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ISSN On-Line 2310-3883
ISSN Print 0038-2337

# Progressive muscle relaxation for pain and wellbeing of garment workers: A pre-test post-test study

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**KEYWORDS**
cognitive behavioral therapy, musculoskeletal pain, chronic pain, mental health, work place rehabilitation, good health and well-being, Visual Analogue Scale (VAS), Stellenbosch Mood Scale (STEMS), Patient Health Questionnaire-9 (PHQ-9)

**HOW TO CITE THIS ARTICLE**
Hoosain M., Dwayi S., Ganie A., Jacobs Z., Labuscagne D., Sokomani Y., Marais S, Plastow N.A. Progressive muscle relaxation for pain and wellbeing of garment workers: A pre-test post-test study. *South African Journal of Occupational Therapy.* Vol 56 No 2, August, 2026, pp 1 - 7.
DOI: https://doi.org/10.17159/2310-3833/2026/vol65no2a3

**ARTICLE HISTORY**
**Received:** 18 August 2025
**Reviewed round 1**: 27 August 2025
**Reviewed round 2**: 23 October 2025
**Revised:** 29 January 2026
**Accepted:** 30 January 2026
**First Online**: 15 July 2026

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**DATA AVAILABILITY**
Datasets are available from the corresponding author on reasonable request

**FUNDING**
This work was supported by a grant from Stellenbosch University ( Grant number RP-22-04-002), Faculty of Medicine and Health Sciences.

## ABSTRACT

**Background:** Musculoskeletal pain is common amongst garment workers due to awkward postures, and repetitive or forceful movements. Chronic pain can have a negative impact on the mental health and quality of life of workers, leading to a decrease in productivity. Progressive muscle relaxation (PMR) is a time efficient, cost-effective and simple technique that can be used by workers at their workstations to address musculoskeletal pain.
**Objective:** This study aimed to determine the immediate effect of PMR on the pain and well-being of garment workers with musculoskeletal pain.
**Methods:** A single-group pretest-posttest design was used. Data were collected in two sessions with the workers (n=24). During the first session, consent was obtained, eligibility was determined, and the Patient Health Questionnaire-9 (PHQ-9) was administered. During the second session, the pain Visual Analogue Scale (VAS) and Stellenbosch Mood Scale (STEMS) were administered before and immediately after the PMR intervention. The intervention was offered by final year occupational therapy students in Cape Town, South Africa.
**Results:** PHQ-9 scores showed more than half the participants (n=15) presented with symptoms of depression requiring monitoring or intervention. Pain VAS scores indicated that PMR substantially decreased musculoskeletal pain (m difference = 2.67, $p < .001$, Cohen's $d = 1.74$). The STEMS showed a moderate improvement in mental wellbeing immediately after the intervention (Cohen's d = 0.34 to 0.90).
**Conclusion:** PMR was effective at reducing musculoskeletal pain and improving the mood of garment workers with musculoskeletal pain. PMR is potentially a feasible intervention for workers to use while at their workstations in resource-constrained environments.

**Implications for Practice**

- A single session of PMR can be used to immediately improve musculoskeletal pain and wellbeing.
- PMR can be used on its own or in combination with other modalities.
- PMR scripts can be shortened, translated and recorded; and then shared with clients via WhatsApp so that they can use it themselves.
- This is an effective, low-resource, quick intervention that can be useful for workplaces where pain and mental distress are common.

## INTRODUCTION

Musculoskeletal pain and mental illness are prevalent issues among garment workers, due to the physical demands of their jobs, which involves prolonged postures, repetitive movements, and the use of vibrating tools in challenging work environments[1]. These workers, engaged in cutting, sewing, finishing, ironing and examining clothing or textiles, often experience chronic pain that negatively impacts their mental health, leading to depressive symptoms and sleep disruption[2]. Progressive muscle relaxation (PMR) has emerged as a promising, time-efficient and cost-effective intervention for alleviating muscle

tension, fatigue, blood pressure and anxiety[3]. By alternating between muscle tension and relaxation exercises, PMR fosters calmness, reduces pain and mitigates anxiety[3]. Given its simplicity and adaptability, PMR may be particularly well suited to high-pressured factory environments, enabling garment workers to practice it at their workstations for immediate relief.

Several occupational risk factors contribute to the high prevalence of musculoskeletal disorders among garment workers, including prolonged sitting or standing, repetitive motions and the use of vibrating tools[1]. Psychosocial risk factors such as excessive productivity demands, poor social support and low autonomy further exacerbate these conditions[4,5,6]. Research highlights alarmingly high rates of musculoskeletal symptoms in this workforce: 77.1% in a Bangladeshi clothing factory , compared to 26.3% in the general Bangladeshi population; and 69.94% in Indian garment workers[1,6,7]. Additionally, female garment workers involved in stitching duties experience persistent shoulder, wrist and hand pain at disproportionately high rates[8]. Poor living conditions, food insecurity, excessive workloads, and limited healthcare access among garment workers further compound their physical and mental health burdens[9]. There is a well-established link exists between chronic pain and depression[10-13]. A Canadian epidemiological study (n=118 533) found that depression rates increased alongside worsening lower back pain[14]. Similarly, cross-sectional studies have demonstrated strong associations between generalized pain, musculoskeletal disorders, and psychological distress, with pain intensifying perceptions of depression and reduced quality of life[15-17]. Research in South Africa and Uganda suggests that pain functions as a biological stressor, significantly contributing to depression[15].

Relaxation techniques, including PMR, have shown efficacy in reducing pain and anxiety in various populations, from burns patients to healthcare workers experiencing occupational stress[18-21]. PMR has demonstrated improvements in quality of life, lower back pain in pregnant women, fatigue, and mobility limitations due to osteoarthritis[22-24]. Originally developed by Edmund Jacobson in 1934[25], PMR involves systematically tensing and relaxing muscle groups, allowing individuals to recognize and experience deep relaxation[25]. A quasi-experimental study in Malaysia (n=352) found that PMR significantly reduced stress and anxiety among male factory workers over a nine-month period[26]. However, despite PMR's proven benefits, no studies have assessed its effectiveness as a workplace-based intervention for garment workers.

This study aims to evaluate the immediate effects of PMR on pain relief and overall well-being among garment workers. Specifically, it seeks to:

1. Describe the characteristics of garment workers presenting with musculoskeletal pain and assess the prevalence of depressive symptoms.
2. Determine the effect of PMR on pain using the Visual Analogue Scale (VAS).
3. Assess the impact of PMR on mental well-being using the Short-Term Evaluation of Mental States (STEMS).

By exploring PMR's potential in this setting, this study may inform future workplace interventions, supporting the integration of PMR as a practical and accessible strategy for improving garment workers' health.

## METHODS

This study used a pre-experimental single group pre-test post-test design. The Template for Intervention Description and Replication (TIDieR) guidelines were used in the reporting of this study[27]. No changes were made to the study protocol once the study commenced. The study protocol was not registered.

### Participants

Garment workers were recruited from a clothing factory in Cape Town, South Africa, that employs approximately 2500 people. Recruitment procedures included posters, pamphlets, meetings with factory management, a sign-up sheet at the on-site occupational health clinic, direct invitation and word of mouth. Inclusion criteria were as follows: 1) presence of musculoskeletal pain within the past seven days, 2) being 18 years of age or older, 3) capable of understanding instructions and providing consent in English, Afrikaans or isiXhosa, and 4) currently employed at the clothing factory during the data collection period (i.e. not on leave). Exclusion criteria comprised contraindications for PMR, including 1) hypertension[28], 2) cardiac conditions such as arrhythmia, peripheral artery disease, coronary heart disease, cardiomyopathy[29], 3) pregnancy[30], 4) dystonia[31], and 5) anyone unable to exercise because of illness or disability (e.g. severe low-back pain)[32]. Based on other studies using the VAS and STEMS[33,34], statistical power of 0.80, significance level of 0.05 and effect size of 0.60, a required sample size of 24 participants was calculated.

### Intervention

The intervention, PMR, was a pre-recorded progressive muscle relaxation session prepared by an occupational therapist. The aim of the intervention was to reduce the musculoskeletal pain and improve the mental well-being of the garment workers in a clothing factory in Cape Town. The materials needed included a script to explain the nature of the intervention, a pre-recorded audio-clip in three languages (English, Afrikaans and isiXhosa), a device to play the recording, a comfortable chair, and a quiet room at the occupational health clinic in the factory. The PMR script was adapted from Payne's handbook of relaxation techniques, 4th edition[35] by reducing the typical intervention time for PMR from 30 minutes to 20 minutes, simplifying the English version to match the education level of the garment workers (e.g. by reducing jargon), and translating the script to Afrikaans and isiXhosa.

At their pre-allocated appointment time, participants came to the consultation rooms within the occupational health centre at the factory. Participants sat in a comfortable chair, and the PMR was explained to them. After completing the pre-test measures, participants closed their eyes and followed the recorded instructions to facilitate progressive muscle relaxation. At the end of the relaxation recording, participants were gently brought back to reality and then completed the post-test measures. The intervention was delivered to each participant once during a single 30-minute session. Of these 30 minutes, 5 minutes were allocated to data collection for the before and after measures, and 20 minutes were allocated for the intervention itself. The intervention was tailored for individual participants by offering a choice in the language of administration. Each PMR intervention was delivered by one of five final year occupational therapy students. Students had received three hours of classroom-based training on the use of relaxation techniques, and some had used relaxation with other clients during their occupational therapy fieldwork. They were supervised by a lecturer with 10 years' experience working at the clothing factory and in the field of work rehabilitation, and an associate professor with 20 years' experience in mental health. Their performance was monitored by both their research supervisors as well as a clinical supervisor for six hours per week. The researchers planned to maintain intervention fidelity by using a pre-rehearsed script in English, Afrikaans and isiXhosa to explain PMR to participants, having pre-recorded PMR sessions available in all three of the above-mentioned languages, and practicing the tone of voice that will be used when interacting with all participants. Intervention fidelity was maintained throughout.

### Outcomes

During the intake interview, participants completed a demographic questionnaire and the Patient Health Questionnaire – 9 (PHQ-9). The PHQ-9 is a nine-item self-reported measure of major depressive disorder[36,37] that has previously been used in South Africa[38], and with diverse groups of people[39]. Each of the 9 items is scored on a three-point scale ranging from 0 to 3, with a total maximum score of 27.

Higher scores indicate higher levels of depression. Scores are interpreted as indicative of no-minimal depressive symptoms (0-4), mild (5-9), moderate (10-14), moderately severe (15-19) and severe (20-27). A validation study (n=397) conducted in a public healthcare clinic in Johannesburg, South Africa found the PHQ-9 demonstrated high levels of accuracy in classifying major depressive episodes, and demonstrated moderate levels of sensitivity as well as specificity within the population under study[38].

Two pre-test post-test measures were used to assess the immediate effect of the PMR intervention. The Visual Analogue Scale (VAS) is a self-report measure of pain that consists of a 10cm line with perpendicular endpoints indicating the extreme limits of pain intensity. These anchor points were orientated horizontally from left to right, with 0 indicating "no pain" and 10 indicating "worst pain ever". The VAS is the best method for subjectively measuring pain and is a reliable outcome for measuring pain and tracking pain relief. Participants were asked to place a mark on the 10cm line representing their current level of pain[40]. Scoring was done by measuring (in mm) the distance between 0 (no pain) and the mark that the participant had made on the line[41]. The four levels of pain intensity included no pain (0-4mm), mild (5mm – 44mm), moderate (45mm – 74mm), and severe (75mm – 100mm)[40].

The second pre-test post-test measure was the Stellenbosch Mood Scale (STEMS). The STEMS[42] is dual-language version of the Brunel Mood scale (BRUMS)[43]. It is a 24-item self-report measure of a person's current emotional state in the six domains of Tension, Anger, Confusion, Depression, Fatigue and Vigour. Each item is scored on a 5-point rating scale (ranging from 0 to 4)[44]. This measure is available in both English and Afrikaans, which are two of the three most common languages spoken in the Western Cape of South Africa. The measure is quick to administer (3 minutes)[42]. The BRUMS has demonstrated good internal consistency, reliability and construct validity in a descriptive, cross-sectional study in healthy and active populations[44]. A normative study by van Wijk[43] conducted in South Africa (n=2 200) found that scores were distributed evenly across race, employment, language, province and education (grade 9 level English). However, there were significant differences found between the scores of men and women.

### Data collection procedures

Data collection was conducted by final year occupational therapy students who were trained in use of the intake interview form and outcome measures. Prospective participants contacted the researchers by WhatsApp, and an intake interview was scheduled. A private room in the on-site occupational health clinic was used for data collection. At the intake interview, participants were provided with written information about the study, in their language of preference (English, Afrikaans or Xhosa). After their questions were answered by the researcher, they provided written consent to participate. The demographic questionnaire and PHQ-9 were then administered. Following the interview, the researchers met to confirm which participants met the inclusion criteria. These participants were invited for the intervention. At the time of the intervention, participants first completed the VAS and STEMS as pre-tests. They then participated in the PMR, and immediately thereafter completed the post-test VAS and STEMS.

### Data analysis

Data were analysed using IBM SPSS Statistics (Version 28.0.1) with the assistance of a biostatistician employed by Stellenbosch University. The first objective of this study was to describe the characteristics of garment workers presenting with musculoskeletal pain. The researchers used descriptive statistics including means, frequencies and percentages to analyse the demographic characteristics of participants and identify the prevalence of depressive symptoms among participants. The second and third objectives were to determine the effect of the PMR on pain using the VAS, and mental wellbeing using the STEMS, respectively. The Shapiro-Wilk test and the normal Q-Q plots were used to test the distribution of the variables. Paired t-tests were used to determine between-participant differences in pain and mental well-being immediately before and after the intervention. Effect sizes were then calculated using Cohen's d.

### Ethical considerations

This study was approved by the Health Research Ethics Committee at Stellenbosch University (U22/01/154) and was conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from the institution as well as all individual participants included in the study. All human research participants provided informed consent for publication. Participants were voluntarily recruited, were provided with adequate information about the study, and provided written informed consent in their language of choice (English, Afrikaans or isiXhosa). Institutional consent was obtained from the clothing factory and the Clothing Industry Healthcare Fund (CIHCF), as well as the occupational therapy clinic practicing within the CIHCF. Participants had the right to participate or withdraw at any time. Confidentiality was maintained throughout by labelling data collection instruments with participant codes. The welfare of participants was a priority throughout the study. All sessions were conducted at the occupational health centre in the clothing factory, to ensure easy and quick access to an occupational health nurse if needed. All possible participants were screened through an intake questionnaire to rule out any factors that could have been a risk to the participant (e.g. hypertension, cardiac conditions, dystonia, severe disability). The intervention and assessments were conducted during a once-off 30-minute session, as a 30-minute occupational health consultation is allowed for each worker during regular work time. This ensured that their break times and income was not affected by the study.

## RESULTS

Recruitment continued until the calculated sample size of 24 was met. Of the first 36 workers who signed up to participate in the study, 12 did not meet the inclusion criteria. Five participants did not complete all sections of the intake (demographic) questionnaire but still participated in the intervention and were included in data analysis (n=24).

### Participants' demographics

The workers' ages ranged between 24 and 54 years (m= 40.67, SD = 8.92). More women (n=22) than men (n=2) participated (see Table I page 4). The participants' highest level of education ranged from grade 6 to grade 12. Half of the participants had achieved grade 12 (n=12). The majority of workers classified themselves as low socio-economic status (n=17), followed by middle socio-economic status (n=6) and one was unspecified. No definitions for these categories were provided to participants. The majority of the participants were sewing machinists (n=12), examiners (n=5) or ironers (n=2). The period worked in their current positions ranged between 2 years and 31 years (M= 10.26 years, SD = 6.63). Almost all (n=23) participants indicated that they had no disability, and 1 participant did not specify. According to the PHQ-9 results, more than half the participants (n=15) had symptoms of depression requiring monitoring or intervention. Of these, most workers had moderate depressive symptoms (n=6), followed by mild (n=5) and moderately severe (n=4). No participants scored severe depressive symptoms on the PHQ-9. The remaining workers reported no-minimal depressive symptoms on the PHQ-9 (n=9).All 24 participants presented with musculoskeletal pain, with sharp pain being the most common type of pain (n=9). The workers also experienced burning, lingering, pins and needles, constant, cramps and non-specific pain. The workers mostly experienced pain in their shoulders (n=7) and lower back (n=6).

Table I: Participant Demographics

| Demographic Variable | Category/ Response | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Gender | Female | 22 | 91.7 |
| | Male | 2 | 8.3 |
| Educational level | Grade 6-7 | 2 | 8.3 |
| | Grade 8-11 | 7 | 29.2 |
| | Grade 12 | 12 | 50 |
| | Unspecified | 3 | 12.5 |
| Socio-economic status | Low | 17 | 70.8 |
| | Middle | 6 | 25 |
| | Unspecified | 1 | 4.2 |
| Job title | Sewing machinist | 12 | 50 |
| | Examiner | 5 | 20.8 |
| | Ironer | 2 | 8.3 |
| | Assistant training instructor | 1 | 4.2 |
| | Fabric inspector | 1 | 4.2 |
| | Factory clerk | 1 | 4.2 |
| | Labourer | 1 | 4.2 |
| | Product auditor | 1 | 4.2 |
| Disability | No disability | 23 | 95.8 |
| | Unspecified | 1 | 4.2 |
| *PHQ-9 results | Minimal depressive symptoms | 9 | 37.5 |
| | Mild depressive symptoms | 5 | 20.8 |
| | Moderate depressive symptoms | 6 | 25 |
| | Moderately severe depressive symptoms | 4 | 16.7 |

*PHQ-9 = Patient Health Questionnaire - 9

**Pain: Visual analogue scale**

The Shapiro-Wilk test and normal Q-Q plots indicated normal distribution of the data. Parametric tests were therefore used to determine the difference in pain levels immediately before and after the PMR. Prior to the PMR, a mean score of 4.73 was obtained. Post-intervention the mean score decreased to 2.06, indicating a mean difference of 2.67, as can be seen in Table II (below). Analysis using paired t-tests indicated a statistically significant effect, $t = 8.52$, $p < .001$. Using Cohen's d, there was a very large clinical effect of the intervention on pain (Effect size = 1.74).

**Table II: Pretest and posttest pain scores**

| | *VAS, M (SD) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pretest | Post-test | **M Difference | 95% ***CI | t(23) | P | Effect Size |
| Pain | 4.73 (1.91) | 2.06 (1.59) | 2.67 | [2.19, 33.14] | 8.52 | <.001 | 1.74 |

**M = Mean, ***CI = Confidence Interval, *VAS = Visual Analogue Scale

**Mood: STEMS**

The Shapiro-Wilk test and normal Q-Q plot indicated normal distribution of the data. Mean difference pre-test to post-test demonstrated a decrease in scores in the domains of tension, depression, anger, fatigue and mental confusion see Table III (below). The Vigour Scale (also known as 'stamina') indicated an increase. The most significant mean differences were in tension and fatigue. Analysis using Cohen's d indicated a moderate to large effect of the intervention on mental well-being.

**Table III: Pretest and posttest STEM scores**

| Mental Well-Being Component | STEMS, M (SD) | | M Difference | 95% CI | t (23) | p | Effect Size |
|---|---|---|---|---|---|---|---|
| | Pretest | Posttest | | | | | |
| Tension | 3.29 (3.58) | 1.17 (1.86) | 2.13 | [.82, 3.43] | 3.38 | .003 | .69 |
| Depression | 2.75 (3.59) | 1.33 (1.97) | 1.42 | [.51, 2.32] | 3.24 | .004 | .66 |
| Anger | 2.08 (3.48) | .50 (.98) | 1.58 | [.48, 2.69] | 2.96 | .007 | .60 |
| Vigour | 7.38 (4.37) | 8.58 (5.06) | -1.21 | [-2.78, .37] | -1.59 | .126 | .324 |
| Fatigue | 4.21 (4.04) | 1.00 (1.45) | 3.21 | [1.71, 4.71] | 4.43 | <,001 | .90 |
| Mental confusion | 2.71 (3.46) | 1.29 (2.93) | 1.42 | [.45, 2.38] | 3.04 | .006 | .62 |

SD= Standard deviation; M= Mean; CI= Confidence Interval; STEMS= Stellenbosch Mood Scale

### Feasibility and acceptability

In general, workers found the intervention to be acceptable and reported that they would use the PMR on their own in future. The PMR recording was sent to participants as a WhatsApp voice clip for their independent use after the study. The shortening of the PMR intervention from 30 minutes to 20 minutes, as well as the translation into simpler English, Afrikaans and isiXhosa made it significantly more user-friendly.

Data collection presented several challenges. A large number of garment workers were excluded from the study due to a history of hypertension or recurrent muscle spasms. Workers did not respond well to recruitment posters in the factory environment. A better response was found through word of mouth and direct recruitment (approaching workers who were known to experience pain through prior contact or referral). It was also difficult to schedule sessions with workers at the on-site occupational health clinic, as this required them to be away from their workstations for 30 minutes at a time, in a fast-paced production line. This had implications for the rest of the production line. However, it was significantly more accessible than interventions based outside of the workplace, as this would require more time off work as well as travel to a rehabilitation centre.

## DISCUSSION

This study assessed the immediate effects of Progressive Muscle Relaxation (PMR) on musculoskeletal pain and mental well-being among garment workers in Cape Town, South Africa. The 24 participants had a mean age of 40.67 years and an average employment duration of 10.26 years. Pain was predominantly reported in the shoulders and lower back, and most participants exhibited signs of depression, with only nine scoring no-minimal depression on the PHQ-9. Following the intervention, both pain and mood improved significantly, with participants responding positively to the adapted, translated version of PMR.

Effect sizes, such as Cohen's d, provided valuable insight into the magnitude of differences observed in this study beyond statistical significance. While the results demonstrated a notable reduction in musculoskeletal pain following PMR, interpreting these findings in clinical terms is essential. The minimal clinically important difference (MCID) for the Visual Analogue Scale (VAS) typically ranges between 1.5 and 2.0 points, depending on the population and condition assessed. If the observed pain reduction exceeds this threshold, it suggests a meaningful clinical improvement rather than a negligible statistical shift. In practical terms, a large Cohen's d value indicates that PMR had a substantial effect on pain relief, reinforcing its potential as a low-cost, accessible intervention for garment workers. This finding supports its integration into workplace wellness programs, particularly in environments where conventional pain management strategies may be limited. Future research should further explore these outcomes in comparison with the MCID to validate the real-world impact of PMR on functional recovery and quality of life.

Previous research has demonstrated PMR's effectiveness in alleviating pain, enhancing quality of life[19,24], and improving mood across various contexts[26]. This study is the first to show PMR's immediate impact on both mood and pain when applied directly in the work environment of garment workers, underscoring its relevance for healthcare in resource-limited settings where workers may struggle to access external rehabilitation services. The bidirectional relationship between pain and mental illness is well established, with recent large-scale studies reinforcing the connection[45]. A Swedish prospective cohort study (n=504 365) found that individuals with pain had an increased risk of developing mental illness, while those with mental illness were more likely to experience chronic pain[45]. Given this interplay, workplace-based interventions such as PMR, which target both conditions simultaneously, may optimize health outcomes for affected individuals.

Relaxation techniques like PMR are often studied in conjunction with other interventions over extended periods. For example, Akmese and Oran[18] examined PMR combined with music for managing lower back pain and quality of life during pregnancy, while Baird and Sands[22] investigated PMR alongside Guided Imagery for reducing chronic pain in osteoarthritis patients. These studies confirm PMR's effectiveness when integrated into multimodal approaches. The current study, however, demonstrates that PMR alone can yield immediate reductions in musculoskeletal pain and improvements in well-being within a single session. While these findings highlight PMR's short-term benefits, further research is needed to evaluate its effects with sustained use over time.

Limited research exists on PMR's application in the manufacturing sector. Edries et al.[46] conducted a randomized controlled trial (n=80) assessing an employee wellness program in South African clothing factories, where PMR was included among several interventions. Although the study did not focus specifically on musculoskeletal pain, the experimental group reported significant pain reduction post-intervention. Similarly, Sundram et al.[26] conducted a quasi-experimental trial (n=369) among Malaysian automobile assembly workers, demonstrating PMR's effectiveness in reducing self-perceived stress, anxiety, and depression. This study adds to existing evidence, reinforcing PMR's potential in industrial settings for improving both physical and mental health outcomes.

While the majority of participants in this study were women, the potential influence of gender on the effectiveness of PMR remains unexplored. Research suggests that biological, psychological, and social factors may shape pain perception and response to relaxation interventions differently across genders. Women tend to report higher pain sensitivity and prevalence of musculoskeletal disorders, potentially due to hormonal variations, occupational exposures, and psychosocial stressors[47]. However, the extent to which these factors affect the efficacy of PMR remains unknown. The gender imbalance in this study limits the ability to generalize findings to male garment workers, who may have distinct pain experiences and coping mechanisms. Future research should aim to assess gender-specific responses to PMR, exploring whether men and women experience differing degrees of pain relief, psychological benefits, and adherence to the intervention within workplace settings. Investigating these differences will provide valuable insights for tailoring PMR interventions to diverse workforce populations, ensuring equitable and effective implementation.

### Limitations

The limitations of the study include a small sample size as well as the single group pre-test post-test design without a control group, which limits generalizability of the results. Data collection was challenging in the factory environment, as workers were reluctant to take even 30 minutes off work in a busy production line. Having participants use the PMR recordings during normal breaktimes may have better indicated whether the intervention is feasible in this environment.

This study only investigated the immediate effect of PMR on musculoskeletal pain and mood and thus cannot comment on the long-term effect of the intervention. Further research should be done in this area. In addition, PMR was used as a sole intervention, whereas in other studies it was a component of multi-modal intervention. The effectiveness and usefulness of PMR as a component of a multi-modal intervention with garment workers warrants further investigation, along with potential adverse effects of PMR such as muscle spasm. It must also be noted that the vast majority of participants were women, therefore inferences about the effects of the intervention on men, as well as potential gender differences in the effects of the intervention, are limited. The response rate in this study was low, possibly reflecting the difficulty of conducting research in a working factory, where productivity demands take priority.

Administering mood assessments in a language that is not the participant's first language may introduce measurement bias and affect data validity in several ways. Language plays a critical role in accurately capturing emotional states, and participants may struggle

to fully comprehend nuanced psychological constructs when assessments are not available in their primary language. Misinterpretation of items, difficulty understanding complex phrasing, and cultural differences in expressing emotions may lead to responses that do not truly reflect participants' experiences.

In this study, the STEMS was not available in isiXhosa, potentially influencing the reliability of self-reported mood assessments. Participants may have found it challenging to engage with certain questions, leading to response inaccuracies, neutral or uncertain answers, and potentially underestimated psychological distress. Furthermore, language barriers can contribute to response fatigue, where participants disengage or provide answers based on general understanding rather than true emotional reflection.

Future research should consider linguistic adaptations or validated translations of mood assessments to enhance data accuracy, ensuring that measurement tools align with the language and cultural context of the study population. Such adaptations would improve participant comprehension, minimize response bias, and strengthen the validity of findings, ultimately leading to more reliable conclusions about the psychological effects of PMR in diverse workplace environments.

## CONCLUSION

To our knowledge, this is the first study investigating the immediate effect of PMR on the pain and wellbeing of garment workers in a factory setting. PMR was found to be significantly effective at improving both pain and mood in a single 30-minute session. The intervention could be adapted to a single 20-minute PMR recording in the workers' language of preference. PMR is thus an effective intervention to consider for the improvement of pain and mental health in resource-constrained environments. Occupational health professionals and factory managers are encouraged to consider implementing PMR in workplaces as an effective and efficient intervention to support pain and well-being.

### Data Availability

The datasets generated and analysed in this study are available from the corresponding author on reasonable request.

### Conflicts of Interest

The authors have no relevant financial or non-financial interests to disclose.

### Author Contributions

All authors contributed to the study conception and design. Data collection and analysis were performed by Sana Dwayi, Aqeela Ganie, Zita Jacobs, Dominique Labuscagne, Yonela Sakomani and Sonya Marais. All authors were involved in preparation of the manuscript for submission. All authors read and approved the final version of the manuscript, and agree to be accountable.

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