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FREQUENCY OF MUSCULOSKELETAL PAIN AMONG FEMALE CAR DRIVERS": A DESCRIPTION CROSS-SECTIONAL STUDY

Original Research

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Acknowledgement: We sincerely thank all participating female drivers for their time and cooperation, and acknowledge the support of those who assisted in data collection and study coordination.

Conflict of Interest: None

Grant Support & Financial Support: None

ABSTRACT

Background: Musculoskeletal pain is a leading cause of disability worldwide and is frequently associated with prolonged sitting, repetitive movements, and suboptimal driving ergonomics. Despite the increasing number of licensed female drivers in Pakistan, limited data exist regarding their musculoskeletal health.

Objective: To determine the frequency and anatomical distribution of musculoskeletal pain among licensed female car drivers in Islamabad and Rawalpindi.

Methodology: A descriptive cross-sectional study was conducted over thirteen months among 377 licensed female drivers aged 18–40 years using non-probability convenience sampling. Participants with at least six months of driving experience were included, while those with recent trauma, surgery, major musculoskeletal or neurological disorders, or pregnancy were excluded. Data were collected through face-to-face and online administration of the Extended Nordic Musculoskeletal Questionnaire, assessing symptoms in nine body regions over specified time periods. Demographic and driving-related information were also recorded. Data were analyzed using SPSS version 21 and presented as frequencies and percentages.

Results: Neck pain was the most frequently reported complaint (49.9%), followed by shoulder (46.2%) and low back pain (41.4%). Upper back pain was reported by 29.7% of participants, while other regions showed lower frequencies. Over the previous twelve months, neck pain remained most prevalent (40.8%), followed by low back (30.0%) and shoulder pain (28.9%). Activity limitation was primarily associated with neck (14.6%) and low back pain (11.4%). Some participants required medical consultation, medication, or temporary work modification due to symptoms.

Conclusion: Musculoskeletal pain is highly prevalent among female drivers, particularly affecting the neck, shoulders, and lower back. Early ergonomic education and preventive rehabilitation strategies are essential to reduce functional limitations in this under-researched population.

Keywords: Automobile Driving; Ergonomics; Female; Musculoskeletal Pain; Occupational Health; Prevalence.

INTRODUCTION

Musculoskeletal disorders are a diverse group of conditions affecting the locomotor system and are recognized as a major cause of impaired mobility, activity limitation, and restricted social participation (1). They represent one of the leading contributors to global disability, substantially reducing work productivity and increasing healthcare costs across regions (2). More than 150 conditions fall under this category according to the International Classification of Diseases (3), and an estimated 1.71 billion people are affected worldwide (1). Low back pain, neck pain, osteoarthritis, and rheumatoid arthritis account for a considerable proportion of this burden (1). Globally, musculoskeletal disorders contribute to nearly 16% of years lived with disability, with prevalence estimates ranging from 20% to 33% depending on age and condition (4) Regional data indicate substantial variation, with reported prevalence ranging from 23% to 45% in Latin America, 26.8% in South India, 17% in Mexico, and 50% in Peru (5). Community-based studies using COPCORD methodology have reported musculoskeletal pain prevalence between 7% and 14% in India, 36.19% in Indonesia, and 41.9% to 54.13% in Iran (6-8), while Bangladesh and Kuwait have reported rates of 26% and 39%, respectively (9.10), and Argentina 53.7% (11).

Despite this global burden, reliable and updated epidemiological data remain limited in low- and middle-income countries, including Pakistan. The last COPCORD survey conducted in northern Pakistan more than two decades ago reported a point prevalence of 14.7% for musculoskeletal pain (12). Occupational and mechanical factors such as prolonged sitting, repetitive movements, and exposure to vibration significantly aggravate musculoskeletal symptoms (13,14). Although driving appears physically undemanding, maintaining a static posture for extended periods imposes sustained load on the cervical and lumbar spine as well as the shoulder girdle (13–15). Prolonged static muscle contraction may result in localized fatigue, discomfort, and pain, which can persist beyond driving hours and affect daily functioning and productivity (15,16).

Professional drivers have consistently demonstrated high rates of musculoskeletal pain, particularly in the lower back, neck, and shoulders (17). Systematic reviews and meta-analyses report prevalence ranging from 43% to 93% among drivers globally, with prolonged driving hours, poor posture, whole-body vibration, and limited physical activity identified as major risk factors (18-20). Local and regional cross-sectional studies further confirm the association between incorrect driving posture and low back pain (21). However, most available evidence focuses predominantly on male commercial drivers such as bus, truck, or taxi operators (22,23), limiting generalizability to other driver groups.

Women experience musculoskeletal pain more frequently and often report higher pain intensity and longer symptom duration compared to men (24–26). Hormonal influences, particularly estrogen-related changes in connective tissue properties, along with differences in pain perception and coping mechanisms, may contribute to this disparity (25-27). In Pakistan, studies have shown a considerable burden of musculoskeletal pain among women in community and household settings (28-30); however, no published data specifically address musculoskeletal pain among non-commercial female drivers. This represents a significant gap, particularly as the number of licensed female drivers in urban centers continues to increase.

Given the combined influence of prolonged static posture, vehicle ergonomics, and gender-specific biological factors, female drivers may be at substantial risk for musculoskeletal symptoms. Yet, their musculoskeletal health remains underexplored in local literature. Generating baseline data is essential to inform ergonomic recommendations, preventive strategies, and rehabilitation planning tailored to this growing population. Therefore, this study was conducted to determine the frequency and anatomical distribution of musculoskeletal pain among licensed female drivers in Islamabad and Rawalpindi using the Extended Nordic Musculoskeletal Questionnaire(31).

METHODS

This descriptive cross-sectional study was conducted over a period of one year, from February 2025 to February 2026, following approval from the Ethical Review Committee of Foundation University School of Health Sciences (FF/FUMC/215-598/ Phy/25). Data were collected from licensed female car drivers residing in Rawalpindi and Islamabad. A non-probability convenience sampling technique was employed to recruit participants who met the predefined eligibility criteria. The required sample size of 377 was calculated

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using Rao soft software, assuming a population size of 20,000, a 95% confidence interval, 5% margin of error, and 50% response distribution.

Female drivers aged 18–40 years, holding a valid driving license and residing in the twin cities, were included in the study. Participants with a history of recent accidents or surgery within the last three months, major musculoskeletal disorders such as thoracic outlet syndrome, osteoarthritis, frozen shoulder, rotator cuff injury, or sciatica, diagnosed neurological disorders including epilepsy or multiple sclerosis, pregnancy, or those driving vehicles other than cars were excluded.

Data were collected using the Extended Nordic Musculoskeletal Questionnaire (NMQ-E), a structured and widely used instrument designed to assess musculoskeletal symptoms in nine body regions (31-33). The questionnaire defines "trouble" as ache, pain, or discomfort and uses a body chart representation for symptom identification. It consists of binary (Yes/No) responses, generating multiple data points across specified anatomical regions. For scoring purposes, "Yes" was coded as 1 and "No" as 0, with higher scores indicating greater symptom burden. The NMQ-E demonstrates excellent reliability, with a mean intraclass correlation coefficient of 0.97 (95% CI 0.94–0.99), Cronbach's alpha ≥0.87 across body regions, and kappa values ranging from 0.71 to 0.92 (34). The original NMQ has also shown good construct validity and moderate-to-excellent reliability across populations.

Data was obtained through both face-to-face and online questionnaire administration after obtaining informed consent. Demographic characteristics and driving-related information were also recorded. Ethical approval was granted by the Ethical Review Committee of Foundation University School of Health Sciences, and the study was conducted in accordance with the Declaration of Helsinki. Confidentiality and anonymity were strictly maintained, and all responses were coded to protect participant identity.

Data from 377 participants were entered and analyzed using SPSS version 21. Categorical variables were summarized as frequencies and percentages, and results of the Extended Nordic Musculoskeletal Questionnaire were presented accordingly.

RESULTS

A total of 377 licensed female drivers were included in the final analysis after applying inclusion and exclusion criteria. Most participants were aged 18–25 years (70.8%). Nearly half had normal BMI (48.0%), while 19.6% were obese. The majority had no children (85.1%) and were students (55.7%). Most participants were not primary caregivers (84.4%) and primarily drove automatic cars (76.9%) (Table 1).

Table 1: Participant Demographics

Variable	Category	n (%)
Age (years)	18–25	265 (70.8%)
	26–35	81 (21.5%)
	36–40	29 (7.7%)
BMI Category	Underweight	63 (16.7%)
	Normal weight	181 (48.0%)
	Overweight	59 (15.6%)
	Obese	74 (19.6%)
Number of Children	0	321 (85.1%)
	1	16 (4.2%)
	2	26 (6.9%)
	3	10 (2.7%)

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Variable	Category	n (%)
	4	4 (1.1%)
Employment Status	Student	210 (55.7%)
	Employed	133 (35.3%)
	Housewife	27 (7.2%)
	Self-employed	7 (1.9%)
Primary Caregiver	Yes	59 (15.6%)
	No	318 (84.4%)
Transmission Type	Automatic	290 (76.9%)
	Manual	87 (23.1%)

Neck pain was the most frequently reported symptom (49.9%), followed by shoulder (46.2%) and low back pain (41.4%). Elbows were the least affected region (5.0%) (Table 2).

Table 2: Lifetime Prevalence of Musculoskeletal Symptoms by Body Region

Body Region	n (%)
Neck	188 (49.9%)
Shoulders	174 (46.2%)
Low Back	156 (41.4%)
Upper Back	112 (29.7%)
Hip/Thigh	52 (13.8%)
Wrist/Hands	51 (13.5%)
Ankles/Feet	51 (13.5%)
Knees	44 (11.7%)
Elbows	19 (5.0%)

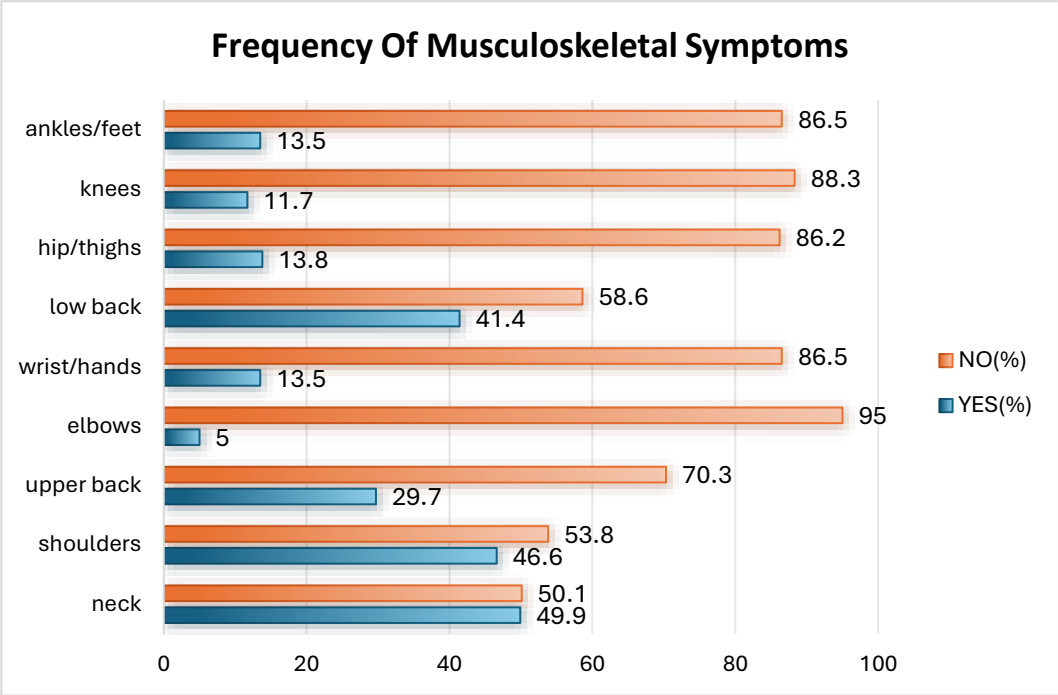

Figure 1 Bar chart depicting the frequency of musculoskeletal symptoms among 9 body regions

During the past 12 months, neck pain remained most prevalent (40.8%), followed by low back (30.0%) and shoulder pain (28.9%). A similar pattern was observed in the last month and on the day of assessment, with neck symptoms consistently reported as the most frequent complaint (Table 3).

Table 3: Musculoskeletal Symptoms Over Time

Body Region	Past 12 Months n (%)	Last Month n (%)	Today n (%)
Neck	154 (40.8)	120 (31.8)	66 (17.5)
Low Back	113 (30.0)	111 (29.4)	63 (16.7)
Shoulders	109 (28.9)	102 (27.1)	52 (13.8)
Upper Back	73 (19.4)	68 (18.0)	36 (9.5)
Hip/Thigh	36 (9.5)	30 (8.0)	19 (5.0)
Wrist/Hands	39 (10.3)	30 (8.0)	14 (3.7)
Ankles/Feet	38 (10.1)	33 (8.6)	21 (5.6)
Knees	24 (6.4)	25 (6.6)	10 (2.7)
Elbows	8 (2.1)	6 (1.6)	3 (0.8)

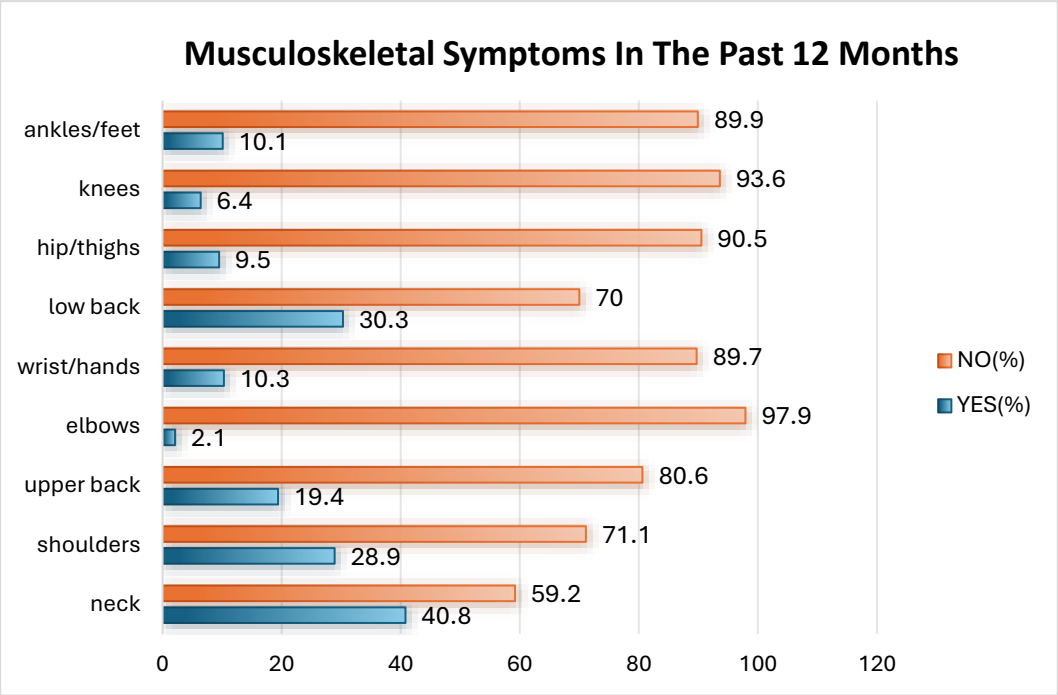

Figure 2 Bar chart for Musculoskeletal symptoms in past 12 months.

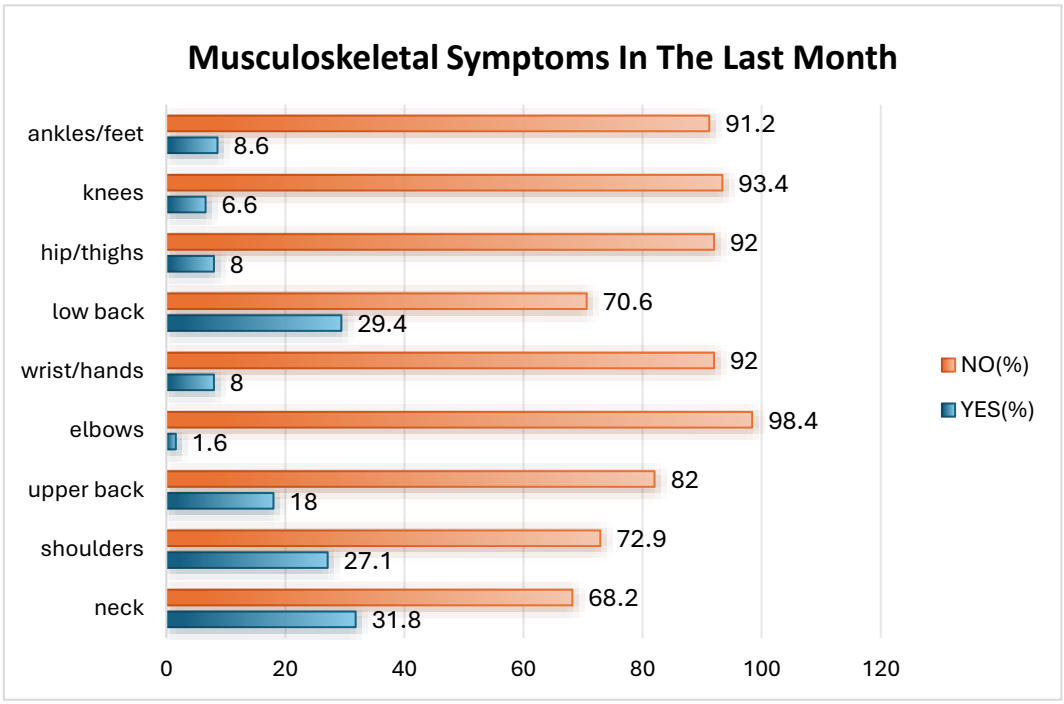

Figure 3 Bar chart for Musculoskeletal symptoms in the last month

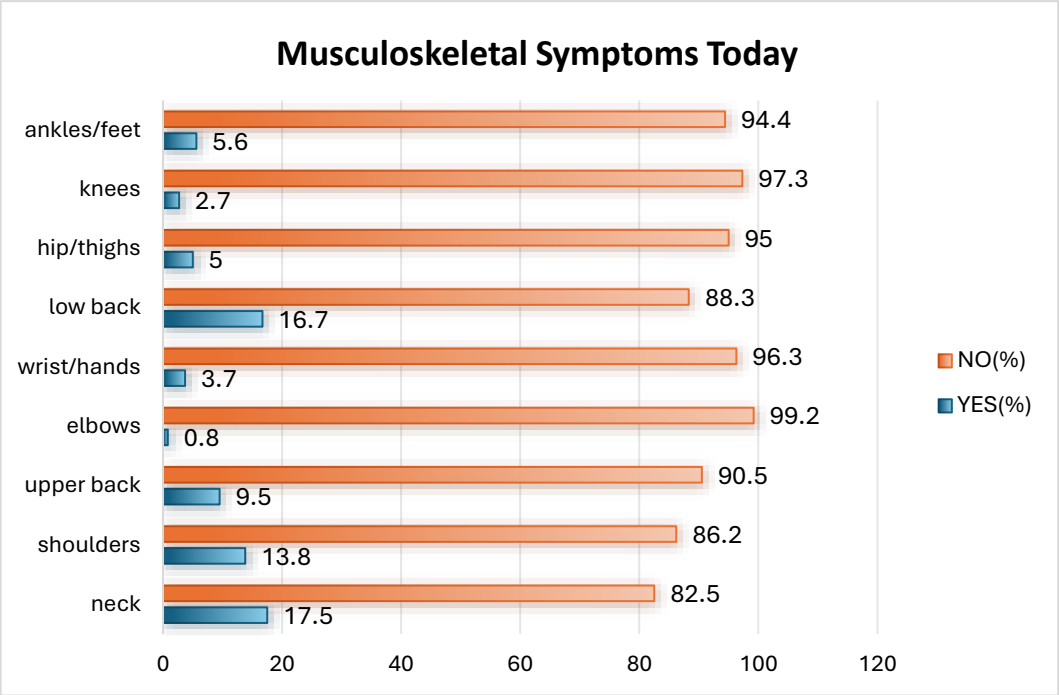

Figure 4 Bar chart for Musculoskeletal symptoms today

Neck pain was the leading cause of activity limitation (14.6%), physician visits (11.1%), medication use (20.2%), and sick leave (8.2%). Low back pain was the most common reason for job modification (5.6%) and hospitalization (2.4%). Overall, the functional burden of musculoskeletal symptoms was primarily associated with the cervical and lumbar regions (Table 4).

Table 4: Functional Impact of Musculoskeletal Symptoms (Past 12 Months)

Body Region	Activity Limitation n (%)	Physician Visit n (%)	Medication Use n (%)	Sick Leave n (%)	Job Change n (%)	Hospitalization n (%)
Neck	55 (14.6)	42 (11.1)	76 (20.2)	31 (8.2)	17 (4.5)	8 (2.1)
Low Back	43 (11.4)	38 (10.1)	74 (19.6)	28 (7.4)	21 (5.6)	9 (2.4)
Shoulders	39 (10.3)	35 (9.3)	63 (16.7)	27 (7.2)	15 (4.0)	5 (1.3)
Upper Back	31 (8.2)	34 (9.0)	45 (12.0)	17 (4.5)	11 (2.9)	2 (0.5)
Hip/Thigh	13 (3.4)	16 (4.2)	20 (5.3)	5 (1.3)	4 (1.1)	1 (0.3)
Wrist/Hands	15 (4.0)	14 (3.7)	13 (3.4)	7 (1.9)	12 (3.2)	4 (1.1)
Ankles/Feet	15 (4.0)	11 (2.9)	20 (5.3)	14 (3.7)	9 (2.4)	8 (2.1)
Knees	13 (3.4)	7 (1.9)	13 (3.4)	1 (0.3)	7 (1.9)	4 (1.1)
Elbows	3 (0.8)	4 (1.1)	3 (0.8)	4 (1.1)	2 (0.5)	2 (0.5)

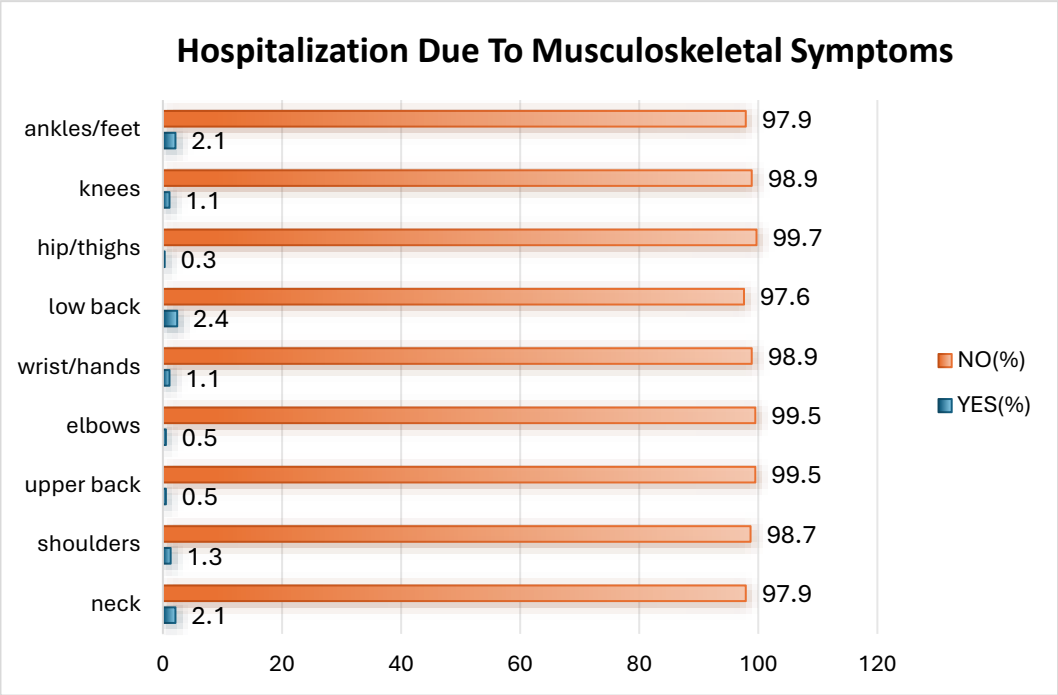

Figure 5 Bar chart for hospitalization due to musculoskeletal symptoms in body regions

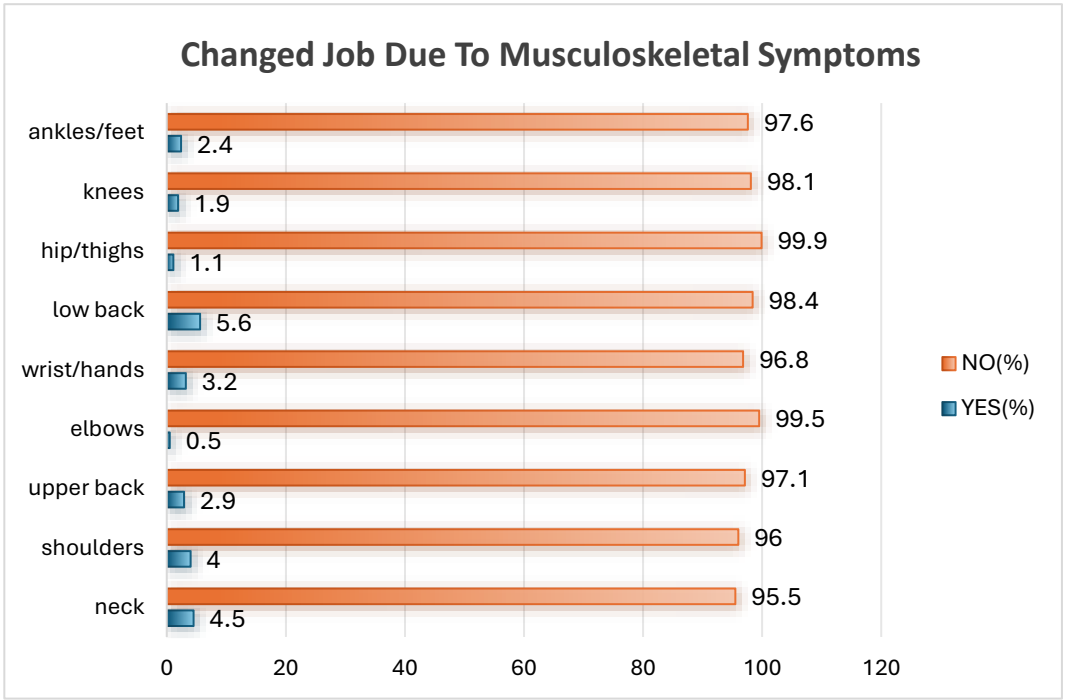

Figure 6 Bar chart for changing job due to musculoskeletal symptoms in body regions

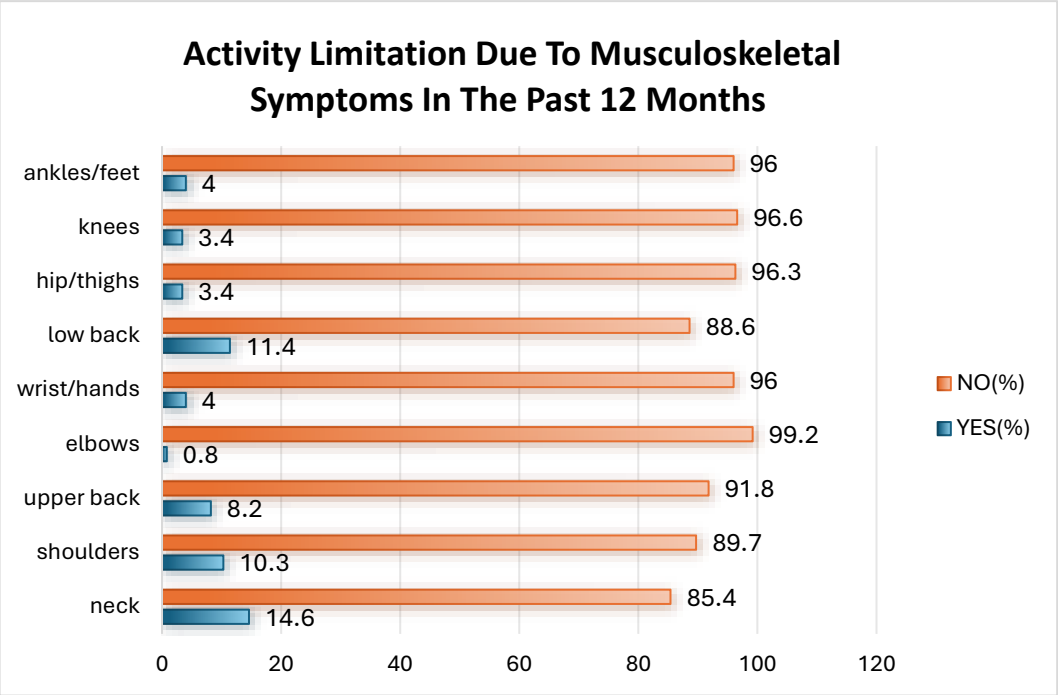

Figure 7 Bar chart for activity limitations due to musculoskeletal symptoms

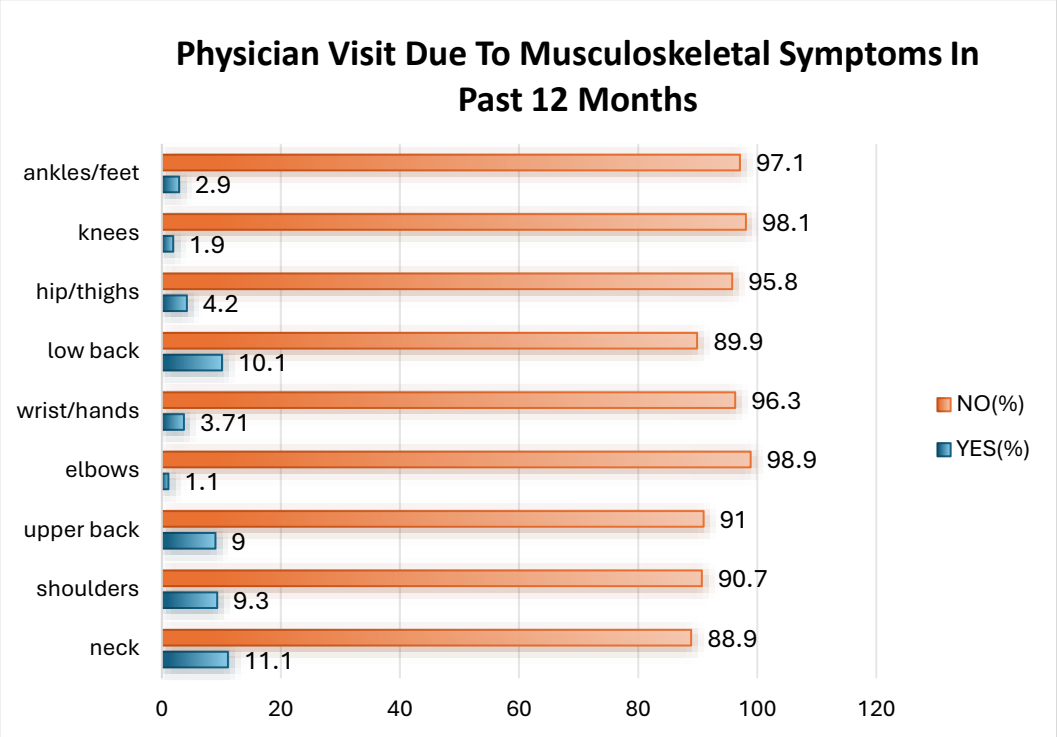

Figure 8 Bar chart depicting physician visit for musculoskeletal symptoms in the past 12 months

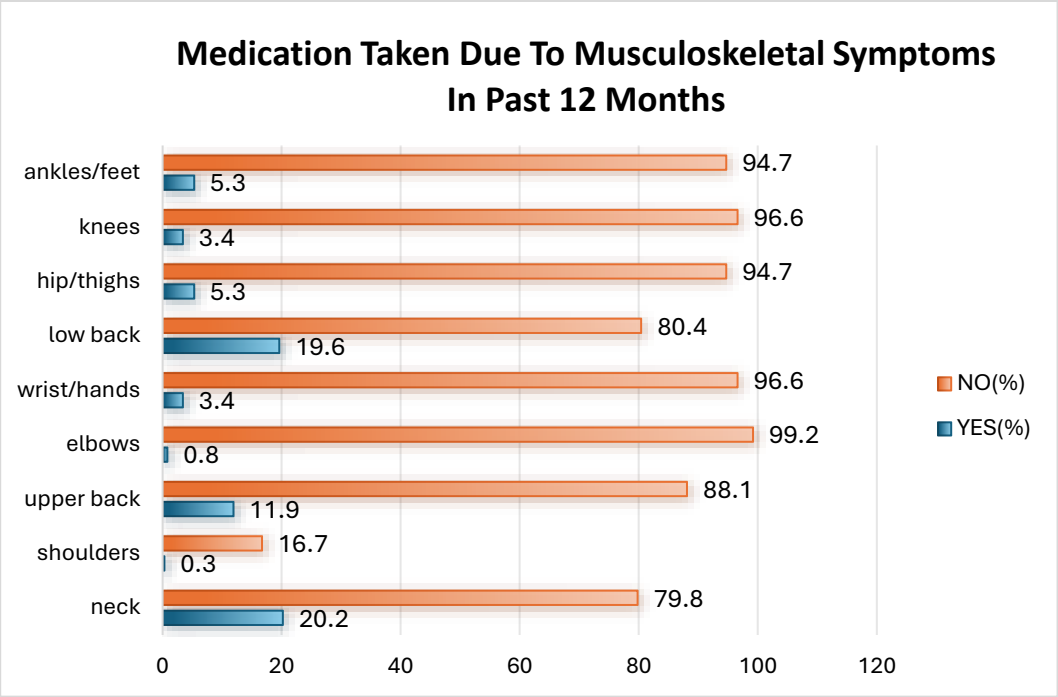

Figure 9 Bar chart depicting medication intake for musculoskeletal symptoms in the past 12 months

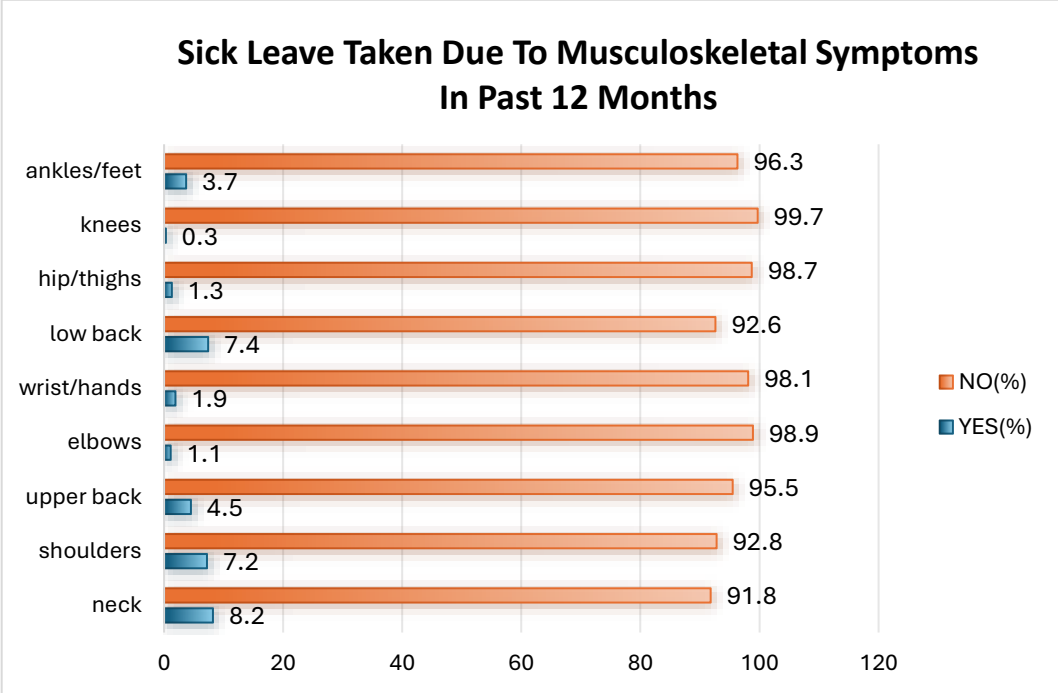

Figure 10 Bar chart for sick leave due to musculoskeletal symptoms

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DISCUSSION

The present study demonstrated a high prevalence of musculoskeletal pain among licensed female drivers in Rawalpindi and Islamabad, with the neck, shoulders, and lower back emerging as the most frequently affected anatomical regions across different recall periods. These findings suggested that musculoskeletal complaints were not confined to occupational or commercial drivers but were also prominent among non-commercial female drivers exposed to routine vehicular use. The predominance of neck pain indicated sustained cervical flexion, inadequate headrest positioning, limited postural variation, and repetitive micro-adjustments during steering as likely contributory mechanisms. Comparable observations were documented by Hakim and Mohsen, who reported that prolonged static posture and poor seat ergonomics significantly increased the risk of cervical and lumbar discomfort among drivers (24). Similarly, Joseph et al. identified neck pain as a leading musculoskeletal complaint among professional drivers, attributing symptoms primarily to prolonged sitting and restricted movement patterns (25). Although their cohort comprised occupational drivers, the convergence in anatomical distribution reinforced the biomechanical demands of driving itself as a fundamental risk factor. Shoulder pain was also highly prevalent, plausibly associated with sustained arm elevation, prolonged gripping of the steering wheel, and inadequate upper limb support. Pickard et al. linked shoulder symptoms in drivers to steering-related static loading and suboptimal ergonomic alignment (20). Low back pain demonstrated measurable functional consequences, including activity limitation, medication use, and physician consultations. Rezaei et al. reported comparable lumbar involvement among taxi drivers, emphasizing prolonged seated posture and insufficient lumbar support as primary contributors (18). Kurtul and Güngördü further identified associations between body mass index, driving duration, and spinal symptoms, underscoring cumulative mechanical loading as a central mechanism (28). The consistency of spinal involvement across commercial and non-commercial populations indicated that sustained seated posture, trunk stabilization, and vibration exposure were sufficient to induce clinically relevant symptoms irrespective of occupational classification. These findings collectively supported the premise that routine driving constituted a significant biomechanical exposure capable of precipitating musculoskeletal dysfunction among women.

The age distribution of symptoms in the present cohort showed a relatively higher proportion of younger participants reporting pain, who documented greater prevalence among older drivers (29). Variations in lifestyle patterns, physical conditioning, occupational roles, and sociocultural demands may have contributed to this discrepancy. Biological influences unique to women were also considered relevant. Chidi-Ogbolu and Baar highlighted the modulatory effects of estrogen on connective tissue properties, including ligament laxity and tendon compliance, potentially altering mechanical load tolerance under repetitive stress (27, 30). Bajaj et al. demonstrated menstrual phase–related fluctuations in pain perception, suggesting that hormonal variability may modulate nociceptive thresholds under chronic mechanical strain (31). Although wrist, hand, and lower limb symptoms were comparatively less frequent, they remained clinically meaningful and were plausibly linked to repetitive gripping of the steering wheel and sustained pedal operation, consistent with the findings of Pickard et al. and Kasemsan et al. (20, 32, 33). The relatively low frequency of hospitalization and job modification suggested predominantly mild-to-moderate symptom severity; however, the presence of activity limitation and healthcare utilization reflected tangible functional impact, aligning with observations (34). The study possessed several strengths, including the use of a standardized and validated assessment instrument, inclusion of a community-based female cohort, and comprehensive regional symptom evaluation across multiple recall periods, thereby enhancing internal consistency and comparability with existing literature. Nonetheless, limitations were acknowledged. Reliance on self-reported data introduced potential recall bias, and the cross-sectional design precluded causal inference or temporal assessment of symptom progression. Confounding variables such as body mass index, driving duration, physical activity level, ergonomic configuration, psychological stress, occupational workload, and domestic responsibilities were not controlled, limiting analytical precision. Convenience sampling and geographic restriction to Rawalpindi and Islamabad constrained generalizability to broader populations. Despite these limitations, the findings underscored the multifactorial etiology of driving-related musculoskeletal pain among women and reinforced the need for ergonomic education, posture optimization, preventive exercise strategies, and gender-sensitive interventions to mitigate functional impairment within this demographic.

CONCLUSION

In conclusion, this study revealed a high frequency of musculoskeletal pain among licensed female car drivers in Islamabad and Rawalpindi, with the neck, shoulders, and lower back being the most commonly affected regions. The findings highlight that even non-commercial driving is associated with significant biomechanical strain, leading to activity limitations, healthcare utilization, and functional burden, particularly involving the cervical and lumbar spine. The consistent predominance of neck pain across different recall

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periods underscores the impact of prolonged static posture and suboptimal driving ergonomics. Although most symptoms were mild to moderate in severity, their cumulative effect on daily activities emphasizes the need for early ergonomic awareness, posture correction strategies, regular physical activity, and preventive rehabilitation programs tailored specifically for female drivers. Further longitudinal and analytical studies are recommended to explore causal relationships and modifiable risk factors to support evidence-based intervention planning.

AUTHOR CONTRIBUTIONS

Author	**Contribution**
Shanzey Fatima	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Maham Riaz	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Manahil Shahid*	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Fatima Waqar	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Minahil Nouman	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Fizzah Amir	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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