Flexion of Group B , when comparing Wrist ROM Flexion pre intervention and after 24 hours the p value is 0.004, when comparing Wrist ROM Flexion after 24 hours and after 48 hours the p value is 1.000 when comparing Wrist ROM Flexion after 48 hours and 72 hours the p value is 0.004 when comparing Wrist ROM Flexion after 72 hours and 96 the p value is 0.154 when comparing Wrist ROM Flexion after 96 hours and 120 hours the p value is 0.102when comparing Wrist ROM Flexion pre intervention and after 120 hours the p value is 0.017

Table: 24 Group A & B Wrist ROM Flexion

		Mean	Std. Deviation	p-value
Wrist ROM Flexion Pre-Intervention	Group A	40	7.77	0.065
	Group B	50	6.99	
Wrist ROM Flexion 24 hours	Group A	44	6.86	0.004
	Group B	57	6.58	
Wrist ROM Flexion 48 hours	Group A	44	6.86	0.003
	Group B	57	6.58	
Wrist ROM Flexion 72 hours	Group A	49	6.99	0.001
	Group B	64	9.66	
Wrist ROM Flexion 96 hours	Group A	53	7.46	0.002
	Group B	65	6.32	
Wrist ROM Flexion 120 hours	Group A	57	6.74	0.005
	Group B	65	6.77	

Table 30 values of Group A and Group B showing Wrist ROM Flexion. Comparing mean ±S.D of groups after 24 hours, 48 hours, 72 hours.96 hours and 120 hours respectively

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Table: 25 Group A Wrist ROM Extension

	Mean	Std. Deviation	p-value
Wrist ROM Extension Pre-Intervention	35	5.89	0.006
Wrist ROM Extension 24 hours	40	4.37	
Wrist ROM Extension 24 hours	40	4.37	1.000
Wrist ROM Extension 48 hours	40	4.37	
Wrist ROM Extension 48 hours	40	4.37	0.002
Wrist ROM Extension 72 hours	45	4.37	
Wrist ROM Extension 72 hours	45	4.37	0.008
Wrist ROM Extension 96 hours	50	4.97	
Wrist ROM Extension 96 hours	50	4.97	0.157
Wrist ROM Extension 120 hours	51	4.74	
Wrist ROM Extension Pre-Intervention	35	5.89	0.020
Wrist ROM Extension 120 hours	51	4.74	

Table 31 shows Wrist ROM Extension of Group A , when comparing Wrist ROM Extension pre intervention and after 24 hours the p value is 0.006, when comparing Wrist ROM Extension after 24 hours and after 48 hours the p value is 1.000 when comparing Wrist ROM Extension after 48 hours and 72 hours the p value is 0.002 when comparing Wrist ROM Extension after 72 hours and 96 the p value is 0.008 when comparing Wrist ROM Extension after 96 hours and 120 hours the p value is 0.157 when comparing Wrist ROM Extension pre intervention and after 120 hours the p value is 0.020

Table: 26 Group B Wrist ROM Extensions

	Mean	Std. Deviation	p-value
Wrist ROM Extension Pre-Intervention	40	7.14	0.004
Wrist ROM Extension 24 hours	49	6.59	
Wrist ROM Extension 24 hours	49	6.59	1.000
Wrist ROM Extension 48 hours	49	6.59	
Wrist ROM Extension 48 hours	49	6.59	0.003
Wrist ROM Extension 72 hours	54	6.47	
Wrist ROM Extension 72 hours	54	6.47	0.016
Wrist ROM Extension 96 hours	57	6.73	
Wrist ROM Extension 96 hours	57	6.73	0.109
Wrist ROM Extension 120 hours	58	7.14	
Wrist ROM Extension Pre-Intervention	40	7.14	0.056
Wrist ROM Extension 120 hours	58	7.14	

Table 32 shows Wrist ROM Extension of Group B , when comparing Wrist ROM Extension pre intervention and after 24 hours the p value is 0.006, when comparing Wrist ROM Extension after 24 hours and after 48 hours the p value is 1.000 when comparing Wrist ROM Extension after 48 hours and 72 hours the p value is 0.003 when comparing Wrist ROM Extension after 72 hours and 96 the p value is 0.016 when comparing Wrist ROM Extension after 96 hours and 120 hours the p value is 0.109 when comparing Wrist ROM Extension pre intervention and after 120 hours the p value is 0.056

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Table: 27 Groups A & B Wrist ROM Extension

		Mean	Std. Deviation	p-value
Wrist ROM Extension Pre-Intervention	Group A	40	5.89	0.003
	Group B	50	7.14	
Wrist ROM Extension 24 hours	Group A	40	4.37	0.004
	Group B	49	6.59	
Wrist ROM Extension 48 hours	Group A	40	4.37	0.004
	Group B	49	6.59	
Wrist ROM Extension 72 hours	Group A	45	4.37	0.005
	Group B	54	6.47	
Wrist ROM Extension 96 hours	Group A	50	4.97	0.035
	Group B	57	6.73	
Wrist ROM Extension 120 hours	Group A	51	4.74	0.052
	Group B	58	7.14	

Table 33 values of Group A and Group B showing Wrist ROM Extension. Comparing mean ±S.D of groups after 24 hours, 48 hours, 72 hours. 96 hours and 120 hours respectively

Table: 28 Group A Wrist ROM Radial Deviation

	Mean	Std. Deviation	p-value
Wrist ROM Radial Deviation Pre-Intervention	10	1.58	0.004
Wrist ROM Radial Deviation 24 hours	14	2.25	
Wrist ROM Radial Deviation 24 hours	14	2.25	1.000
Wrist ROM Radial Deviation 48 hours	14	2.25	
Wrist ROM Radial Deviation 48 hours	14	2.25	0.017
Wrist ROM Radial Deviation 72 hours	16	2.78	
Wrist ROM Radial Deviation 72 hours	16	2.78	0.016
Wrist ROM Radial Deviation 96 hours	19	2.21	
Wrist ROM Radial Deviation 96 hours	19	2.21	0.317
Wrist ROM Radial Deviation 120 hours	19	1.58	
Wrist ROM Radial Deviation Pre-Intervention	10	1.58	0.045
Wrist ROM Radial Deviation 120 hours	19	1.58	

Table 34 shows Wrist ROM Radial Deviation of Group A , when comparing Wrist ROM Radial Deviation pre intervention and after 24 hours the p value is 0.004, when comparing Wrist ROM Radial Deviation after 24 hours and after 48 hours the p value is 1.000 when comparing Wrist ROM Radial Deviation after 48 hours and 72 hours the p value is 0.017 when comparing Wrist ROM Radial Deviation after 72 hours and 96 the p value is 0.016 when comparing Wrist ROM Radial Deviation after 96 hours and 120 hours the p value is 0.317 when comparing Wrist ROM Radial Deviation pre intervention and after 120 hours the p value is 0.045

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Table: 29 Group B Wrist ROM Radial Deviations

	Mean	Std. Deviation	p-value
Wrist ROM Radial Deviation Pre-Intervention	11	0.96	0.004
Wrist ROM Radial Deviation 24 hours	15	0.47	
Wrist ROM Radial Deviation 24 hours	15	0.47	0.317
Wrist ROM Radial Deviation 48 hours	15	0.56	
Wrist ROM Radial Deviation 48 hours	15	0.56	0.011
Wrist ROM Radial Deviation 72 hours	17	1.63	
Wrist ROM Radial Deviation 72 hours	17	1.63	0.005
Wrist ROM Radial Deviation 96 hours	19	0.96	
Wrist ROM Radial Deviation 96 hours	19	0.96	1.000
Wrist ROM Radial Deviation 120 hours	19	0.96	
Wrist ROM Radial Deviation Pre-Intervention	11	0.96	0.046
Wrist ROM Radial Deviation 120 hours	19	0.96	

Table 35 shows Wrist ROM Radial Deviation of Group B, when comparing Wrist ROM Radial Deviation pre intervention and after 24 hours the p value is 0.04, when comparing Wrist ROM Radial Deviation after 24 hours and after 48 hours the p value is 0.317 when comparing Wrist ROM Radial Deviation after 48 hours and 72 hours the p value is 0.011 when Comparing Wrist ROM Radial Deviation after 72 hours and 96 the p value is 0.005 when comparing Wrist ROM Radial Deviation after 96 hours and 120 hours the p value is 1.000 when comparing Wrist ROM Radial Deviation pre intervention and after 120 hours the p value is 0.046

Table: 30 Group A & B Wrist ROM Radial Deviations

		Mean	Std. Deviation	p-value
Wrist ROM Radial Deviation Pre-Intervention	Group A	10	1.58	0.529
	Group B	11	0.96	
Wrist ROM Radial Deviation 24 hours	Group A	14	2.25	1.000
	Group B	15	0.47	
Wrist ROM Radial Deviation 48 hours	Group A	14	2.25	0.739
	Group B	15	0.56	
Wrist ROM Radial Deviation 72 hours	Group A	16	2.78	0.786
	Group B	17	1.63	
Wrist ROM Radial Deviation 96 hours	Group A	19	2.21	0.529
	Group B	19	0.96	
Wrist ROM Radial Deviation 120 hours	Group A	19	1.58	0.529
	Group B	19	0.96	

Table 36 values of Group A and Group B showing Wrist ROM Radial Deviation. Comparing mean ±S.D of groups after 24 hours, 48 hours, 72 hours.96 hours and 120 hours respectively

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Table: 31 Group A Wrist ROM Ulnar Deviation

	Mean	Std. Deviation	P value
Wrist ROM Ulnar Deviation Pre-Intervention	12	1.58	0.005
Wrist ROM Ulnar Deviation 24 hours	17	2.44	
Wrist ROM Ulnar Deviation 24 hours	17	2.44	0.317
Wrist ROM Ulnar Deviation 48 hours	17	2.50	
Wrist ROM Ulnar Deviation 48 hours	17	2.50	0.004
Wrist ROM Ulnar Deviation 72 hours	21	2.98	
Wrist ROM Ulnar Deviation 72 hours	21	2.98	0.023
Wrist ROM Ulnar Deviation 96 hours	23	2.57	
Wrist ROM Ulnar Deviation 96 hours	23	2.57	0.180
Wrist ROM Ulnar Deviation 120 hours	24	1.58	
Wrist ROM Ulnar Deviation Pre-Intervention	12	1.58	0.020
Wrist ROM Ulnar Deviation 120 hours	24	1.58	

Table 37 shows Wrist ROM Ulnar Deviation of Group A , when comparing Wrist ROM Ulnar Deviation pre intervention and after 24 hours the p value is 0.005, when comparing Wrist ROM Ulnar Deviation after 24 hours and after 48 hours the p value is 0.317 when comparing Wrist ROM Ulnar Deviation after 48 hours and 72 hours the p value is 0.004 when comparing Wrist ROM Ulnar Deviation after 72 hours and 96 the p value is 0.023 when comparing Wrist ROM Ulnar Deviation after 96 hours and 120 hours the p value is 0.180 when comparing Wrist ROM Ulnar Deviation pre intervention and after 120 hours the p value is 0.020

Table: 32 Group B Wrist ROM Ulnar Deviation

	Mean	Std. Deviation	P value
Wrist ROM Ulnar Deviation Pre-Intervention	14	0.67	0.004
Wrist ROM Ulnar Deviation 24 hours	18	1.49	
Wrist ROM Ulnar Deviation 24 hours	18	1.49	1.000
Wrist ROM Ulnar Deviation 48 hours	18	1.49	
Wrist ROM Ulnar Deviation 48 hours	18	1.49	0.004
Wrist ROM Ulnar Deviation 72 hours	21	2.09	
Wrist ROM Ulnar Deviation 72 hours	21	2.09	0.009
Wrist ROM Ulnar Deviation 96 hours	24	1.25	
Wrist ROM Ulnar Deviation 96 hours	24	1.25	0.180
Wrist ROM Ulnar Deviation 120 hours	24	0.67	
Wrist ROM Ulnar Deviation Pre-Intervention	14	0.67	0.026

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Wrist ROM Ulnar Deviation 120 hours	24	0.67	

Table 38 shows Wrist ROM Ulnar Deviation of Group B , when comparing Wrist ROM Ulnar Deviation pre intervention and after 24 hours the p value is 0.004, when comparing Wrist ROM Ulnar Deviation after 24 hours and after 48 hours the p value is 1.000 when comparing Wrist ROM Ulnar Deviation after 48 hours and 72 hours the p value is 0.004 when comparing Wrist ROM Ulnar Deviation after 72 hours and 96 the p value is 0.009 when comparing Wrist ROM Ulnar Deviation after 96 hours and 120 hours the p value is 0.180 when comparing Wrist ROM Ulnar Deviation pre intervention and after 120 hours the p value is 0.026

Table: 33 Group A & B Wrist ROM Ulnar Deviation

		Mean	Std. Deviation	p-value
Wrist ROM Ulnar Deviation Pre-Intervention	Group A	12	1.58	0.796
	Group B	14	0.67	
Wrist ROM Ulnar Deviation 24 hours	Group A	17	2.44	0.280
	Group B	18	1.49	
Wrist ROM Ulnar Deviation 48 hours	Group A	17	2.50	0.631
	Group B	18	1.49	
Wrist ROM Ulnar Deviation 72 hours	Group A	21	2.98	0.853
	Group B	21	2.09	
Wrist ROM Ulnar Deviation 96 hours	Group A	23	2.57	0.912
	Group B	24	1.25	
Wrist ROM Ulnar Deviation 120 hours	Group A	24	1.58	0.796
	Group B	24	0.67	

Table 39 values of Group A and Group B showing Wrist ROM Ulnar Deviation. Comparing mean ±S.D of groups after 24 hours, 48 hours, 72 hours. 96 hours and 120 hours respectively

4. DISCUSSION

The results of this study shows that Group-A (Passive Stretching) and Group-B (Active Stretching) had pain before intervention. After intervention pain was noted in different hours and decreases gradually in both groups. There was significance change in pain was noted in both groups. Both active and passive stretching group had same effects.

A study conducted by Baxter C et al in 2017 which shows that post-test static stretching techniques did not reduce DMS neither pulls immediately. Afterwards the pain was temporarily relieved and there was no general reduction in pain during the three-day post-tuxer period. Serum creatine kinase levels - commonly used for muscle damage were increased after exercise and thigh muscle strength was reduced. Pulling had no effect on these reactions. These results contradict claims of static stretching benefits for exercise-affected DMS. (47)

Another Study conducted by BehmDG et al in 2017, found that passive stretching did not have a significant effect on muscle pain, muscle strength, indicating that passive stretching after eccentric exercise could not prevent secondary pathological changes. (48)

The results of this study shows that Group-A (Passive Stretching) had 145 degree shoulder flexion and Group-B (Active Stretching) had 145 degree shoulder flexion before intervention. After intervention shoulder flexion increases between 24 , 72 ,96 and 120 hours. There was a significance change in shoulder Flexion was noted in both groups. Both active and passive stretching group had s effects. The results of this study shows

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that Group-A (Passive Stretching) had 43 degree shoulder extension and Group-B (Active Stretching) had 50 degree shoulder extension before intervention. After intervention shoulder extension, decreases between 24 to 72 hours and then increases from 96 to 120 hours. At 72 hours Passive stretching group shows significant increase in extension as compare to active stretching group with p-value 0.035. At 96 hours Passive stretching group again shows significant increase in extension as compare to active stretching group with p-value 0.029. There was no significance change in shoulder extension was noted in both groups at 120 hours.

The study showed significant improvement in IR ROM by including passive stretching literature, with active dynamic stretching and active static stretching groups showing significant improvement in ER and HA ROMs on dominant sides. (49)

The results of this study shows that Group-A (Passive Stretching) had 161 degree shoulder abduction and Group-B (Active Stretching) had 167 degree shoulder abduction before intervention. After intervention shoulder abduction, decreases between 24 to 72 hours and then increases from 96 to 120 hours. There was no significance change in shoulder abduction was noted in both groups. Both active and passive stretching group had same effects.

The study showed that the improvement in passive horizontal abduction and IR ROM was significantly higher in the passive stretcher group than in the active drag group (P <.001). (50)

The results of this study shows that Group-A (Passive Stretching) had 59 degree shoulder internal rotation and Group-B (Active Stretching) had 68 degree shoulder internal rotation before intervention. After intervention shoulder internal rotation, decreases between 24 to 72 hours and then increases from 96 to 120 hours. At 24 hours Passive stretching group shows significant increase in internal rotation as compare to active stretching group with p-value 0.052. At 48 hours Passive stretching group again shows significant increase in internal rotation as compare to active stretching group with p-value 0.052. At 72 hours Passive stretching group again shows significant increase in internal rotation as compare to active stretching group with p-value 0.043. There was no significance change in shoulder extension was noted in both groups at 96 and 120 hours. The results of this study shows that Group-A (Passive Stretching) had 63 degree shoulder external rotation and Group-B (Active Stretching) had 73 degree shoulder external rotation before intervention. After intervention shoulder external rotation, decreases between 24 to 72 hours and then increases from 96 to 120 hours. There was no significance change in shoulder external rotation was noted in both groups.

A study conducted by Brownstein J in 2015 which shows that passive stretching increased internal rotation as compare to active stretching. This complies with the findings of the study. (51)

The results of this study shows that Group-A (Passive Stretching) had 125 degree elbow flexion and Group-B (Active Stretching) had 137 degree elbow flexion before intervention. After intervention elbow flexion, decreases between 24 to 72 hours and then increases from 96 to 120 hours. At 24 hours Passive stretching group shows significant increase in flexion as compare to active stretching group with p-value 0.043. At 48 hours Passive stretching group again shows significant increase in flexion as compare to active stretching group with p-value 0.043. At 72 hours Passive stretching group again shows significant increase in flexion as compare to active stretching group with p-value 0.023. There was significance change in shoulder flexion was noted in both groups at 120 hours with p-value 0.035.

The results of this study shows that Group-A (Passive Stretching) had 52 degree wrist flexion and Group-B (Active Stretching) had 66 degree wrist flexion before intervention. After intervention elbow flexion, decreases between 24 to 72 hours and then increases from 96 to 120 hours. At 24 hours Passive stretching group shows significant increase in flexion as compare to active stretching group with p-value 0.000. At 48 hours Passive stretching group again shows significant increase in flexion as compare to active stretching group with p-value 0.000. At 72 hours Passive stretching group again shows significant increase in flexion as compare to active stretching group

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with p-value 0.001. At 92 hours Passive stretching group again shows significant increase in flexion as compare to active stretching group with p-value 0.002. At 120 hours Passive stretching group again shows significant increase in flexion as compare to active stretching group with p-value 0.005. The results of this study shows that Group-A (Passive Stretching) had 47 degree wrist extension and Group-B (Active Stretching) had 58 degree wrist extension before intervention. After intervention elbow extension, decreases between 24 to 72 hours and then increases from 96 to 120 hours. At 24 hours Passive stretching group shows significant increase in extension as compare to active stretching group with p-value 0.004. At 48 hours Passive stretching group again shows significant increase in extension as compare to active stretching group with p-value 0.004. At 72 hours Passive stretching group again shows significant increase in extension as compare to active stretching group with p-value 0.005. At 92 hours Passive stretching group again shows significant increase in extension as compare to active stretching group with p-value 0.035. At 120 hours Passive stretching group again shows significant increase in extension as compare to active stretching group with p-value 0.0052.

Studies suggest that stretching exercise may reduce muscle spasms and improve circulation, which in turn reduces the concentration of metabolites, according to another study. There has been a significant improvement in the ROM of wrist flexion and wrist extension, and this is the group of hand prep who did stretching exercises and showed that stretching exercises are more beneficial in managing wrist pain and wrist room.(52)

CONCLUSION

This study concluded that both active and passive stretching methods showed no significant effects in delayed onset muscle soreness. But passive stretching showed significant improvement in delayed onset muscle soreness as compare to active stretching,

5.1Limitations

The limitations of the study were that large representative group of participants could not be included due to availability of limited gym members, which could lead to bias in results. Only male participants were included in the study which could affect the results as males and females have different physical statures. Sample size also decreased due to COVID-19 pandemic impediments

5.2 Recommendations

Future recommendations include use of diverse more valid and reliable tests for measuring the effect of active and passive static stretching in delayed onset muscle soreness of recreational body builders.. Athletes of both genders should be considered for future research to get a better understanding of effects of active and passive static stretching in delayed onset muscle soreness.

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4.An Evidence-Based Approach for Choosing Post-exercise Retrieval Techniques to Reduce Markers of Muscle Damage, Soreness, Fatigue, and Inflammation: A Systematic Review With Meta-Analysis

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19.The Effects of Proprioceptive Neuromuscular Facilitation Stretching on Post-Exercise Delayed onset muscle soreness in Young Adults
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36.A prophylactic effect of proprioceptive neuromuscular facilitation (PNF) stretching on symptoms of muscle damage persuaded by eccentric exercise of the wrist extensors Peanchai Khamwong, Ubon Pirunsan, Aatit Paungmali*
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