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Original Article

Prevalence of Musculoskeletal Pain and Its Association With Upper Limb Function Among Textile Designers in Lahore

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ABSTRACT

Background: Textile designers are exposed to prolonged static postures, sustained cervical flexion, repetitive upper-limb activity, and extended seated work, which may increase the risk of work-related musculoskeletal pain and functional limitation. **Objective:** To determine the prevalence of musculoskeletal pain in different body regions and assess its association with upper-limb function among textile designers in Lahore. **Methods:** This observational cross-sectional study included 188 textile designers aged 18–60 years working in selected textile and fashion-design settings in Lahore. Musculoskeletal pain was assessed across the neck, shoulder, upper back, elbow, wrist, lower back, hip, knee, and ankle regions using the Standardized Nordic Musculoskeletal Questionnaire. Upper-limb function was evaluated using the Upper Limb Functional Scale and categorized into score ranges of 8–20, 21–40, 41–60, and 61–80. Descriptive statistics summarized participant characteristics and pain prevalence, while chi-square tests assessed associations between regional pain and upper-limb functional categories. **Results:** Pain was most prevalent in the upper back (60.1%), shoulder (59.6%), and neck (56.4%), followed by elbow (41.5%) and wrist (35.6%). Lower-body symptoms were less frequent, including knee (21.3%), hip (17.6%), lower back (14.4%), and ankle pain (13.3%). Most participants had minimal to mild upper-limb functional limitation, with 37.8% scoring 8–20 and 47.3% scoring 21–40. Elbow pain was significantly associated with upper-limb function ($\chi^2 = 13.275$, $p = 0.004$), as was lower-back pain ($\chi^2 = 9.292$, $p = 0.026$). Neck, shoulder, upper-back, wrist, hip, knee, and ankle pain showed no statistically significant association with upper-limb functional categories. **Conclusion:** Musculoskeletal pain was highly prevalent among textile designers, particularly in the upper back, shoulder, and neck regions. Elbow and lower-back pain showed significant associations with upper-limb functional status, highlighting the need for ergonomic assessment, posture education, rest breaks, and targeted preventive rehabilitation strategies in this occupational group. **Keywords:** Musculoskeletal pain; Textile designers; Upper-limb function; Nordic Musculoskeletal Questionnaire; Occupational health; Ergonomics.

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INTRODUCTION

Textile designers represent an occupational group exposed to prolonged static postures, repetitive upper-limb movements, sustained visual attention, and fine motor tasks that place continuous biomechanical load on the cervical spine, shoulder girdle, upper back, and distal upper extremities. Their routine work often involves sketching, cutting, sewing, fabric handling, pattern development, and computer-based designing, all of which commonly require forward head posture, sustained neck flexion, elevated or protracted shoulders, and repetitive hand and wrist activity (1,2). These postural and movement demands may increase muscular fatigue, soft-tissue strain, altered scapulocervical mechanics, and cumulative microtrauma, thereby contributing to the development of work-related musculoskeletal pain and

functional limitation. In occupational settings where workstation ergonomics, rest breaks, and postural variation are inadequate, these symptoms may progress from transient discomfort to persistent pain, reduced work efficiency, and disability affecting daily and professional performance (3).

Musculoskeletal pain is a major occupational-health concern because it can arise from repeated mechanical overload of muscles, tendons, ligaments, joints, and related soft tissues. Among textile and garment workers, previous studies have consistently identified the neck, shoulders, upper back, lower back, wrists, and hands as commonly affected regions, largely due to repetitive tasks, awkward postures, prolonged sitting, and high production demands (4). Similar findings have been reported among sewing-machine operators, tailors, handicraft workers, fashion-design students, and garment workers, where high frequencies of neck, shoulder, and back pain have been linked to poor ergonomic conditions, extended working hours, and insufficient recovery time (5). These findings suggest that musculoskeletal disorders in textile-related professions are not isolated events but reflect repeated exposure to occupational risk factors that accumulate over time and may compromise physical function, productivity, and quality of life.

The upper limb is particularly important in textile design because most professional tasks depend on coordinated shoulder, elbow, wrist, and hand function. Activities such as reaching, drawing, cutting, stitching, fabric manipulation, and digital design require sustained muscular control and repetitive fine-motor performance. Pain in the neck, shoulder, upper back, elbow, wrist, or related body regions may therefore interfere with movement efficiency, grip, endurance, task precision, and overall functional capacity. Prior research has shown that upper-quarter musculoskeletal symptoms may be associated with reduced functional performance, especially when pain affects regions involved in repetitive occupational activity (6,7). However, the relationship between pain in specific body regions and upper-limb function remains insufficiently explored among textile designers, particularly in local occupational settings where ergonomic awareness and preventive workplace strategies may be limited.

Although international and regional studies have reported a high burden of musculoskeletal symptoms among textile and garment workers, much of the available evidence focuses on sewing-machine operators, factory workers, tailors, students, or general industrial workers rather than professional textile designers. Textile designers differ from many factory-based workers because their tasks combine creative, technical, manual, and digital activities, often requiring prolonged concentration and static upper-body positioning (8). In Lahore, where textile designing is a major professional activity, limited evidence is available regarding the prevalence of musculoskeletal pain across different body regions and its association with upper-limb functional status. This gap is clinically and occupationally important because identifying the most affected regions and their functional consequences can guide ergonomic modifications, targeted physiotherapy interventions, workplace education, and preventive health policies for this professional group.

The present study was therefore designed to determine the prevalence of musculoskeletal pain among textile designers in Lahore and to examine its association with upper-limb function. Using textile designers as the target population, musculoskeletal pain in different body regions as the exposure, pain-free or less affected participants as the comparison group, and upper-limb functional score as the outcome, this study addresses whether musculoskeletal pain is associated with impaired upper-limb function in this occupational group. The primary objective was to determine the prevalence of musculoskeletal pain among textile designers and assess the association between pain in different body regions and upper-limb functional status. It was hypothesized that musculoskeletal pain would be significantly associated with upper-limb function among textile designers in Lahore.

MATERIALS AND METHODS

This observational cross-sectional study was conducted to determine the prevalence of musculoskeletal pain and assess its association with upper-limb function among textile designers working in Lahore,

Pakistan. A cross-sectional design was selected because it allowed simultaneous assessment of musculoskeletal pain in different body regions and upper-limb functional status within a defined occupational population. The study was carried out among textile designers employed in selected textile and fashion-design settings in Lahore, including Nishat Mills, Sapphire Mills, Maria B, and Shazia Kiyani. Data were collected through direct workplace-based participant contact, allowing responses to be obtained from designers within their routine professional environment.

The study population consisted of professional textile designers aged 18–60 years who were actively involved in textile-design-related work. Participants were eligible if they had at least one year of continuous professional experience in textile designing, worked approximately 8–12 hours per day, were physically able to perform their regular occupational duties, and provided written informed consent. Participants were excluded if they had a history of recent or previous fracture involving the neck, spine, shoulder, or upper limb; recent surgery involving the neck, shoulder, spine, or upper extremity; pregnancy or lactation; or any non-occupational condition likely to interfere with musculoskeletal pain reporting or upper-limb functional assessment. These criteria were applied to reduce the influence of non-work-related musculoskeletal conditions on the study outcomes.

A non-probability convenience sampling technique was used because textile designers were approached from accessible workplace settings where permission for data collection was obtained. The final sample included 188 participants. The sample size was calculated using the WHO sample size calculator, based on the expected prevalence of musculoskeletal symptoms in textile-related occupational groups, with a 95% confidence level and an acceptable margin of error. Participants were recruited after workplace permission was obtained from the relevant management authorities (9). Each eligible participant was approached individually, informed about the purpose and procedures of the study, and invited to participate voluntarily. Written informed consent was obtained before data collection, and participants were assured that refusal or withdrawal would not affect their employment or professional standing.

Data were collected using a structured questionnaire format administered in person at the workplace. The researcher provided uniform instructions to all participants before questionnaire completion and remained available to clarify procedural questions without influencing responses. Questionnaires were completed in a quiet and private workplace area to support accurate reporting and maintain confidentiality. Completed forms were reviewed at the time of collection to ensure that responses were complete and clearly marked. Each participant's data were recorded anonymously, and personal identifiers were removed before entry into the electronic database.

Musculoskeletal pain was assessed using the Standardized Nordic Musculoskeletal Questionnaire, which records the presence of pain or discomfort in specific anatomical regions. In this study, pain was assessed across the neck, shoulder, upper back, elbow, wrist, lower back, hip, knee, and ankle regions. Musculoskeletal pain was operationally defined as self-reported discomfort, aching, soreness, or pain affecting muscles, joints, bones, tendons, ligaments, or related soft tissues in any of the assessed body regions. Responses were categorized as pain present or pain absent for each anatomical region. Upper-limb function was assessed using the Upper Limb Functional Scale, an eight-item self-report instrument evaluating difficulty during activities involving the shoulder, arm, wrist, and hand. Total scores were categorized into functional-disability levels as 8–20, 21–40, 41–60, and 61–80, representing increasing levels of upper-limb functional difficulty (10).

The primary exposure variable was musculoskeletal pain in each assessed body region, classified separately as present or absent. The primary outcome variable was upper-limb functional status, measured using categorized Upper Limb Functional Scale scores. Sociodemographic and occupational variables included age group and gender, while work-related eligibility factors included professional experience and daily working duration. Age was categorized into 18–28, 29–38, 39–49, and 50–60 years. Gender was recorded as male or female. Pain in each anatomical region was analyzed separately to determine whether specific regional pain patterns were associated with upper-limb functional status.

Several procedures were used to minimize bias and improve data quality. Standardized instruments were used for all participants to maintain consistency in outcome measurement. Identical instructions were given before questionnaire administration to reduce information bias. Data were collected under similar workplace conditions wherever possible. Questionnaires were reviewed immediately after completion to reduce missing responses. To minimize selection-related variability, the same eligibility criteria were applied across all recruitment sites. Data were entered into a password-protected electronic database after removal of identifying information, and entries were checked for completeness and consistency before analysis.

Data analysis was performed using IBM SPSS Statistics version 26. Descriptive statistics were used to summarize participant characteristics, musculoskeletal pain prevalence, and upper-limb functional categories. Frequencies and percentages were calculated for categorical variables, including age group, gender, pain presence in each body region, and Upper Limb Functional Scale categories. Cross-tabulations were generated to examine the distribution of upper-limb functional categories among participants with and without pain in each anatomical region. The chi-square test of independence was used to assess associations between musculoskeletal pain in each body region and upper-limb functional status. A p-value of less than 0.05 was considered statistically significant. Where cross-tabulated categories contained small observed frequencies, results were interpreted with attention to the distribution of cell counts and the clinical pattern of association.

Ethical approval was obtained from the Research Ethics and Support Committee of the relevant academic institution before data collection. Written permission was obtained from the selected workplace authorities.

All participants provided written informed consent after receiving information about the study purpose, procedures, voluntary participation, confidentiality, and right to withdraw at any stage. Participant anonymity was maintained throughout the study, and collected data were used only for research purposes. Completed questionnaires were stored securely, and electronic data were protected with restricted access to preserve confidentiality and data integrity.

RESULTS

A total of 188 textile designers were included in the analysis. The largest age group was 39–49 years, comprising 64 participants (34.0%), followed by 29–38 years with 45 participants (23.9%), 18–28 years with 41 participants (21.8%), and 50–60 years with 38 participants (20.2%). Male participants represented 108 cases (57.4%), while female participants represented 80 cases (42.6%), indicating a slightly higher proportion of male textile designers in the study sample.

Table 1. Demographic Characteristics of Participants

Variable	Category	Frequency (n)	Percentage (%)
Age group	18–28 years	41	21.8
	29–38 years	45	23.9
	39–49 years	64	34.0
	50–60 years	38	20.2
	Total	188	100.0
Gender	Female	80	42.6
	Male	108	57.4
	Total	188	100.0

Musculoskeletal pain was most frequently reported in the upper back, shoulder, and neck regions. Upper back pain was reported by 113 participants (60.1%), followed by shoulder pain in 112 participants (59.6%) and neck pain in 106 participants (56.4%). Elbow pain was present in 78 participants (41.5%), while wrist pain was reported by 67 participants (35.6%). Lower-limb and lower-trunk symptoms were less common: knee pain was reported by 40 participants (21.3%), hip pain by 33 participants (17.6%), lower back pain by 27 participants (14.4%), and ankle pain by 25 participants (13.3%). Overall, the distribution showed a clear predominance of upper-body musculoskeletal symptoms among textile designers.

Table 2. Prevalence of Musculoskeletal Pain by Body Region

Body Region	Pain Present, n (%)	Pain Absent, n (%)	Total, n (%)
Neck	106 (56.4)	82 (43.6)	188 (100.0)
Shoulder	112 (59.6)	76 (40.4)	188 (100.0)
Upper back	113 (60.1)	75 (39.9)	188 (100.0)
Elbow	78 (41.5)	110 (58.5)	188 (100.0)
Wrist	67 (35.6)	121 (64.4)	188 (100.0)
Lower back	27 (14.4)	161 (85.6)	188 (100.0)
Hip	33 (17.6)	155 (82.4)	188 (100.0)
Knee	40 (21.3)	148 (78.7)	188 (100.0)
Ankle	25 (13.3)	163 (86.7)	188 (100.0)

Upper-limb functional scores were distributed mainly in the lower-to-moderate disability ranges. The most frequent category was 21–40, observed in 89 participants (47.3%), followed by 8–20 in 71 participants (37.8%). Moderate functional limitation, represented by scores of 41–60, was observed in 25 participants (13.3%), while only 3 participants (1.6%) were classified in the highest disability category of 61–80. This indicates that most textile designers had minimal to mild upper-limb functional difficulty, while severe functional limitation was uncommon.

Table 3. Distribution of Upper-Limb Functional Score Categories

Upper-Limb Functional Score Category	Frequency (n)	Percentage (%)
8–20	71	37.8
21–40	89	47.3
41–60	25	13.3
61–80	3	1.6
Total	188	100.0

The association between musculoskeletal pain in different body regions and upper-limb functional score categories was examined using the chi-square test of independence. Statistically significant associations were found for elbow pain and lower back pain. Elbow pain showed the strongest association with upper-limb functional scores, with $\chi^2 = 13.275$, df = 3, $p = 0.004$, and Cramer's V = 0.266, indicating a small-to-moderate association. Among participants with elbow pain, 16 were in the 41–60 category and 3 were in the 61–80 category, compared with 9 and 0 participants, respectively, among those without elbow pain. Lower back pain was also significantly associated with upper-limb functional scores, with $\chi^2 = 9.292$, df = 3, $p = 0.026$, and Cramer's V = 0.222. Participants with lower back pain were distributed differently across functional categories, with 17 in the 8–20 category, 9 in the 21–40 category, 1 in the 41–60 category, and 1 in the 61–80 category.

No statistically significant association was observed between upper-limb functional score categories and pain in the neck, shoulder, upper back, wrist, hip, knee, or ankle regions. Neck pain showed $\chi^2 = 0.649$, $p = 0.885$; shoulder pain showed $\chi^2 = 0.570$, $p = 0.903$; and upper back pain showed $\chi^2 = 0.688$, $p = 0.876$, indicating similar functional-score distributions between participants with and without pain in these high-prevalence regions. Wrist pain approached a higher effect size than neck, shoulder, and upper back pain but remained non-significant, with $\chi^2 = 5.570$, $p = 0.135$, and Cramer's V = 0.172. Hip pain also did not reach statistical significance, although its p-value was closer to the threshold than most non-significant regions, with $\chi^2 = 6.806$, $p = 0.078$, and Cramer's V = 0.190. Knee and ankle pain showed weak and non-significant associations with upper-limb functional scores.

Table 4. Association Between Musculoskeletal Pain and Upper-Limb Functional Score Categories

Pain Region	Pain Status	ULFS 8–20, n	ULFS 21–40, n	ULFS 41–60, n	ULFS 61–80, n	χ^2	df	p-value	Cramer's V
Neck	No	36	42	11	1	0.649	3	0.885	0.059
	Yes	35	47	14	2				
Shoulder	No	29	41	11	1	0.570	3	0.903	0.055
	Yes	42	48	14	2				
Upper back	No	33	39	11	2	0.688	3	0.876	0.060
	Yes	38	50	14	1				
Elbow	No	40	61	9	0	13.275	3	0.004	0.266
	Yes	31	28	16	3				
Wrist	No	46	59	16	0	5.570	3	0.135	0.172
	Yes	25	30	9	3				

Pain Region	Pain Status	ULFS 8–20, n	ULFS 21–40, n	ULFS 41–60, n	ULFS 61–80, n	χ^2	df	p-value	Cramer's V
Lower back	No	54	80	24	3	9.292	3	0.026	0.222
	Yes	17	9	1	1				
Hip	No	57	79	17	2	6.806	3	0.078	0.190
	Yes	14	10	8	1				
Knee	No	57	69	20	2	0.464	3	0.927	0.050
	Yes	14	20	5	1				
Ankle	No	60	77	23	3	1.368	3	0.713	0.085
	Yes	11	12	2	0				

Overall, the findings demonstrate that musculoskeletal pain was highly prevalent among textile designers, particularly in the upper back, shoulder, and neck regions, where more than half of participants reported symptoms. However, the presence of pain in these highly affected regions was not statistically associated with upper-limb functional score categories. In contrast, elbow pain and lower back pain showed significant associations with upper-limb functional status, suggesting that these regions may have a greater measurable relationship with functional difficulty in this sample. Most participants remained within the 8–20 and 21–40 ULFS categories, indicating that minimal to mild upper-limb functional limitation predominated despite the high prevalence of musculoskeletal symptoms.

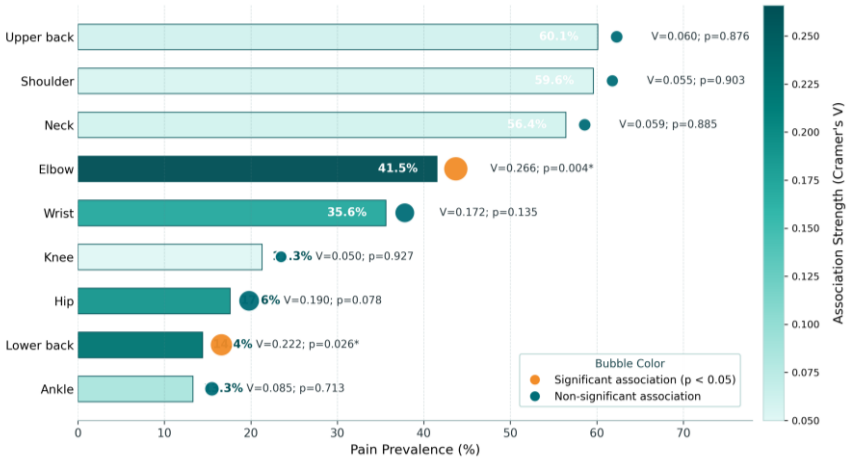

Figure 1. Regional Musculoskeletal Pain Burden and Functional Association Among Textile Designers

The integrated figure demonstrates that musculoskeletal pain was most prevalent in the upper back (60.1%), shoulder (59.6%), and neck (56.4%), yet these high-burden regions showed very weak and non-significant associations with upper-limb functional categories, with Cramer's V values of 0.060, 0.055, and 0.059, respectively. In contrast, elbow pain showed a lower prevalence of 41.5% but the strongest functional association (Cramer's V = 0.266, p = 0.004), followed by lower back pain, which had relatively low prevalence (14.4%) but a significant association with upper-limb function (Cramer's V = 0.222, p = 0.026). This pattern indicates that symptom burden and functional impact were not fully parallel: upper-body pain was common, but elbow and lower-back pain showed the clearest measurable relationship with functional limitation in this textile-designer sample.

DISCUSSION

The present study identified a high burden of musculoskeletal pain among textile designers in Lahore, with symptoms predominantly affecting the upper back, shoulder, and neck regions. Upper back pain was the most frequently reported complaint, affecting 60.1% of participants, followed closely by shoulder pain at 59.6% and neck pain at 56.4%. This pattern reflects the occupational demands of textile design, where prolonged sitting, sustained cervical flexion, forward head posture, elevated or protracted shoulders, and repetitive upper-limb activity are common. These postural and repetitive demands may increase static loading of the cervical and scapulothoracic musculature, particularly the upper trapezius, levator scapulae, rhomboids, suboccipital muscles, and deep cervical stabilizers. Over time, sustained

low-level muscle contraction can contribute to fatigue, reduced local circulation, myofascial tenderness, and discomfort in the neck–shoulder–upper-back complex. The predominance of symptoms in these regions therefore appears biomechanically consistent with the working posture and task profile of textile designers.

The high prevalence of upper-body symptoms in this study is broadly consistent with previous occupational-health research in textile-related workers and other repetitive manual professions. A study reported a high prevalence of neck, shoulder, and lower-back symptoms among handicraft workers engaged in prolonged hand-sewing tasks, attributing these complaints to forward-leaning posture, continuous sitting, and repetitive upper-limb work (11). Similarly, another study found that upper-back pain was highly prevalent among tailors in Pakistan, reinforcing the view that sustained seated work and repetitive arm activity can place substantial strain on the upper trunk even when overt ergonomic risk is not always recognized by workers (12). The current findings also correspond with studies among textile factory and garment workers, where neck, shoulder, and back symptoms commonly emerge as dominant musculoskeletal complaints due to long working hours, non-neutral postures, and limited opportunities for movement variability (13,14).

Although neck, shoulder, and upper-back pain were the most prevalent complaints, their associations with upper-limb functional score categories were not statistically significant. Neck pain showed no significant association with upper-limb function, and similar non-significant findings were observed for shoulder and upper-back pain. This distinction between symptom prevalence and measurable functional limitation is clinically important. Pain in these regions may be common but not always severe enough to produce detectable impairment on a categorized upper-limb functional scale, particularly when most participants fall within minimal or mild functional limitation categories. In the present sample, 37.8% of participants were classified in the 8–20 ULFS category and 47.3% in the 21–40 category, while only 13.3% and 1.6% were in the 41–60 and 61–80 categories, respectively. This distribution suggests that many participants experienced discomfort without severe loss of functional capacity, possibly because they had adapted to symptoms, modified task performance, or continued working despite pain.

Elbow pain demonstrated the strongest association with upper-limb functional score categories, with a statistically significant relationship and the highest observed effect size among the assessed regions. This finding is clinically plausible because elbow function is directly involved in reaching, lifting, carrying, gripping, fabric handling, cutting, drawing, and repetitive positioning during textile-design tasks. Unlike neck or upper-back discomfort, which may remain postural and diffuse, elbow pain may more directly interfere with task execution requiring coordinated arm movement and sustained upper-limb loading. Participants with elbow pain were more frequently represented in higher ULFS categories, including moderate and severe functional limitation, indicating that elbow symptoms may have a more direct measurable impact on occupational performance. This finding aligns with evidence from upper-extremity occupational studies showing that pain in distal or task-specific joints can be strongly associated with disability because these joints are directly engaged in repetitive manual and precision-based activities 15,16).

Lower-back pain was less prevalent than upper-body pain but was also significantly associated with upper-limb functional status. This finding may initially appear unexpected because lower-back pain is not anatomically part of the upper limb; however, it may reflect the broader functional consequences of prolonged sitting, poor trunk support, and reduced postural endurance. Textile designers often rely on stable trunk posture to perform precise upper-limb tasks. When lower-back discomfort is present, sitting tolerance, forward reach, balance, and sustained work posture may be compromised, indirectly affecting upper-limb activity. Lower-back pain may also indicate a more generalized musculoskeletal burden, where participants with trunk discomfort experience greater overall functional difficulty. Similar findings have been observed in textile and garment workers, where lower-back symptoms frequently

coexist with upper-body complaints and are associated with prolonged static posture, limited rest, and repetitive occupational demands (17,18).

Wrist and hip pain showed non-significant associations with upper-limb functional score categories, although their effect sizes and p-values suggested a stronger pattern than those observed for neck, shoulder, and upper-back pain. Wrist pain was reported by 35.6% of participants and may be occupationally relevant because textile-design tasks often involve repetitive hand movements, sketching, cutting, computer use, and fine fabric manipulation. However, the absence of statistical significance may reflect the distribution of disability categories, limited numbers in the severe ULFS group, or variability in task exposure among participants. Hip pain also showed a non-significant trend, which may be related to prolonged sitting and restricted mobility during work. These findings suggest that while wrist and hip symptoms may contribute to discomfort, their functional impact was not as clearly measurable as elbow and lower-back pain in this sample.

The relatively lower prevalence of lower-limb symptoms, including knee pain at 21.3%, hip pain at 17.6%, and ankle pain at 13.3%, indicates that musculoskeletal strain among textile designers is more concentrated in the upper body and trunk than in the lower extremities. This distribution differs from occupations requiring prolonged standing, walking, load carrying, or repetitive lower-limb movement. The finding supports the interpretation that textile-design work primarily exposes workers to seated static posture and upper-limb repetitive activity rather than lower-limb mechanical loading. Similar upper-body-dominant patterns have been reported in creative, sewing, and textile-related workers whose tasks are performed mainly in seated or forward-flexed positions (19,20).

The findings also have practical implications for workplace ergonomics and preventive rehabilitation. Since upper-back, shoulder, and neck pain were highly prevalent, ergonomic strategies should prioritize workstation height, chair support, monitor positioning, task layout, and reduction of sustained forward head posture. Scheduled micro-breaks, postural variation, cervical and scapular endurance training, and stretching of overactive muscle groups may help reduce cumulative load in the neck–shoulder complex. However, because elbow pain showed the strongest association with upper-limb functional limitation, preventive programs should also include task-specific upper-limb strategies, such as optimizing arm support, reducing repetitive elbow loading, improving cutting and drawing posture, and educating workers about neutral forearm and wrist positioning. The significant relationship between lower-back pain and functional status further supports the need for lumbar support, seated posture education, and trunk-endurance interventions in this occupational group.

The study contributes local evidence regarding musculoskeletal pain patterns among textile designers in Lahore, a professional group that has received less focused attention than factory-based textile workers, sewing-machine operators, or garment laborers. By examining pain across multiple anatomical regions and relating these symptoms to upper-limb functional categories, the study highlights that the most prevalent pain sites are not necessarily the sites most strongly associated with functional limitation. This distinction is important for clinical assessment and workplace intervention planning. Screening programs should therefore not rely only on prevalence ranking but should also consider which pain regions are most strongly linked with functional performance.

Several limitations should be considered when interpreting the findings. The cross-sectional design allows identification of associations but does not establish temporal or causal relationships between musculoskeletal pain and upper-limb function. The use of convenience sampling may limit generalizability to all textile designers in Lahore or other regions. Pain and functional limitation were measured through self-reported instruments, which may be influenced by recall bias, symptom perception, or reporting differences among participants. The analysis categorized upper-limb functional scores, and the severe disability group included few participants, which may have reduced statistical precision for some comparisons. In addition, occupational factors such as workstation measurements, posture duration, rest-break frequency, psychosocial stress, workload intensity, hand dominance, and

detailed task exposure were not included in adjusted statistical models, although these factors may influence both pain and functional outcomes.

Despite these limitations, the results provide meaningful occupational-health insight. The high prevalence of upper-back, shoulder, and neck pain demonstrates a substantial musculoskeletal burden among textile designers, while the significant associations involving elbow and lower-back pain identify regions with clearer functional relevance. These findings support the need for ergonomic assessment, early symptom screening, workplace education, and targeted physiotherapy strategies focusing not only on common pain sites but also on pain regions most closely linked to functional difficulty. Future research using longitudinal designs, objective ergonomic assessment, clinical examination, and adjusted multivariable analysis would further clarify risk factors and help guide evidence-based interventions for reducing musculoskeletal pain and preserving upper-limb function among textile designers.

CONCLUSION

Musculoskeletal pain was common among textile designers in Lahore, with the highest prevalence observed in the upper back, shoulder, and neck regions, indicating that the occupational demands of textile design primarily affect the upper trunk and cervical–shoulder complex. Although these regions represented the greatest symptom burden, they were not significantly associated with upper-limb functional score categories. In contrast, elbow pain and lower-back pain showed statistically significant associations with upper-limb functional status, suggesting that these pain sites may have a more direct or measurable relationship with functional difficulty during occupational tasks. Most participants demonstrated minimal to mild upper-limb functional limitation, yet the high frequency of musculoskeletal symptoms highlights the need for early ergonomic assessment, posture education, scheduled rest breaks, and targeted preventive rehabilitation strategies to reduce work-related pain and preserve functional capacity among textile designers.

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