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# Psychological Intervention for Pain Management Following Musculoskeletal Injury: A Comprehensive Review and Meta-Analysis

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# Abstract

## Introduction

Psychological therapies are beneficial in controlling pain, but there is still a significant information gap about the combined effects of various interventions, especially in managing pain related to the musculoskeletal system.

## Methodology

A risk of bias assessment was conducted using the Cochrane tool for the included studies. This entailed assessing the risk associated with allocation by considering factors such as data evaluation (participation and result assessment) and blinding (randomization and concealment).

## Results

Five studies on the impact of psychological-based therapies on managing musculoskeletal pain were thoroughly examined for the meta-analysis. A statistically significant effect was seen in the pooled data, and the standardized mean differences (SMDs) showed a substantial decrease in the intensity of musculoskeletal discomfort. Effective results were shown in both the fixed-effects and random-effects models, supporting the validity of the conclusions. However, the large degree of variability between the studies highlights the need for care in interpreting the findings. It raises the possibility of differences in the effects of psychological therapies across various groups and methodologies.

## Conclusion

The study highlighted the therapeutic value of psychological therapies for reducing pain related to the musculoskeletal system. These findings should be taken into account by researchers and clinicians when creating customized pain treatment plans.



## *Keywords*

*Cognitive Behavior Therapy, Injuries, Pain Management, Psychology.*

## Introduction

Pain is a common cause of discomfort, accounting for up to 40% of primary health-care visits in the general population[1]. Musculoskeletal, non-malignant pain (MSKP) is the most common cause for seeking medical assistance, with 55.7% of non-hospitalized patients experiencing MSKP during the past three months[2-3]. Chronic musculoskeletal pain, in particular, can negatively impact different parts of life, influencing sleep, daily activities, work capability, and social relationships, lowering overall quality of life[4-5]. The socioeconomic impact of MSK pain is significant, accounting for up to 40% and almost 50% of physician visits in Europe and the United States, respectively. Furthermore, MSK pain has a substantial social cost, reaching up to $635 billion each year in the United States, surpassing the total expenditures of heart disease, cancer, and diabetes[6-7]. Psychological therapies for chronic pain have a long history and have been used in scientifically validated multidisciplinary pain care programs for many decades[7]. These therapy techniques are critical in addressing the varied nature of chronic pain and provide significant tools for improving overall pain management. These therapies provide a substantial contribution to the overall care of people suffering from chronic pain by addressing psychological aspects such as cognitive processes, emotional reactions, and behavioral strategies[8-9]. Incorporating psychological strategies into pain care not only treats the physical components of discomfort but also seeks to promote mental well-being, coping mechanisms, and overall quality of life for people suffering from chronic pain[10]. Based on Frederickson's Broaden and Build theory of positive psychology, good emotions should widen people's thought-action repertoires, fostering psychological resilience over time[11-12]. Based on this principle, positive activity therapies aim to evoke pleasant feelings through simple and enjoyable activities. These therapies can potentially enhance pain outcomes by favorably influencing various pathways, including improved mental health, greater behavioral engagement, decreased catastrophizing, reduced fear avoidance, and increased social support[13-14]. Considering the possible influence of psychological treatments on pain management, comprehensive meta-analyses are essential to identifying the precise effects of various psychological therapies. This thorough research may provide insightful information on the efficacy of different therapies, opening the door to individualized care plans catered to specific groups and improving general pain management techniques. Although psychological therapies are beneficial

in controlling pain, there is still a significant information gap about the combined effects of various interventions, especially in managing pain related to the musculoskeletal system (MSK). Meta-analyses that methodically assess the combined effects of psychologically based therapies created especially for MSK pain are necessary to close this gap. This detailed study can offer a more thorough comprehension of how psychological therapies affect MSK pain and can help to develop evidence-based pain management plans.

## Methodology

### *Search Strategies*

Two independent reviewers conducted a comprehensive search of electronic databases, including "Google Scholar, Pedro, MEDLINE, Cochrane Library, EMBASE, and Web of Science", using MeSH phrases like "pain", "psychological therapy", and "musculoskeletal injury". Finding papers for a thorough review and meta-analysis evaluating the efficacy of psychological therapies in pain management for musculoskeletal injury was the goal.

### *Inclusion and Exclusion Criteria*

The inclusion criteria were centered on research that examined the impact of psychological interventions on pain outcomes in individuals with musculoskeletal injuries. By the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) criteria, the studies selected were to be carried out between 2015 and 2023 (Figure-1).

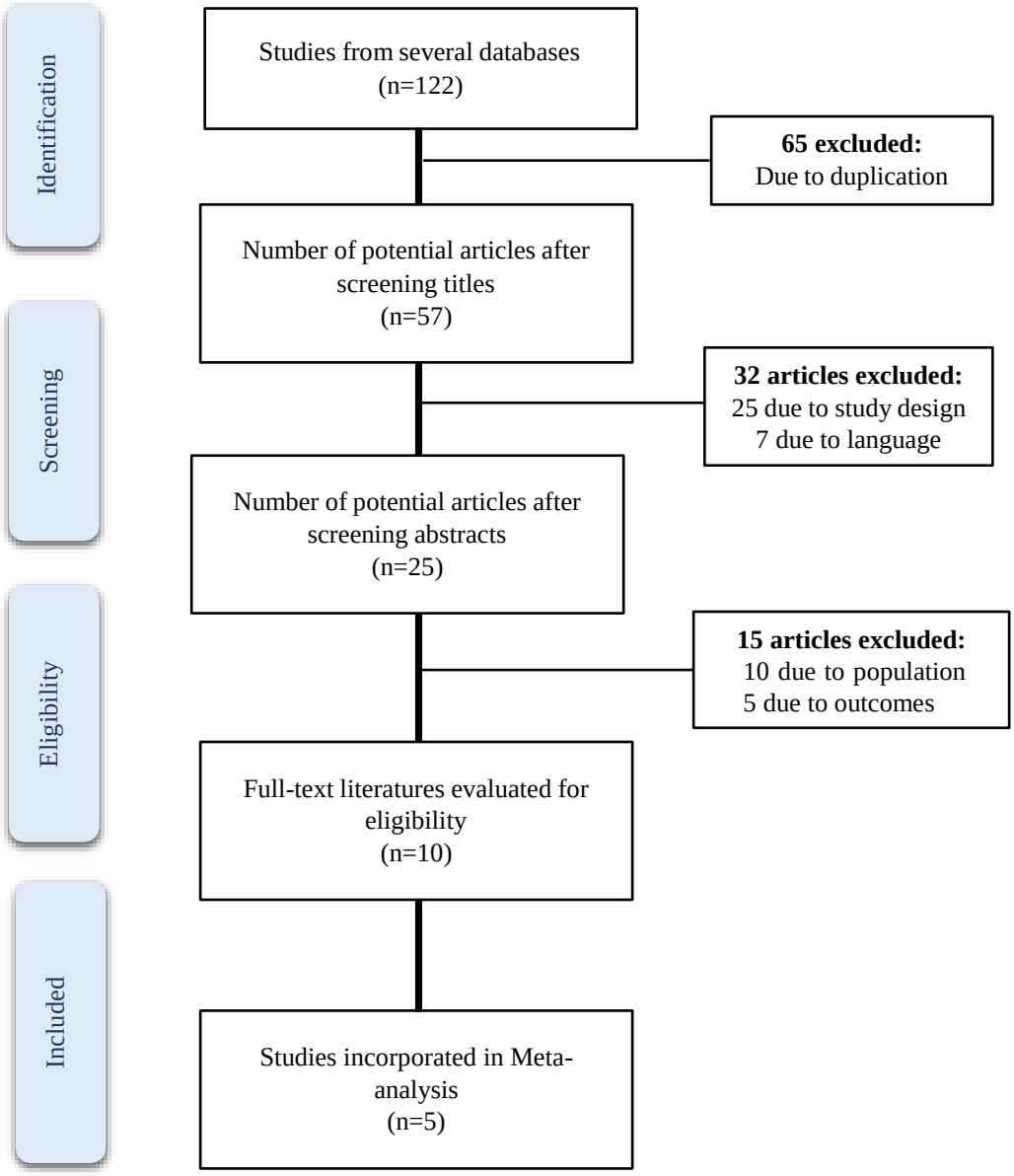


***Figure-1 Flow chart showing inclusion of studies based on PRISM guidelines***

Studies using therapies other than psychological management approaches published in English and studies that remained unreachable even after corresponding authors were contacted were all excluded from the review. To enable a thorough examination of the available studies, a standardized data extraction form was created to methodically collect data on author identities, publication years, participant demographics, and lengths of interventions (Table-1).

**Table-1 Description of studies included in the meta-analysis**

| Author' Year | Sample Size | Target Population | Study Design | Age in Years (Mean) | Intervention | | Outcome Measures |
|---|---|---|---|---|---|---|---|
| | | | | | Experimental Group | Control Group | |
| Shygan and Hosseini (2022)[16] | 66 | Acute and chronic pain | Quasi experimentation | 50.10 ± 10.63 years | Psychosocial skills training in pain management in acute pain | Conventional Therapy | VAS |
| Javdaneh et al. (2020)[17] | 72 | Neck pain and scapula | Randomized Controlled Trial | 29 ±5.09 years | Cognitive-Behavioral Therapy plus scapular exercise | Instructed home exercise program | VAS. |
| Westenberg et al. (2018)[18] | 125 | Upper extremity injury | Randomized Controlled Trial | 55±15 years | Mindfulness-based video exercises | Educational pamphlet | NRS |
| Brage et al. (2015)[19] | 15 | neck | Randomized Controlled Trial | 41.3±12.4 years | Pain education (acceptance of pain, coping strategies, and goal settings based upon pain, management and cognitive therapy) plus exercise (aerobic, neck, standing balance, eye-neck coordination, shoulder) | Pain education (same as above group) | VAS |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Alparslan et al. (2015)[20] | 37 | Fibromyalgia | Randomized Controlled Trial | 43.59± 10.30 years | Music therapy | Expressive writing | VAS |

*EG: Experimental group performed Scoliosis Specific Exercises*
*CG: Control Group performed either conventional exercises or no exercises*
*VAS: Visual Analogue Scale*
*NRS: Numeric Rating Scale*

### *Quantitative Analysis*

The statistical software MedCalc version 20.112 was utilized for quantitative analysis. Continuous measure analysis was used to ascertain the pooled effect based on the Standardized Mean Difference (SMD) at a 95% Confidence Interval (CI). Cohen's rule of thumb was used to estimate effect sizes, which were then divided into three categories: small (0.2 to 0.5), moderate (0.5 to 0.8), and large (more than 0.8). The $I^2$ value was used to measure the degree of heterogeneity and choose whether to apply a fixed effect model or a random effect model ($I^2$<50 for fixed effect and $I^2$>50 for random effect).

## Results

Initially, n=122 articles were identified through searches across six databases. Following title screening, n=57 articles remained for further evaluation. Upon abstract screening, n=25 studies were deemed relevant for full-text assessment. Ultimately, after applying inclusion criteria, n=5 studies were selected for inclusion in the study. The analysis encompassed a sample size of n=315 participants drawn from these five studies, wherein the impact of psychotherapy-based interventions on MSK pain management was investigated.

#### *Estimating the Pool Effects of Psychological Intervention on Pain Management*

Five studies on the impact of psychological-based therapies on managing MSK pain were thoroughly examined for the meta-analysis. A statistically significant effect was seen in the pooled data, and the SMDs showed a substantial decrease in the intensity of MSK discomfort. Significant results were shown in both the fixed-effects and random-effects models, supporting the validity of the conclusions. However, the large degree of variability between the studies highlights the need

for care in interpreting the findings. It raises the possibility of differences in the effects of psychological therapies across various groups and methodologies. The research results demonstrated the treatments' clinical importance, with effect sizes ranging from moderate to significant -0.845 (Fixed effect) and -1.003 (random effect), suggesting a difference in pain severity. The meta-analysis presents strong evidence in favor of the inclusion of psychological treatment in MSK pain management regimens, even accepting the existence of publication bias. In order to create more individualized and successful pain management strategies, clinicians and researchers should consider these findings when developing therapies and look into additional aspects that contribute to heterogeneity (Table-2, Figure-2).

**Table-2 Pool effect model determining the effect of psychological therapies on pain**

| Study | N1 | N2 | Total | SMD | SE | 95% CI | t | P | Weight (%) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Fixed | Random |
| **Shygan and Hosseini (2022)** | 33 | 33 | 66 | 0.189 | 0.244 | -0.298 to 0.676 | | | 31.69 | 20.39 |
| **Javdenah et al. (2020)** | 24 | 24 | 48 | 0.259 | 0.285 | -0.315 to 0.833 | | | 23.17 | 20.26 |
| **Westenberg et al. (2018)** | 64 | 62 | 126 | -3.810 | 0.298 | -4.400 to -3.220 | | | 21.17 | 20.21 |
| **Alparslan et al. (2015)** | 21 | 16 | 37 | -0.448 | 0.329 | -1.115 to 0.220 | | | 17.42 | 20.09 |
| **Brage et al. (2015)** | 7 | 8 | 15 | -1.230 | 0.536 | -2.388 to -0.0712 | | | 6.55 | 19.05 |
| **Total (fixed effects)** | 149 | 143 | 292 | -0.845 | 0.137 | -1.116 to -0.575 | -6.160 | <0.001 | 100.00 | 100.00 |
| **Total (random effects)** | 149 | 143 | 292 | -1.003 | 0.814 | -2.605 to 0.599 | -1.233 | 0.219 | 100.00 | 100.00 |

| **Test for Heterogeneity** | |
|---|---|
| **Q** | 133.7488 |
| **DF** | 4 |
| **Significance level** | P<0.0001 |
| **$I^2$ (inconsistency)** | 97.01% |
| **95% CI for $I^2$** | 95.06 to 98.19 |

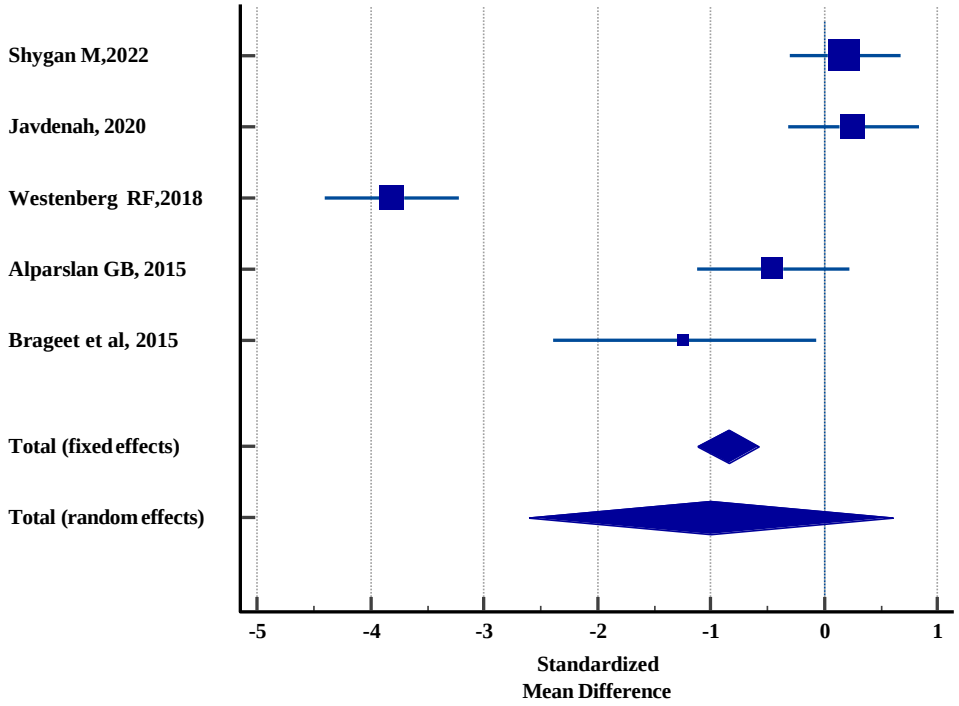


***Figure-2 Forest plot illustrating effects of psychological based intervention on pain management***

## *Quality Appraisal and Risk of Bias*

Author judgment of risk of bias assessment was illustrated in Table-3 based on Cochrane tool of bias assessment.

### *Random Sequence Generation*

The randomization sequence analysis suggested that three studies revealed low risk of bias[16,17,18] whereas for two studies random sequence generation were unknown[19, 20].

### *Allocation Concealment*

All studies under this parameter reveled low risk of bias as per author's judgment[16-20].

### *Blinding of Participants and Personnel*

Two Studies[16-17] considered the participants blinding whereas three studies[18-20] reflects high risk.

***Outcome Assessment Blinding***

Outcome assessment blinding were at low risk in all studies[16-20].

***Incomplete Outcome Data***

Three studies[16-18] showed low risk of bias while remaining represented unknown risk[19-20].

***Reporting Selection Bias***

All studies reflects low bias risk under this head bias[16-20].

**Table-3 Assessing Risk of Bias using a Cochrane Collaboration's Tool**

| Studies | Random Allocation | Allocation Concealment | Participants Blinding | Outcome Assessment Blinding | Incomplete Outcome Data | Selective Reporting |
|---|---|---|---|---|---|---|
| **Shygan and Hosseini (2022)[16]** | + | + | + | + | + | + |
| **Javdaneh et al. (2020)[17]** | + | + | + | + | + | + |
| **Westenberg et al. (2018)[18]** | + | + | - | + | + | + |
| **Brage et al. (2015)[19]** | ? | + | - | + | ? | + |
| **Alparslan et al. (2015)[20]** | ? | + | - | + | ? | + |

*−, bias at high risk*
*+, low risk bias*
*? , unknown risk of bias*

## Discussion

A total of 5 studies with 315 individuals were selected for the assessment of psychotherapy-based interventions in the management of MSK pain out of the 122 papers that the meta-analysis had originally found across six databases. A statistically significant overall impact was found in the analysis, and standardized mean differences showed a significant decrease in MSK pain. Both the random-effects and fixed-effects models provided evidence for the validity of the results. The moderate to high effect sizes reinforced the influence on lowering pain severity, demonstrating the clinical importance of psychological intervention in pain management. A study examined the impact of psychosocial skill training on patients' pain levels during acute and chronic musculoskeletal pain. A total of 64 individuals recruited by convenience sampling received group-based psychosocial training for one-hour sessions[16]. Using a numerical rating scale (NRS), data gathered at baseline, post-intervention, and a 3-month follow-up were analyzed. The findings revealed a noteworthy influence of time on pain intensity ($p<0.001$), implying a generally beneficial outcome of psychosocial training. The interaction between group and time showed significance ($p<0.001$), while the group impact on pain intensity was not statistically significant ($p=0.07$). Notably, early administration of psychosocial training was found to be more beneficial in treating individuals experiencing acute pain[16]. These results highlight the beneficial effects of psychosocial therapies in musculoskeletal pain reduction and give insightful information for medical professionals, particularly about treating acute pain in treating chronic neck discomfort with scapular downward rotation impairment, a single-blind, randomized controlled study was conducted to evaluate the efficacy of scapular exercises alone against a combination strategy of scapular exercises and cognitive functional therapy. Seventy-two individuals, ages 20 to 45, were divided into three groups for the study: those who received scapular exercise only, those who received scapular exercise together with cognitive functional therapy, and a control group. The therapies were given three times a week for six weeks, and the significant and secondary end measures were muscular activity, kinesiophobia, and pain severity[17]. The findings showed that pain intensity, kinesiophobia, and muscle activation at six weeks were statistically significantly better in the multimodal physiotherapy group (which included cognitive functional therapy) than in the scapular exercise alone group[17]. These results imply that a group-based rehabilitation

program that combines cognitive functional therapy and scapular exercises is more effective in treating different elements of chronic neck pain[17]. Compared to an attention placebo control, a 60-second personalized mindfulness-based video exercise improved pain intensity, anxiety symptoms, depression, and anger in patients with upper extremity injuries in orthopedic practices. Although the pain intensity changes found were insignificant enough to warrant a minimum clinically relevant difference (MCID), the short mindfulness-based video exercise demonstrated notable practicality and acceptance, indicating its potential use as a valuable tool in orthopaedic clinics[18]. The combined intervention group substantially reduced neck pain, according to research comparing pain education and specialized training to pain education alone for women with chronic neck pain.

Furthermore, improvement in the Global Perceived Effect, decreased sway length, improved neck extensor activity, and decreased sternocleidomastoid activity during the Cranio-Cervical Flexion Test were among the patterns observed. These results highlight the potential advantages of using specialized training and pain education to manage persistent neck pain[19]. In a randomized clinical trial involving individuals with fibromyalgia, the experimental group's exposure to a music CD with sounds of waves and water dramatically decreased their level of pain compared to the control group. According to the study, fibromyalgia patients may benefit from using music as a non-pharmacologic nursing intervention for pain management[20].

## Conclusion

The study highlighted the therapeutic value of psychological therapies for reducing pain related to the musculoskeletal system. These findings should be taken into account by researchers and clinicians when creating customized pain treatment plans. Subsequent research endeavors may delve into extraneous elements that contribute to heterogeneity and deeper into the particular pathways by which distinct psychological therapies influence musculoskeletal pain.

## Authors Contribution

**Raza Q:** Conception, design and data acquisition.

**Ayaz P:** Data acquisition and analysis, writing the article.

**Iqbal A:** Writing the article and final approval of article.

**Rafiq R:** Critical revision of the article and final approval of article.

## Declaration of Interest

None.

## Funding Sources

None.

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