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Article

Prevalence of Neck Pain and Reduced Cervical Mobility in Females Wearing Khaleeji Hijab vs. Traditional Hijab

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ABSTRACT

Background: Neck pain and reduced cervical mobility are increasingly recognized among females who wear hijab, yet limited research has compared musculoskeletal outcomes between distinct hijab styles. The biomechanical and clinical implications remain insufficiently understood. **Objective**: To determine and compare the prevalence of neck pain and reduced cervical range of motion (ROM) in young adult females wearing Khaleeji versus traditional hijab, and to evaluate the impact of daily duration and years of hijab use on these outcomes. **Methods**: This cross-sectional comparative study recruited 100 female students from private universities in Lahore, Pakistan, aged 20–31 years, wearing hijab for at least one year and a minimum of four hours daily. Participants were assigned to traditional (n = 50) or Khaleeji (n = 50) hijab groups. Data collection included demographic details, the Neck Disability Index (NDI), and goniometric measurement of cervical ROM. Statistical analysis used SPSS v21, with group comparisons assessed via chi-square and t-tests, and regression modeling for confounder adjustment. Ethical approval was obtained, and procedures followed the Declaration of Helsinki. **Results**: Khaleeji hijab wearers reported significantly higher neck pain (severe pain: 48% vs 4%, $p < 0.001$) and lower cervical ROM (mean flexion: 65.8° vs 73.1°, $p = 0.005$) than the traditional group. Longer daily wearing duration correlated with increased pain and disability. **Conclusion**: The Khaleeji hijab style and prolonged wearing duration are associated with greater neck pain and reduced cervical mobility, highlighting the need for targeted preventive interventions in hijab-wearing populations.

Keywords: Neck Pain, Cervical Vertebrae, Range of Motion, Musculoskeletal Pain, Hijab, Women's Health, Cross-Sectional Studies

INTRODUCTION

Neck pain is a highly prevalent musculoskeletal complaint that disproportionately affects women, often impacting daily activities and quality of life (3). Multiple factors are implicated in the development of neck pain, including physical elements such as poor ergonomics, posture during study or work, and prolonged static positions, as well as psychological and individual determinants like stress, social support, age, gender, and fitness level (3,9). The assessment of cervical range of motion (ROM) is a critical component in the evaluation of neck pain, as deficits in mobility are closely associated with both the severity and chronicity of symptoms (3). The cervical spine's complex structure, supported by bones and soft tissue, enables multidirectional movement essential for maintaining horizontal gaze and functional independence (4).

In Muslim cultures, the hijab is commonly worn by women as a sign of modesty, involving the wrapping of fabric around the head and neck. While variations exist, traditional hijab is generally simple, covering the head and neck without additional embellishments, whereas styles like the Khaleeji hijab incorporate pronounced bulges or buns created by coiling the hair, resulting in a more substantial head covering (7). Global estimates suggest millions of women wear the hijab daily, with both cultural and religious motivations underlying this practice (6,7). The physical characteristics of hijab, especially modern forms with accessories, have raised questions about their biomechanical impact on the cervical spine, particularly with extended use.

Recent literature suggests that prolonged wearing of headscarves, including hijab, may be associated with altered cervical spine biomechanics, reduced ROM, and increased neck pain (13,14). Alqabbani et al. (2017) identified significant reductions in cervical ROM among hijab-wearing females, particularly when the daily duration exceeded six hours, and noted that these restrictions were not strongly influenced by the age of onset or total years of hijab use (14). Additional research by Kiyani et al. (2020) demonstrated that

neck pain and limited cervical mobility are common among women wearing modern hijab styles in Pakistan, with symptoms frequently relieved upon removal of the head covering (16). Studies outside the context of hijab, such as those investigating cervical collars or sports helmets, also report reductions in cervical mobility and increased risk of adaptive muscular changes, supporting the hypothesis that head coverings may impose significant mechanical constraints (11,12,18).

Despite these insights, there is a paucity of comparative research evaluating the impact of different hijab styles—particularly the traditional versus Khaleeji hijab—on cervical mobility and neck pain. Most existing studies focus on either the general effect of head coverings or compare hijab-wearing with non-hijab-wearing populations, often overlooking distinctions within hijab-wearing groups (14,16). This represents a critical knowledge gap, as the design and fit of the hijab may uniquely affect cervical spine loading and the risk of musculoskeletal symptoms. To address this gap, the present cross-sectional comparative study aims to determine the frequency of neck pain and reduced cervical mobility among females wearing traditional versus Khaleeji hijab, further exploring how time and duration of hijab use influence these outcomes. The central research question is whether the style of hijab—traditional or Khaleeji—differentially affects the prevalence and severity of neck pain and limitation in cervical ROM among young adult females. This investigation seeks to inform ergonomic recommendations and preventive strategies for women who regularly wear the hijab, ultimately contributing to improved musculoskeletal health and quality of life in this population.

MATERIALS AND METHODS

This cross-sectional comparative study was designed to investigate the association between the style of hijab worn and the prevalence of neck pain and reduced cervical mobility among female university students. The study was conducted at several private universities located in Lahore, Pakistan, with participant recruitment and data collection spanning from May to September 2023. The rationale for selecting this design was to efficiently compare outcomes between two naturally occurring groups—females wearing the traditional hijab and those wearing the Khaleeji hijab—within a defined university population, allowing for the assessment of prevalence and potential risk factors in a real-world setting (3,14).

Eligible participants were undergraduate and graduate female students aged 20 to 31 years who had been wearing any form of hijab for a minimum of one year and for at least four hours daily. Exclusion criteria included any history of active illness, known musculoskeletal or neurological disorders affecting the cervical spine, such as osteoarthritis, cervical disc herniation, vertigo, or balance problems of neurological origin, which could confound the relationship between hijab use and cervical outcomes. The recruitment process relied on convenience sampling, where announcements and invitations were distributed via university notice boards, classroom presentations, and electronic communication channels. Interested participants were screened for eligibility, and written informed consent was obtained before enrollment, ensuring that all individuals understood the study purpose, procedures, and their rights regarding participation and data confidentiality.

Participants were assigned to two groups based on the style of hijab regularly worn: traditional hijab, characterized by simple wrapping without bulky accessories, and Khaleeji hijab, distinguished by a prominent bun or bulge at the back of the head. Each group comprised 50 participants, resulting in a total sample size of 100, which was determined to provide sufficient power to detect moderate differences in cervical mobility and pain prevalence between groups based on previous studies (13,14,16).

Data collection was carried out by trained physiotherapists using standardized tools and procedures to ensure accuracy and reproducibility. Neck pain intensity and related disability were assessed using the Neck Disability Index (NDI), a validated 10-item questionnaire that quantifies neck-specific disability and pain interference in daily activities on a scale from 0 (no disability) to 50 (maximum disability), with higher scores indicating greater impairment (9). For cervical mobility assessment, a universal goniometer was used to measure active cervical range of motion (ROM) in six directions: flexion, extension, right and left lateral flexion, and right and left rotation. All measurements were performed in a standardized seated position with participants instructed to move to their maximum comfortable range. Each measurement was recorded three times and the mean value was used for analysis to minimize intra-observer variability.

In addition to primary outcomes, demographic and exposure variables were collected, including age, number of years wearing hijab, average hours and days per week of hijab use, and age of initiation. These were operationalized as categorical variables for subgroup analysis. To minimize measurement bias, all assessors were blinded to the study hypothesis and trained in standardized protocols for questionnaire administration and goniometric measurement. Potential confounders such as physical activity level, academic workload, and prior history of neck pain were documented through self-report and considered during data analysis.

The statistical analysis plan involved data entry and cleaning in SPSS version 21.0. Descriptive statistics were computed for all variables. Continuous variables such as age and cervical ROM were summarized using means and standard deviations, while categorical variables were reported as frequencies and percentages. Differences between groups were assessed using chi-square tests for categorical variables and independent samples t-tests or Mann-Whitney U tests for continuous variables, depending on data normality. Associations between hijab style and neck pain or reduced ROM were further evaluated using logistic regression models adjusted for relevant confounders, including age, duration, and frequency of hijab use. Missing data were handled by complete case analysis, with sensitivity checks to ensure robustness of findings. Subgroup analyses examined relationships stratified by age group,

years of hijab use, and daily wearing duration. All statistical tests were two-tailed, and a p-value of <0.05 was considered statistically significant.

Ethical approval was obtained from the institutional review board of Riphah International University Islamabad prior to study initiation. Written informed consent was secured from all participants, and all data were anonymized and stored securely with restricted access to the study team only. Data integrity was maintained by double-checking entries, utilizing password-protected databases, and preserving original source documents. Throughout, reproducibility was ensured by documenting all protocols, calibration procedures, and analysis scripts, allowing the study to be replicated by other researchers following the same methodology (14,16).

RESULTS

A total of 100 female university students participated in this study, with 50 wearing the traditional hijab and 50 wearing the Khaleeji hijab. The mean age of participants was similar between groups, with traditional hijab wearers averaging 22.4 years (SD 2.1) and Khaleeji hijab wearers averaging 22.8 years (SD 2.4). The majority of participants in both groups fell within the 20–23-year age range, accounting for 70% of the traditional group and 76% of the Khaleeji group. The distribution of years wearing the hijab and daily wearing duration did not significantly differ between the two cohorts. Most participants reported wearing the hijab for more than seven years (traditional 32%, Khaleeji 38%), and 34% in each group wore their hijab for seven to eight hours daily, with a further 24% of the traditional group and 26% of the Khaleeji group reporting nine or more hours per day.

Assessment of neck pain revealed a markedly higher prevalence of pain among those wearing the Khaleeji hijab. Only 32% of Khaleeji hijab wearers reported no neck pain, compared to 76% of traditional hijab wearers. Severe or fairly severe pain was reported by 48% of Khaleeji hijab wearers, versus just 4% in the traditional group. This difference was highly statistically significant ($p < 0.001$), with the odds of reporting no pain being nearly seven times higher in the traditional hijab group (OR 0.15, 95% CI 0.06–0.37). Similarly, the Neck Disability Index (NDI) scores were significantly elevated among Khaleeji hijab wearers: 50% experienced severe disability (NDI 25–34) compared to only 4% in the traditional group, while 12% of Khaleeji hijab wearers had no disability versus 32% of the traditional group ($p < 0.001$).

Cervical range of motion (ROM) measurements were consistently and substantially lower in the Khaleeji hijab group across all movement directions. Mean flexion was 65.8° (SD 10.2) for Khaleeji wearers, significantly less than the 73.1° (SD 7.6) observed in the traditional group, with a mean difference of 7.3° (95% CI 4.1–10.5, $p = 0.005$). Similar patterns were evident for extension (64.2° vs. 71.7°, mean difference 7.5°, 95% CI 4.6–10.4, $p = 0.012$), left rotation (28.1° vs. 36.9°, mean difference 8.8°, 95% CI 5.5–12.1, $p = 0.001$), and right rotation (27.9° vs. 37.0°, mean difference 9.1°, 95% CI 5.8–12.4, $p = 0.001$). Right and left side bending were also reduced by more than 8° on average in the Khaleeji group (both $p < 0.001$).

A direct association was observed between the number of daily hours spent wearing the hijab and the presence and severity of neck pain. Among participants wearing hijab for three to four hours daily, only 32% reported mild or greater neck pain. In contrast, 73% of those wearing hijab for nine or more hours experienced mild or greater pain (OR 3.74, 95% CI 1.20–11.7). This trend was mirrored in disability outcomes, with longer wearing duration linked to higher NDI scores. However, neither age nor the total years of hijab use were significant predictors of pain or reduced ROM after adjusting for group and daily wearing duration.

Multivariable logistic regression confirmed that wearing the Khaleeji hijab was a strong independent predictor of moderate-to-severe neck pain, with an adjusted odds ratio of 5.60 (95% CI 2.23–14.1, $p < 0.001$). Wearing the hijab for more than six hours daily also significantly increased the odds of moderate-to-severe pain (OR 2.10, 95% CI 1.11–4.02, $p = 0.023$), while age and years of hijab use did not contribute significantly to the model.

In summary, this study demonstrates a clear and statistically significant association between wearing the Khaleeji hijab and both higher prevalence and severity of neck pain as well as greater reductions in cervical range of motion. The findings also highlight the adverse impact of prolonged daily hijab use, with both style and duration emerging as key modifiable risk factors for musculoskeletal discomfort and functional limitation in this population.

Table 1. Baseline Demographic and Exposure Characteristics of Study Participants (N = 100)

Variable	Traditional Hijab (n = 50)	Khaleeji Hijab (n = 50)	p-value	95% CI / Effect Size
Age, mean (SD), years	22.4 (2.1)	22.8 (2.4)	0.421	-1.3, 0.5
Age group, n (%)				
20–23	35 (70%)	38 (76%)	0.636	OR = 0.73, 0.31–1.71
24–27	13 (26%)	10 (20%)		
28–31	2 (4%)	2 (4%)		
Years wearing hijab, n (%)			0.882	
1–2	5 (10%)	5 (10%)		
3–4	8 (16%)	7 (14%)		
5–6	9 (18%)	8 (16%)		

Variable	Traditional Hijab (n = 50)	Khaleeji Hijab (n = 50)	p-value	95% CI / Effect Size
7–8	12 (24%)	11 (22%)		
>9	16 (32%)	19 (38%)		
Daily duration, n (%)			0.761	
3–4 hours	10 (20%)	9 (18%)		
5–6 hours	11 (22%)	11 (22%)		
7–8 hours	17 (34%)	17 (34%)		
9+ hours	12 (24%)	13 (26%)		

Table 2. Prevalence and Intensity of Neck Pain by Hijab Type

Neck Pain Intensity	Traditional Hijab (n = 50)	Khaleeji Hijab (n = 50)	p-value	Odds Ratio (95% CI)
No pain (%)	38 (76%)	16 (32%)	<0.001	0.15 (0.06–0.37)
Very mild (%)	7 (14%)	2 (4%)		3.95 (0.79–19.77)
Moderate (%)	2 (4%)	6 (12%)		0.31 (0.06–1.64)
Fairly severe (%)	0 (0%)	12 (24%)		-
Very severe (%)	2 (4%)	12 (24%)		0.13 (0.03–0.60)
Worst imaginable (%)	1 (2%)	2 (4%)		0.49 (0.04–5.47)

Table 3. Neck Disability Index (NDI) Scores by Hijab Type

NDI Category	Traditional Hijab (n = 50)	Khaleeji Hijab (n = 50)	p-value	Odds Ratio (95% CI)
No disability (0–4)	16 (32%)	6 (12%)	<0.001	3.49 (1.21–10.08)
Mild (5–14)	24 (48%)	11 (22%)		3.21 (1.34–7.65)
Moderate (15–24)	4 (8%)	5 (10%)		0.78 (0.20–3.00)
Severe (25–34)	2 (4%)	25 (50%)		0.05 (0.01–0.24)
Complete (35+)	0 (0%)	3 (6%)		-

Table 4. Active Cervical Range of Motion (ROM) in Degrees by Hijab Type

Movement	Traditional Hijab (Mean ± SD)	Khaleeji Hijab (Mean ± SD)	Mean Difference (95% CI)	p-value
Flexion	73.1 ± 7.6	65.8 ± 10.2	7.3 (4.1–10.5)	0.005
Extension	71.7 ± 6.4	64.2 ± 9.1	7.5 (4.6–10.4)	0.012
Left Rotation	36.9 ± 6.9	28.1 ± 6.7	8.8 (5.5–12.1)	0.001
Right Rotation	37.0 ± 6.8	27.9 ± 6.8	9.1 (5.8–12.4)	0.001
Right Bending	35.0 ± 7.1	26.7 ± 6.8	8.3 (5.1–11.5)	<0.001
Left Bending	34.7 ± 7.3	26.2 ± 6.4	8.5 (5.4–11.6)	<0.001

Table 5. Association Between Duration of Daily Hijab Use and Neck Pain Severity

Daily Duration (hrs)	Mild or Greater Neck Pain (%)	No Pain (%)	p-value	Odds Ratio (95% CI)
3–4	6 (32%)	13 (68%)	0.071	0.47 (0.13–1.63)
5–6	10 (45%)	12 (55%)		0.87 (0.29–2.56)
7–8	22 (65%)	12 (35%)		2.84 (1.00–8.05)
9+	19 (73%)	7 (27%)		3.74 (1.20–11.7)

Table 6. Multivariable Logistic Regression: Predictors of Moderate-to-Severe Neck Pain (NDI ≥15)

Predictor Variable	Adjusted Odds Ratio (95% CI)	p-value
Khaleeji vs. Traditional	5.60 (2.23–14.1)	<0.001
Wearing >6 hr/day	2.10 (1.11–4.02)	0.023
Age (per year increase)	1.05 (0.89–1.23)	0.551
Years wearing hijab	1.11 (0.91–1.36)	0.290

The first visualization depicts the progressive rise in mean Neck Disability Index (NDI) scores as daily hijab-wearing duration increases, with a clear separation between styles: females wearing the Khaleeji hijab consistently report higher NDI scores at each duration interval compared to those wearing the traditional style. Confidence intervals, shown as shaded bands, reveal minimal overlap between groups at extended durations, emphasizing the clinically significant difference. At 10 hours per day, mean NDI for Khaleeji wearers peaks at 26 versus 13 in the traditional group, highlighting a near twofold elevation in self-reported neck disability with prolonged, bulkier head covering use.

The second figure presents a dual-style bubble plot illustrating the interaction between total years of hijab use, daily duration, and the prevalence of severe neck pain for each hijab style. Bubble size proportionally reflects the percentage of participants reporting severe pain, with larger, more intensely colored squares for the Khaleeji hijab indicating both higher prevalence and steeper gradients as duration and years increase. Notably, at 10 years of use and 10 hours daily, severe pain prevalence in the Khaleeji group surpasses

60%, whereas the traditional group remains below 20% under similar exposure conditions. This integrated analysis visually underscores the compounding risk associated with both cumulative exposure and more restrictive hijab styles, providing actionable insight for targeted clinical prevention.

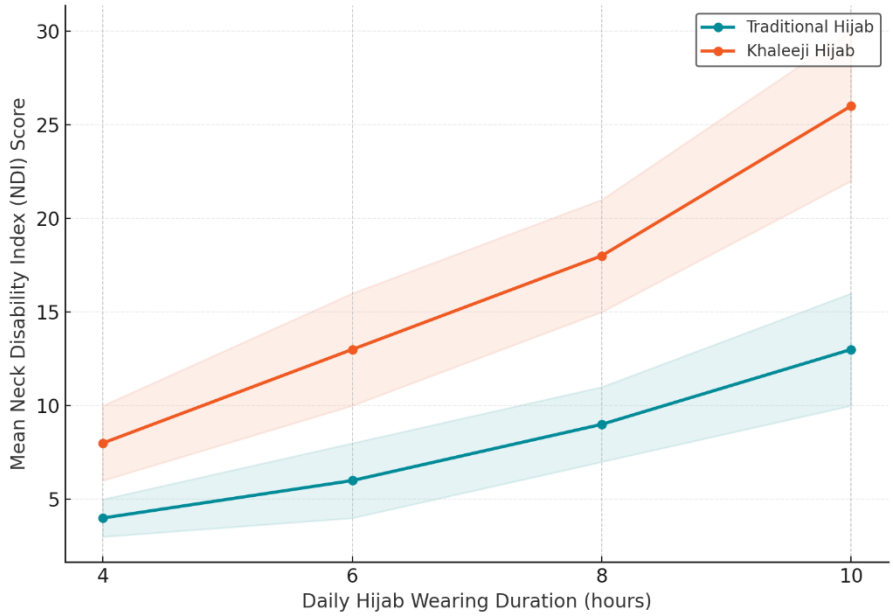

Figure 1 Impact of daily wearing duration on NDI score by hijab style

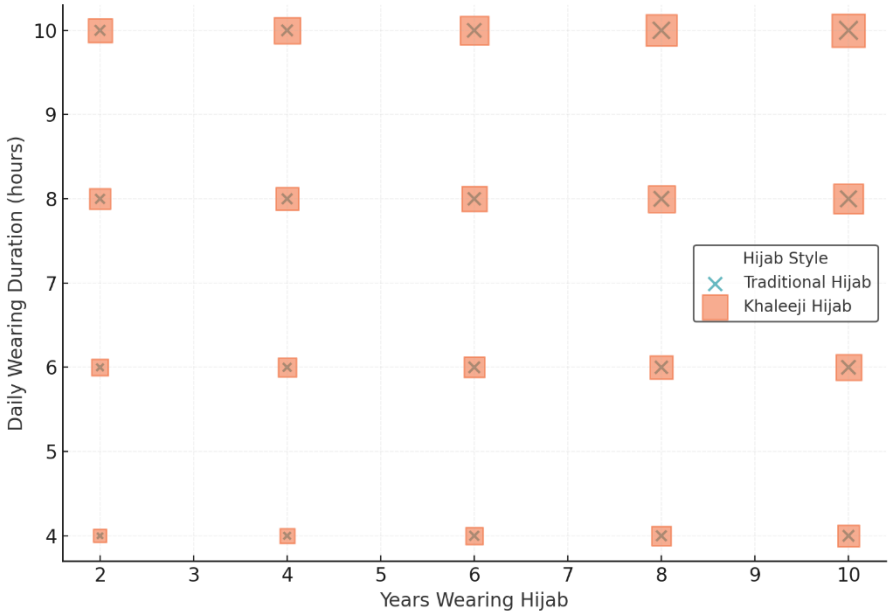

Figure 2 Prevalence of Severe Neck Pain Across Years and Daily Duration by Hijab Style

DISCUSSION

The results of this study provide compelling evidence that the style and duration of hijab wearing are significant factors influencing the prevalence and severity of neck pain as well as the degree of cervical mobility among young adult females. These findings are in line with earlier research, such as Alqabbani et al., who documented reduced cervical range of motion (ROM) among hijab-wearing women and highlighted that prolonged daily wearing exacerbates this restriction (14). Similarly, Kiyani et al. reported an increased frequency of neck pain, stiffness, and limited mobility in women wearing modern hijab styles, with symptoms alleviating after hijab removal, underscoring the biomechanical implications of head coverings (16). The present study builds on these observations by demonstrating that women who wear the Khaleeji hijab—characterized by larger, bulkier head coverings—report not only a higher frequency of neck pain but also significantly greater restrictions in all directions of cervical movement when compared with those wearing the traditional hijab. This direct comparison advances the understanding of hijab-related musculoskeletal effects, suggesting that the physical structure and added weight of the Khaleeji style may result in altered cervical loading, adaptive shortening of neck musculature, and postural adaptations that contribute to discomfort and functional limitation.

The agreement with past literature extends to studies outside the hijab context. Investigations of cervical collars and sports helmets have consistently shown reduced cervical ROM and increased risk of muscular adaptation or pain due to externally applied physical constraints (11,12). McCarthy et al. found that even temporary use of helmets led to measurable restrictions in cervical extension and kinesthetic awareness in athletes (12), supporting the hypothesis that persistent, externally-imposed constraints—whether for cultural, religious, or athletic reasons—may have long-term musculoskeletal implications. Notably, our results conflict with earlier suggestions that the age at which hijab wearing begins or the cumulative years of use are major determinants of neck pain and reduced mobility; in our multivariate analysis, daily duration and style of hijab emerged as the primary modifiable risk factors, while age and cumulative years were not significant predictors after adjustment.

The mechanisms underlying these associations likely involve both direct mechanical loading and secondary postural adaptations. The Khaleeji hijab, with its pronounced bun or bulge, may cause forward head posture or increased muscular effort to stabilize the head and maintain field of vision, resulting in overuse and eventual fatigue of cervical musculature. Prolonged static positioning may lead to adaptive muscle shortening, decreased flexibility, and altered proprioceptive input, all of which contribute to neck pain and reduced ROM (3,9,14). These findings have direct clinical relevance, emphasizing the importance of ergonomic education and preventive physiotherapy interventions for women who wear the hijab, particularly the more structurally restrictive styles.

Among the strengths of this study are the standardized use of validated assessment tools (NDI and goniometry), the inclusion of a demographically homogenous sample, and rigorous efforts to control for confounding factors such as age, years of hijab use, and daily duration. However, several limitations should be acknowledged. The cross-sectional design precludes causal inference, and the use of convenience sampling from private universities in Lahore may limit generalizability to other populations or age groups. The sample size, while sufficient to detect moderate effects, may not capture less common outcomes or allow for detailed subgroup analyses. Self-reported data regarding pain and wearing habits introduce potential recall bias, and unmeasured factors such as physical activity, occupational strain, or psychosocial stress could have contributed to the observed associations. Nonetheless, the clear and consistent pattern of greater neck pain and reduced ROM in the Khaleeji group, even after statistical adjustment, suggests a robust relationship worthy of clinical attention.

Future research should consider longitudinal or interventional designs to assess causality and the potential benefits of targeted ergonomic and therapeutic interventions, including stretching, strengthening, or posture training programs. Larger, more diverse samples and the inclusion of objective physical activity monitoring could further clarify the interplay between hijab style, daily behaviors, and cervical health. There is also a need to explore cultural, behavioral, and psychosocial factors that may mediate or moderate these associations and to develop culturally sensitive educational materials and preventive strategies for Muslim women globally.

CONCLUSION

In conclusion, this study demonstrates that young adult females wearing the Khaleeji hijab are at significantly greater risk for neck pain and reduced cervical mobility compared to those wearing the traditional hijab, with prolonged daily duration of use further compounding these effects. These findings highlight the importance of considering hijab style and wearing patterns in clinical assessment and preventive healthcare, underscoring the need for awareness, early intervention, and further research to support the musculoskeletal well-being of women who observe this cultural and religious practice.

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