International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

# Effect of Graded Repetitive Arm Supplementary Protocol and Stretch Break Protocol on Pain, Grip Strength and Quality of Life among Handloom Weavers

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**Abstract:** ***Handloom weaving is a traditional occupation in Tamil Nadu involving prolonged and repetitive upper-limb movements, increasing the risk of work-related musculoskeletal disorders, pain, reduced grip strength, and impaired quality of life. This study aimed to determine the effect of a Graded Repetitive Arm Supplementary Program (GRASP) and Stretch Break Protocol (SBP), along with conventional exercises, on pain, grip strength, and quality of life among handloom weavers. Twenty handloom weavers aged 35 - 45 years meeting the eligibility criteria were selected and divided equally into Group A and Group B. Group A received GRASP, SBP, and conventional exercises, while Group B received SBP and conventional exercises for 4 weeks, 5 days per week, with each session lasting 60 minutes. Pain, grip strength, and functional status were assessed using the Numeric Pain Rating Scale (NPRS), handheld dynamometer, and QuickDASH questionnaire, respectively. Significant improvements were observed in pain, grip strength, and functional status, with t-values of 2.3867, 4.140, and 3.7490, respectively ($p < 0.05$). The findings suggest that the combined intervention may improve musculoskeletal health and functional quality of life among handloom weavers.***

**Keywords:** Occupational Diseases; Musculoskeletal Diseases; Pain; Muscle Strength; Quality of Life

## 1. Introduction

The textile industry is an important contributor to the Indian economy and provides employment to a large population. Among its traditional sectors, handloom weaving is one of the oldest occupations, particularly in rural communities where many people depend on it for their livelihood [1]. Tamil Nadu is one of the major handloom-producing states in India, with nearly 2.43 lakh handloom workers reported in the Fourth All India Handloom Census [2]. Despite its economic and cultural importance, handloom weaving involves prolonged working hours, repetitive movements, traditional techniques, and poorly designed workstations, which can increase the risk of occupational health problems, particularly musculoskeletal disorders (MSDs) [3].

Weaving requires continuous and repetitive movements of the upper and lower limbs for operating pedals, handling shuttles, and maintaining loom activity. Repeated arm, wrist, and hand movements place sustained stress on muscles, tendons, and nerves, increasing the risk of cumulative trauma disorders and repetitive strain injuries (RSI) [3,4]. Previous studies have reported an association between repetitive work, years of weaving experience, and increased pain among handloom workers [5]. The hand is one of the most commonly affected regions, with approximately 64.11% of weavers reporting hand pain or discomfort, followed by the lower back, ankle, shoulder, knee, wrist, arm, and upper back [3]. Continuous gripping and repetitive wrist movements may contribute to pain, stiffness, weakness, tendinopathies, and nerve irritation, which can ultimately reduce work efficiency and quality of life [5,8].

Management of work-related musculoskeletal disorders generally aims to relieve symptoms and restore function. Medical management may include medications, supportive braces, and other interventions, while severe cases may require surgical procedures [4]. Physiotherapy plays an important role in long-term functional recovery through stretching, strengthening, mobility exercises, manual therapy, pain-relieving modalities, ergonomic education, posture correction, workplace modification, and scheduled stretch breaks [7,12]. In the present study, the Graded Repetitive Arm Supplementary Program (GRASP), Stretch Break Protocol (SBP), and conventional exercises are used to address pain, grip strength, and quality of life among handloom weavers with repetitive strain injury. GRASP is a structured exercise program incorporating graded strengthening, stretching, range-of-motion, coordination, and functional activities to improve upper-limb performance [13]. SBP involves brief stretching exercises during work intervals, targeting the wrist, forearm, shoulder, and upper-back muscles to reduce muscular tension and fatigue associated with repetitive work [14,15].

Pain, grip strength, and quality of life are important indicators of functional health in handloom workers. Pain may reduce endurance, alter movement patterns, and interfere with occupational performance. The Numerical Pain Rating Scale (NPRS) is a simple and reliable tool commonly used to assess pain intensity and changes following rehabilitation [10,16,22]. Grip strength is essential for effective shuttle handling and loom operation and can be assessed reliably using a handheld dynamometer [20]. Reduced grip strength may occur due to pain and muscle fatigue in workers with repetitive strain injury [7]. Quality of life may also be affected by persistent pain, fatigue, reduced work capacity, and psychological stress. The Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) questionnaire is a reliable measure used to assess upper-limb functional limitations and work-related disability [11]. Therefore, combining GRASP and SBP with conventional exercises may help reduce pain, improve grip strength, and enhance functional quality of life among handloom weavers.

## 2. Literature Survey

Handloom weaving is associated with prolonged static postures, repetitive movements of the hand and forearm, and sustained muscular activity, which may contribute to work-related musculoskeletal disorders (WMSDs). Previous literature reported musculoskeletal discomfort among handloom workers involving multiple body regions, with the wrist, hand, arm, shoulder, back and lower limb commonly affected. Repetitive wrist and hand movements and prolonged gripping have also been associated with pain, stiffness, weakness and reduced occupational efficiency among workers involved in repetitive manual activities [3,5,7,8].

Physiotherapy management of work-related musculoskeletal problems commonly focuses on reducing pain, improving joint mobility, increasing muscle strength and endurance, and preventing recurrence. Stretching and strengthening exercises targeting the wrist, forearm, hand and shoulder musculature, together with ergonomic education and workplace modification, have been reported as important components of management [7,10,12]. Evidence from handloom settings also indicates that structured physiotherapy interventions can improve muscle strength, flexibility and posture, thereby contributing to improved occupational health [23].

Workplace stretching and scheduled breaks have been investigated as practical strategies for managing musculoskeletal symptoms associated with repetitive occupational activities. Durlov et al. reported that a modified work–rest schedule among handloom weavers reduced perceived exertion, energy expenditure, cardiovascular strain and mental fatigue [16]. Luik et al. reported that workplace stretching exercises reduced musculoskeletal complaints among traditional weaving workers and recommended their incorporation during work breaks [20]. Similarly, Vitolas et al. reported that active micro-breaks incorporating stretching, strengthening and ergonomic interventions were beneficial in reducing pain and fatigue among workers. However, Da Costa et al. indicated that although stretching may reduce work-related discomfort, further high-quality controlled studies are required to establish its preventive effectiveness [15,18].

The Graded Repetitive Arm Supplementary Program (GRASP) is a structured, graded and repetitive upper-limb exercise program incorporating strengthening, range-of-motion and functional activities. Harris et al. demonstrated that GRASP improved upper-limb function and grip strength in individuals undergoing stroke rehabilitation [13]. Klempel et al. reported that GRASP-based interventions were associated with improvements in upper-limb motor function, grip strength, dexterity and functional arm use. Grealy et al. further reported improvements in movement quality, arm function, self-efficacy and quality of life following GRASP intervention. Although these studies primarily involved neurological populations, the graded and repetitive nature of the program provides a potential basis for application to individuals engaged in repetitive manual occupations.

Grip strength is an important functional indicator in workers exposed to repetitive hand and forearm activity. Reduced grip strength may occur due to muscle fatigue and pain-related inhibition in individuals with repetitive strain conditions [7]. Hand-grip dynamometry has been identified as a useful clinical measure of muscle strength [9]. Similarly, pain is an important determinant of functional capacity, as persistent upper-limb pain may contribute to fatigue, reduced endurance and limitations in occupational activities. The Numerical Pain Rating Scale (NPRS) is used in the assessment of pain intensity [10,22]. Functional limitations associated with upper-limb musculoskeletal disorders can also affect quality of life. The Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) questionnaire provides a practical patient-reported measure for assessing upper-extremity functional limitations and work-related difficulties [11].

Overall, the literature available in the present study indicates that handloom weaving is associated with repetitive occupational loading and musculoskeletal symptoms, while exercise, workplace stretching and structured work–rest strategies may provide beneficial effects. GRASP has demonstrated benefits for upper-limb function and grip strength, particularly in neurological rehabilitation, whereas stretch-break interventions have shown potential for reducing occupational discomfort and fatigue. However, within the literature reviewed in the present study, there is limited evidence evaluating the combined application of GRASP and Stretch Break Protocol (SBP), along with conventional exercise, specifically among handloom weavers. Therefore, the present study was undertaken to determine the effect of GRASP and SBP along with conventional exercise on pain, grip strength and quality of life among handloom weavers.

## 3. Methodology

### 1) Study Design

The study was Pre – test and Post – test Experimental study design.

### 2) Study Setting

The study was conducted in the K.G. College of Physiotherapy, Outpatient Department, Saravanampatti, Coimbatore.

### 3) Study Duration
This study was conducted for a period of 6 months, everyone received training for 4 weeks, 5 days per week, and 60 minutes per session.

### 4) Study Sampling
Individuals were selected based on convenient sampling.

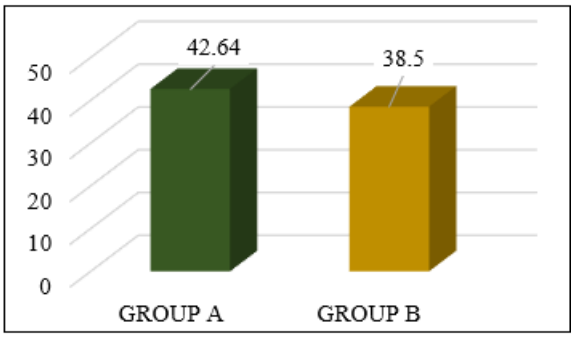
### Criteria For Selection

### Inclusion Criteria
- Males are included
- Age group between 35 - 45 years
- Individuals engaged in handloom weaving for a minimum duration of > 5 years
- Presence of work - related upper limb pain for more than 6 months with intensity > 4 (NPRS)
- Reduction in hand grip strength compared with age and sex matched normative values measured using a handheld dynamometer.
- Difficulty in performing daily activities related to hand function.
- Willingness to participate in the program

### Exclusion Criteria
- Acute trauma or injury to upper limb within the past 6 months
- Presence of neurological conditions such as stroke, peripheral neuropathy, cervical radiculopathy
- Recent surgeries of upper limb (within 6 months)
- Any visual or communication limitations affecting the program
- Diagnosed with any inflammatory conditions like rheumatoid arthritis, severe osteoarthritis
- Uncontrolled diabetes mellitus

### Outcome Measures
- Numerical pain rating scale (NPRS) - PAIN
- Handheld dynamometer - GRIP STRENGTH
- QuickDASH questionnaire - QUALITY OF LIFE

### Procedure for the Training Given to the Groups
A total 20 individuals who fulfil inclusion criteria were taken and randomly assigned equally into two Groups A and B of n=10 in each. **Group A** receives Graded Repetitive Arm Supplementary Program (GRASP) and Stretch Break Protocol (SBP) along with the conventional exercises. **Group B** receives Stretch Break Protocol (SBP) and Conventional exercises. Total duration of the session was 60 minutes in a day, 5 days per week for 4 weeks. Post-test evaluation was done using the outcome measures and the results were calculated using statistical analysis.




### Ethical Concern
The study was approved by the Institutional Ethics Committee of K.G. College of Physiotherapy, Coimbatore.

## 4. Results

**Table I:** Numerical Pain Rating Scale (NPRS) Unpaired 't' Test – NPRS of Group A Vs B (Post – Test Values)

| S.NO | DBP | Mean | Mean Difference | Standard Deviation | 't' Value |
|---|---|---|---|---|---|
| 1. | Group A | 3.1 | 1.0 | 1.10 | 2.3867 |
| 2. | Group B | 4.1 | | 0.74 | |

The table I shows an analysis of Numerical Pain Rating Scale (NPRS) of Group A and B. Using the Unpaired 't' test with 18 degrees of freedom and 0.05% as level of significance, The results shows that there was marked significant difference between post-test values of Group A and B.

**Table II:** Handheld Dynamometer (HHD) Unpaired 't' Test- Group A Vs Group B

| S. No | DBP | Mean | Mean Difference | Standard Deviation | 't' Value |
|---|---|---|---|---|---|
| 1. | Group A | 42.64 | 4.140 | 2.935 | 3.7068 |
| 2. | Group B | 38.5 | | 1.964 | |

The table II shows an analysis of Handheld Dynamometer of Group A and B. Using the Unpaired 't' test with 18 degrees of freedom and 0.05% as level of significance. The results shows that there was marked significant difference between post-test values of Group A and B.

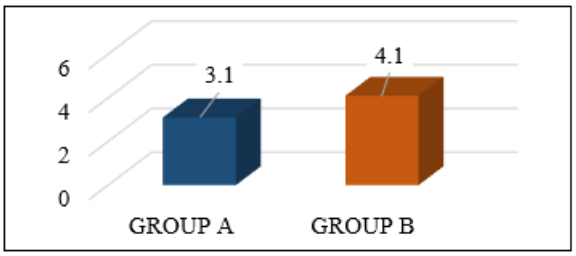
**Table III:** QuickDASH Questionnaire Unpaired 't' Test – Group A Vs Group B

| S. No | DBP | Mean | Mean Difference | Standard Deviation | 't' Value |
|---|---|---|---|---|---|
| 1. | Group A | 22.5 | 5.9 | 2.37 | 3.7490 |
| 2. | Group B | 28.4 | | 4.38 | |

The table III shows an analysis of QuickDASH Questionnaire of Group A and B. Using the Unpaired 't' test with 18 degrees of freedom and 0.05% as level of significance. The results shows that there was marked significant difference between post-test values of Group A and B.

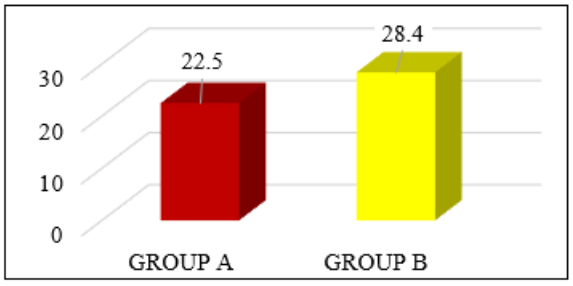
**Graphs**

**Graph - Inumerical Pain Rating Scale (NPRS)**
Unpaired 't' Test – NPRS of Group A Vs B




**Graph II**

**Handheld Dynamometer**
Unpaired 't' Test – Group A Vs Group B




**Graph III**

QuickDASH Questionnaire
Unpaired 't' Test – Group A Vs Group B

A Total of 20 handloom weavers are included in the study. The age group of individuals in the study are from 35 to 45 years males and are divided into 2 groups with each group consist of 10 handloom weavers.

On comparing the pre-test and post-test values of Group A and Group B, both groups showed improvement, Group A who GRASP and SBP Protocol showed significant improvement on NPRS, Handheld Dynamometer and QuickDASH questionnaire in Handloom weavers. This result rejects all null hypothesis and accepts the alternate hypothesis.

## 5. Discussion

Handloom weaving is an occupation that demands prolonged static postures, repetitive hand and forearm movements, and sustained low-load muscular activity for several hours each day. These biomechanical and ergonomic characteristics place substantial stress on the upper extremity, particularly the wrist, elbow, shoulder girdle, and upper back. Previous studies have consistently reported a high prevalence of work-related musculoskeletal disorders (WMSDs) among handloom weavers, with pain predominantly localized to the hand and wrist, accompanied by reduced grip performance and functional limitations [14].

The present study was designed to evaluate the combined effect of the Graded Repetitive Arm Supplementary Program (GRASP) and Stretch Break Protocol (SBP), along with conventional exercises, on pain intensity, grip strength, and quality of life among handloom weavers. A total of 20 participants aged between 35 and 45 years, who fulfilled the inclusion and exclusion criteria, were divided into two equal groups. Group A received GRASP combined with SBP and conventional exercises, whereas Group B received SBP along with conventional exercises alone. Outcomes were assessed using the

Numerical Pain Rating Scale (NPRS), handheld dynamometry for grip strength, and the QuickDASH questionnaire to evaluate upper limb-related disability and quality of life.

The effectiveness of GRASP can be explained through its influence on neuromuscular and cortical mechanisms. Repetitive reach, grasp, and manipulation tasks reinforce motor learning and promote cortical reorganization by repeatedly activating sensorimotor pathways responsible for fine hand movements. Increased cortical representation of hand muscles enhances voluntary control, coordination, and force production [13].

Regular exposure to graded resistance and task-specific practice facilitates hypertrophy of the forearm flexors and intrinsic hand muscles while improving neuromuscular activation patterns. The structured progression from simple to complex tasks minimizes compensatory strategies and promotes optimal muscle engagement, thereby enhancing grip force capacity and functional efficiency. These effects explain the significant improvements in grip strength observed in Group A participants [21].

The Stretch Break Protocol (SBP), widely used in occupational rehabilitation, complements GRASP by addressing the adverse effects of prolonged static postures and repetitive loading. SBP incorporates periodic stretching and scheduled breaks that induce viscoelastic changes in muscle-tendon units, reducing muscle stiffness and passive tension while increasing sarcomere length. These adaptations enhance tissue extensibility and decrease mechanical stress during repetitive tasks [22]. Furthermore, break-related restoration of circulation reduces intramuscular pressure, improves capillary perfusion, and facilitates oxygen delivery while enhancing the removal of inflammatory mediators accumulated during sustained work activity [22].

Improvements in quality of life observed in the present study can be attributed to both physiological and psychosocial factors. Reduction in pain intensity decreases activity limitation and improves participation in daily and occupational tasks. Enhanced grip strength directly improves functional independence and work efficiency, which is particularly relevant for handloom weavers whose productivity depends on sustained manual performance [23].

Conventional exercise programs, including stretching, strengthening, and ergonomic training, form the foundation of musculoskeletal rehabilitation. Stretching improves tissue extensibility and joint mobility, reducing muscle tightness and pain associated with repetitive tasks. Strengthening exercises targeting the forearm flexors, wrist extensors, and intrinsic hand muscles enhance force production and endurance, thereby improving grip strength and functional capacity. Ergonomic education further minimizes exposure to adverse postures, reducing cumulative mechanical stress [10].

In conclusion, the combined application of GRASP and SBP along with conventional exercises appears to be a

comprehensive and effective approach for reducing pain, improving grip strength, and enhancing quality of life among handloom weavers. By addressing neuromuscular control, muscle strength, circulation, and pain modulation simultaneously, this integrated intervention targets both the underlying pathophysiology and functional limitations associated with work-related musculoskeletal disorders in this population [14].

## 6. Conclusion

The purpose of this study is to find the effect of the GRASP program and SBP along with conventional exercise on pain, grip strength, and quality of life among handloom weavers. A total 20 subjects who fulfil inclusion criteria were taken and assigned equally into two Groups A and B. Both the Group have 10 handloom weavers.

**Group A** receives Graded Repetitive Arm Supplement Program (GRASP) and Stretch Break Protocol (SBP) along with conventional exercises. **Group B** receives Stretch Break Protocol (SBP) and Conventional exercises. Total duration of the session was 60 minutes in a day, 5 days per week for 4 weeks. Pre and Post-test evaluation was done using the outcome measures and the results were calculated using statistical analysis.

Pain was measured by the Numerical Pain Rating scale (NPRS), Grip was measured by the Handheld dynamometer and Quality of Life was analysed using the QuickDASH questionnaire. Both pre and post-test measures was obtained, by use of these measures within group analysis and between group analysis was done. The result was obtained based on the findings.

Hence, this study rejects the null hypothesis and accepts the alternative hypothesis. Therefore, suggests that there is a significant improvement in the group A who received GRASP and SBP rather than group B who received SBP and conventional exercises. This study concludes that Group A has an improved effect on the Pain, Grip strength and Quality of Life among Handloom weavers.

## 7. Future Scope

Based on the findings and limitations of the present study, future research may be undertaken with a larger sample size to improve the generalizability of the findings. Similar studies may include handloom weavers from different age groups and both male and female participants to determine whether the intervention produces comparable effects across different populations.

Further studies may evaluate the effectiveness of the Graded Repetitive Arm Supplementary Program (GRASP) and Stretch Break Protocol (SBP) among workers involved in other repetitive occupations associated with work-related musculoskeletal disorders. Future research may also investigate the effectiveness of these interventions for other occupational musculoskeletal problems, including low back pain.

Future studies may incorporate additional outcome measures to evaluate other aspects of occupational function and musculoskeletal health. Longer intervention periods and extended follow-up assessments may also be considered to determine the sustainability of the improvements achieved following the intervention.

Additionally, future research may consider occupational and lifestyle-related factors, including nutritional factors and activities performed during work breaks, which may influence treatment outcomes. These studies could provide further evidence regarding the applicability of GRASP and SBP as practical physiotherapy interventions for workers exposed to repetitive occupational activities.

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