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RESEARCH ARTICLE
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PREVALENCE AND ASSOCIATED RISK FACTORS OF LOWER BACK PAIN AMONG FEMALES OF RURAL AND URBAN AREAS

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ABSTRACT

Background: Lower back pain (LBP) is a leading cause of disability worldwide, disproportionately affecting women due to physiological, occupational, and lifestyle factors. Despite its prevalence, region-specific data on female LBP in both rural and urban settings remain limited in Pakistan.

Objective: To determine the prevalence and associated risk factors of lower back pain among females in rural and urban populations.

Methods: A cross-sectional study was conducted from June 2023 to January 2025 at Al-Rehman Clinic, Mianwali, Pakistan, n=154 adult female participants. Data were collected using a physician-designed questionnaire that assessed pain location, lifestyle, occupation, sleep patterns, dairy intake, and family history. Statistical analysis was performed using SPSS, with descriptive and cross-tab analyses presented in both tabular and graphical forms.

Results: The prevalence of lower back pain was 77.3%, with higher rates among women aged 25–54, those with sedentary or physically intensive occupations, poor sleep quality, and low physical activity. Urban and rural women both exhibited high LBP rates, with subtle variations in pain distribution. Neither dairy consumption nor family history showed significant protective associations.

Conclusion: LBP is highly prevalent among females across diverse settings, primarily driven by modifiable behavioral and occupational factors. Interventions promoting physical activity, ergonomic awareness, and sleep hygiene are urgently needed to reduce the burden and improve women's musculoskeletal health.

Keywords: Lower back pain, women's health, rural and urban populations, risk factors, physical activity, sleep hygiene, ergonomic stress, Pakistan, cross-sectional study.

INTRODUCTION

Lower back pain (LBP) is one of the most widespread and burdensome musculoskeletal disorders globally, representing a leading cause of years lived with disability in both high-income and low- to middle-income countries. According to the Global Burden of Disease Study (GBD), LBP affects an estimated 540 million people worldwide at any given time and remains a persistent public health challenge due to its chronic nature, economic cost, and functional limitations it imposes on affected individuals[1]. Although LBP affects people of all ages, genders, and occupational backgrounds, there is growing recognition that women are disproportionately affected due to a confluence of anatomical, physiological, occupational, and social determinants that interact in complex ways [2].

In women, the risk of developing lower back pain is amplified by unique biomechanical and hormonal factors. The female anatomy, including a wider pelvic structure, increased lumbar lordosis, and a relatively lower muscle-to-fat ratio, contributes to decreased spinal support and greater strain on the lower back. Additionally, the hormonal changes associated with menstruation, pregnancy, and menopause can influence ligament laxity and joint stability, further predisposing women to musculoskeletal discomfort and injury. Pregnancy, in particular, introduces significant biomechanical stress due to changes in weight distribution, posture, and centre of gravity, while postnatal physical strain, especially in the absence of postpartum physiotherapy or support, may result in long-term spinal complications [3].

Beyond physiological differences, the social and occupational roles predominantly assigned to women also contribute substantially to the burden of LBP. In many developing countries, women are involved in a wide spectrum of physically demanding tasks ranging from domestic chores to agricultural Labor, often performed under ergonomically unfavourable conditions and with minimal rest or mechanical support [4]. Repetitive lifting, prolonged standing, continuous bending during household work or caregiving, and the absence of assistive devices significantly elevate the risk of developing lower back pain. Even in urban environments, where occupational roles may be less physically strenuous, women often engage in sedentary work involving extended hours of sitting, poor posture, and inadequate physical activity, factors equally detrimental to spinal health [5].

Lifestyle behaviors, such as physical inactivity, high body mass index (BMI), poor nutritional status, inadequate calcium and vitamin D intake, smoking, and sleep disturbances, are well-documented contributors to the development and perpetuation of LBP [6]. Sleep quality and duration, for instance, have been closely linked to pain perception and chronic pain syndromes. Inadequate or irregular sleep, a common consequence of psychosocial stress and modern work-life imbalance, may lower the threshold for experiencing musculoskeletal discomfort. Furthermore, limited awareness of ergonomics, absence of regular exercise, and insufficient participation in rehabilitative activities (e.g., stretching, yoga, physiotherapy) exacerbate the risk [7].

Geographical location, particularly the rural–urban divide, plays a pivotal role in shaping the epidemiology and clinical presentation of LBP. Rural women often engage in subsistence-level manual labor with limited mechanization, lack of ergonomic training, and poor access to healthcare services. Health literacy in these areas may also be lower, resulting in delayed diagnosis, inappropriate self-treatment, and progression to chronic or disabling pain. On the other hand, urban women, despite better access to healthcare facilities, frequently encounter risk factors such as sedentary lifestyles, psychological stress, and reduced opportunities for physical activity. While the risk profiles differ between rural and urban areas, the burden remains substantial in both settings, necessitating context-specific interventions [8].

Despite the growing burden of LBP, especially among women, there is a dearth of gender-specific and geographically stratified epidemiological studies in low- and middle-income countries. In particular, Pakistan faces a unique challenge wherein female health issues, especially non-communicable and chronic musculoskeletal conditions, are often underreported, underprioritized, and poorly addressed within the healthcare system. Limited data exist on how LBP prevalence and

associated risk factors vary between women residing in rural versus urban environments. Most available studies generalize findings across genders or fail to account for contextual variables such as occupation, lifestyle, socioeconomics, and cultural practices [9].

Addressing this knowledge gap is essential for formulating evidence-based public health strategies and allocating resources efficiently. Without a granular understanding of how rural and urban women experience and manage LBP, health policy remains inadequately informed and interventions poorly targeted. Gender-sensitive, location-specific data are imperative for guiding prevention, diagnosis, and management strategies that are culturally appropriate and practically applicable [10].

Therefore, the present study aims to comprehensively assess the prevalence of lower back pain among females in rural and urban areas, and to identify the key demographic, occupational, lifestyle, and behavioural risk factors associated with LBP in these populations. By delineating these differences, this research intends to contribute meaningful insights into the contextual etiology of LBP and to support the development of tailored, community-oriented health promotion and pain prevention strategies [11].

MATERIALS AND METHODS

Study Design and Duration:

This study was conducted as a cross-sectional, community-based analytical investigation to assess the prevalence and associated risk factors of lower back pain among females in both rural and urban regions. The study was carried out over nineteen months, starting from June 2023 and concluding in January 2025, at Al-Rehman Clinic, Mianwali, Pakistan. The design allowed for the simultaneous collection and analysis of data across diverse community settings, facilitating comparison between rural and urban populations.

Study Setting and Population:

The study population consisted of adult female residents aged between 18 and 60 years, recruited from selected rural and urban communities through household visits and clinic-based interviews. Al-Rehman Clinic served as the primary base of operations, where urban participants were invited for interviews, while rural participants were assessed through outreach visits. Inclusion criteria required participants to be permanent residents of their respective areas for at least one year. Exclusion criteria included pregnancy, postpartum status within six months, a history of spinal surgery or deformity, neurological impairment, or any condition that could independently account for back pain. Those unable to provide informed consent or complete the survey were also excluded.

Sampling Technique and Sample Size Calculation:

The study employed a stratified random sampling technique, with stratification based on residence (rural or urban). Within each stratum, a randomized list of households was generated, and one eligible female participant per household was selected using simple random sampling. The required sample size was calculated using the standard formula for prevalence studies:

$$n = \frac{Z^2 \times p \times (1-p)}{d^2}$$

In this formula:

- nnn is the required sample size,
- ZZZ is the Z-score for a 95% confidence level (1.96),
- ppp is the estimated prevalence of lower back pain (assumed at 0.5 for maximum variability),
- ddd is the margin of error, set at 0.08 (8%).

Substituting these values:

$$n = \frac{(1.96)^2 \times 0.5 \times (1-0.5)}{(0.08)^2} = \frac{3.8416 \times 0.25}{0.0064} = \frac{0.9604}{0.0064} \approx 150$$

Thus, the minimum required sample size was 150. To enhance power and accommodate any potential non-responses, a final sample of 154 participants was selected, including respondents from both rural and urban backgrounds.

Data Collection Tool and Procedure:
Data were collected through a structured and pre-validated questionnaire developed after a thorough literature review and expert consultation. The questionnaire comprised five major sections: sociodemographic information (age, marital status, education, residence, and occupation), lifestyle and behavioural factors (physical activity, diet, and sleep patterns), occupational profile (working hours, physical workload, posture), clinical details (site and duration of pain, comorbid conditions), and family history of lower back pain. Interviews were conducted either at Al-Rehman Clinic or in participants' homes, depending on their location. Trained female healthcare workers conducted the interviews in Urdu or English, depending on the respondent's preference. Each interview took approximately 15 to 20 minutes and was conducted in a private setting to ensure comfort and confidentiality.

Ethical Considerations:
Before data collection, ethical approval was obtained from the institutional review board associated with Al-Rehman Clinic. All participants were provided with written and verbal explanations about the purpose and procedures of the study, along with assurances regarding confidentiality and the voluntary nature of participation. Written informed consent was obtained before enrolment. Participants were informed of their right to withdraw from the study at any point without any consequences.

Data Analysis:
All collected data were entered, cleaned, and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics, including frequencies and percentages, were used to summarize categorical variables such as age group, pain location, occupation type, and sleep habits. To determine associations between lower back pain and independent risk factors such as area of residence, working hours, physical activity, and sleeping patterns, cross-tabulations were conducted. The Chi-square test of independence was applied to evaluate the statistical significance of these associations. A p-value less than 0.05 was considered statistically significant. The analytical findings were used to draw comparisons between rural and urban populations, identify high-risk groups, and provide clinical insights that could support preventive and therapeutic strategies in primary care settings such as Al-Rehman Clinic.

RESULTS

The 154 adult women included in this study reported a strikingly high burden of musculoskeletal pain, with lower back pain (LBP) overwhelmingly predominant across all subgroups. Overall, 77.3% of participants identified the lumbar region as their primary site of discomfort (Table 1, Figure 1), dwarfing reports of leg pain (13.0%), other regional complaints (7.1%), and buttocks pain (2.6%). This pervasive lumbar symptomatology persisted regardless of age, occupation, or residential setting, although its absolute prevalence varied by more than 30 percentage points from a low of 68.2% in the youngest cohort (18–24 years) to a peak of 100% in the 45–54 age group (Table 2, Figure 2).
Manual and sedentary occupational roles alike were strongly associated with LBP: retirees and technical trades workers reported universal LBP, while office-based professionals also suffered 90.0% prevalence (Table 3, Figure 3). Rural inhabitants experienced marginally higher LBP (80.6%) than urban counterparts (76.3%), reflecting the heavy-labor demands of agricultural and domestic work, whereas urban women exhibited a broader distribution of distal pain likely driven by sedentary lifestyles (Table 4, Figure 4). Marital and caregiving responsibilities further amplified lumbar strain; married, divorced, and widowed women all exceeded 88% LBP (Table 5, Figure 5), and the relationship between workload, lifestyle, and rest was non-linear. Part-time workers endured the

highest LBP (84.0%), "mostly sedentary" lifestyles correlated with a staggering 90.5% LBP, and irregular sleep patterns rose to 85.7% LBP (Tables 6–8, Figures 6–8). Nutritional habits and genetic predisposition proved less predictive: dairy intake and positive family history were not protective and, in some groups, inversely associated with LBP (Tables 9–10, Figures 9–10). Collectively, these findings reveal a multifaceted interplay of biomechanical, behavioral, and psychosocial determinants driving the LBP epidemic among women in both rural and urban settings.

Overall, Pain Distribution:

As shown in Table 1 and Figure 1, lower back pain was by far the most prevalent complaint, affecting 119 of 154 women (77.3%). This dominance of lumbar symptoms over five times more frequent than leg pain (13.0%) and nearly thirty times more than buttocks pain (2.6%) highlights the lumbar spine as the primary locus of musculoskeletal burden in this cohort. The relative paucity of non-lumbar pain (other sites 7.1%, buttocks 2.6%) suggests that while radicular and hip-related syndromes are present, they constitute a small fraction of the overall pain profile. Clinicians should therefore prioritize diagnostic and therapeutic strategies that target the lumbar region without neglecting the minority whose symptoms localize elsewhere.

Table 1. Demographics and Overall Pain Location (N = 154)

Characteristic	Frequency	Percentage (%)
Pain Location		
Lower back	119	77.3
Leg	20	13.0
Other	11	7.1
Buttocks	4	2.6
Age Group		
18–24	88	57.1
25–34	50	32.5
35–44	8	5.2
45–54	4	2.6
55+	4	2.6
Occupation		
Student	85	55.2
Professional/Managerial	50	32.5
Service Industry	4	2.6
Technical/Skilled Trade	7	4.5
Retired	1	0.6
Other	7	4.5
Area of Residence		
Urban	118	76.6
Rural	36	23.4
Marital Status		
Single	116	75.3
Married	34	22.1
Widowed	1	0.6
Divorced	1	0.6
Other	2	1.3
Working Hours		
Not employed	61	39.6
30–40 hrs/week	33	21.4
< 30 hrs/week	25	16.2
41–50 hrs/week	20	13.0
> 50 hrs/week	15	9.7

Lifestyle		
Moderately active	69	44.8
Very active	37	24.0
More home-oriented	19	12.3
Mostly sedentary	21	13.6
Socially active	8	5.2
Sleep Pattern		
6–7 hrs/night	57	37.0
7–8 hrs/night	42	27.3
< 6 hrs/night	29	18.8
Irregular schedule	14	9.1
> 8 hrs/night	12	7.8
Dairy Intake		
Yes	93	60.4
No	55	35.7
Don't like it	6	3.9
Family History		
Yes	84	54.5
No	61	39.6
Don't know	9	5.8

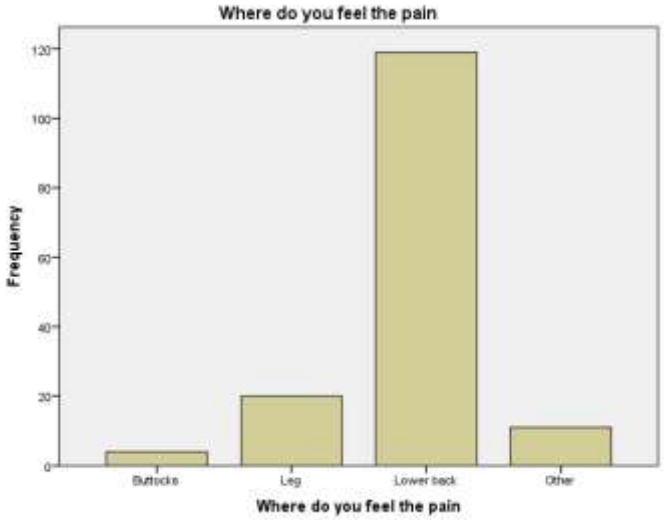

Figure 1: Overall pain location distribution, with lower back pain comprising 77.3% of reports.

Age-Specific Pain Patterns:

Pain distribution varied markedly by age (see Table 2, Figure 2). In the 18–24 group, although 68.2% reported lower back pain, a significant 18.2% experienced leg pain and 10.2% "other" pain, indicating diverse biomechanical stressors perhaps related to sports, academic posture, or early career activities. By contrast, women aged 25–34 and 35–44 reported very high LBP rates of 90.0% and 87.5%, respectively, reflecting reproductive and occupational burdens prevalent in mid-life. Remarkably, the 45–54 cohort exhibited 100% lower back pain, underscoring cumulative mechanical strain and early degenerative changes. While the 55+ group showed a slightly lower LBP rate of 75.0%, the spike in leg pain to 25.0% suggests an evolving pattern of neurogenic involvement, such as early spinal stenosis or radiculopathy, in later years.

Table 2. Pain Location by Age Group (%)

Age Group	Lower Back	Leg	Buttocks	Other
18–24	68.2	18.2	3.4	10.2
25–34	90.0	6.0	0.0	4.0
35–44	87.5	0.0	12.5	0.0
45–54	100.0	0.0	0.0	0.0
55+	75.0	25.0	0.0	0.0

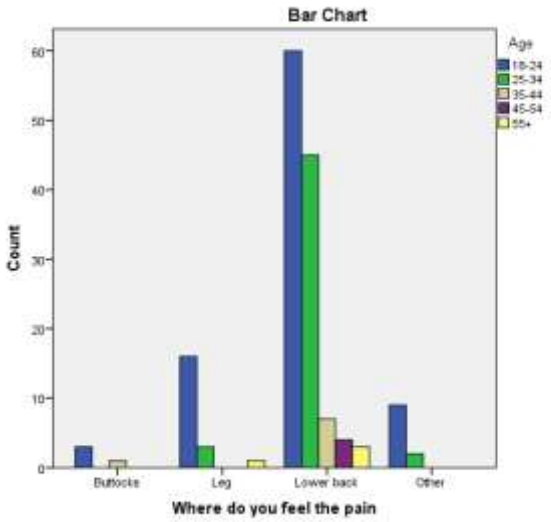

Figure 2: Age-related pain distribution demonstrating peak LBP in mid-life.

Occupational Influences:

Table 3 and Figure 3 reveal that occupation strongly shapes pain patterns. Both retired and technical/skilled trade participants (each 0.6% and 4.5% of the sample) reported 100% LBP, likely reflecting long-term manual labor or age-related biomechanical degeneration. Among professional/managerial women, 90.0% experienced LBP, implicating sedentary work and office ergonomics as key drivers. In contrast, students (55.2%) and service-industry workers (2.6%) reported lower LBP rates (68.2% and 50.0%, respectively) but disproportionate leg and buttocks pain (17.6% and 25.0%). This suggests that heavy backpacks, prolonged study postures, or prolonged standing in service roles shift symptomatology distally, highlighting the need for role-specific ergonomic interventions.

Table 3. Pain Location by Occupation (%)

Occupation	Lower Back	Leg	Buttocks	Other
Retired	100.0	0.0	0.0	0.0
Technical/Skilled Trade	100.0	0.0	0.0	0.0
Professional/Managerial	90.0	6.0	0.0	4.0
Other	85.7	14.3	0.0	0.0
Student	68.2	17.6	3.5	10.6
Service Industry	50.0	25.0	25.0	0.0

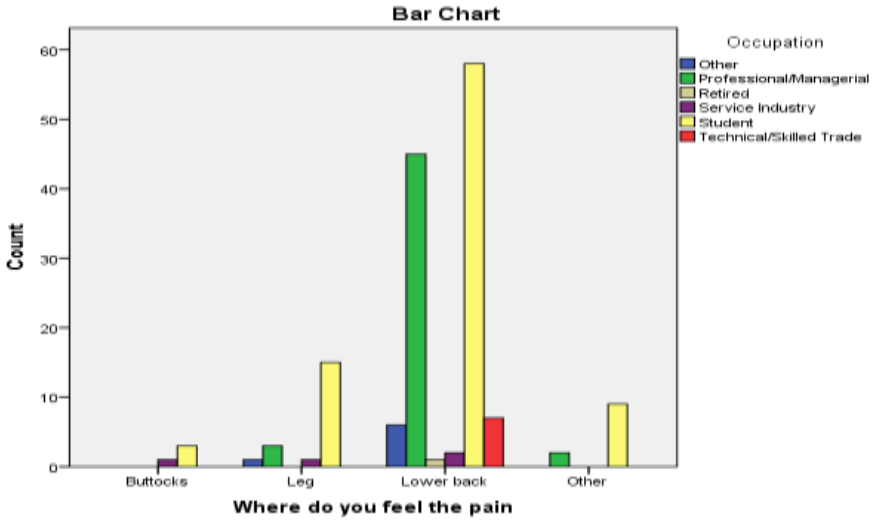

Figure 3: Higher LBP in manual and sedentary professional occupations.

Urban vs. Rural Disparities:

Despite better healthcare access, urban women (76.6% of participants) exhibited slightly lower LBP (76.3%) than rural women (80.6%), as detailed in Table 4 and Figure 4. The rural cohort's elevated LBP likely reflects the physical demands of agricultural and domestic labor conducted without ergonomic aids. Conversely, urban residents displayed marginally higher rates of leg (13.6% vs. 11.1%) and "other" pain (7.6% vs. 5.6%), pointing to sedentary lifestyles, commuting stresses, or psychosocial factors that contribute to a broader pain distribution. These findings underscore the importance of context-specific prevention strategies: ergonomic training in rural areas and activity promotion in urban settings.

Table 4. Pain Location by Area of Residence (%)

Area	Lower Back	Leg	Buttocks	Other
Rural	80.6	11.1	2.8	5.6
Urban	76.3	13.6	2.5	7.6

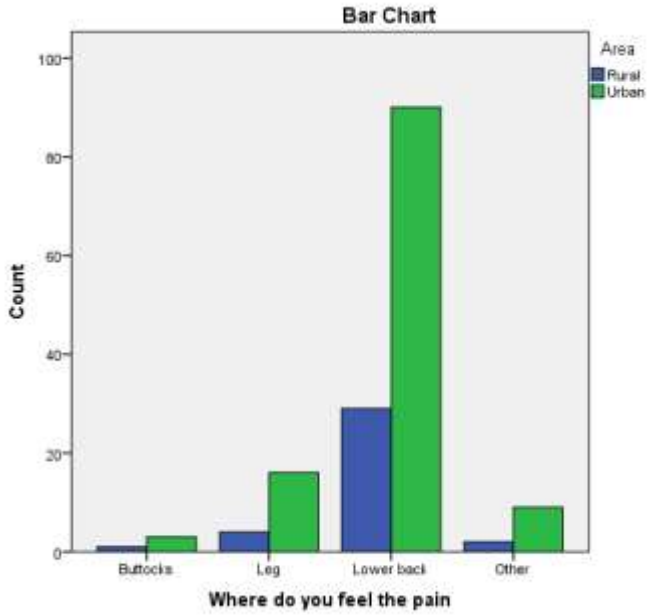

Figure 4: Slightly higher LBP in rural participants.

Marital Status Effects:
Pain profiles differed by marital status (Table 5, Figure 5). Married women (22.1%) reported 88.2% LBP, likely driven by combined household, caregiving, and employment responsibilities. Divorced and widowed participants, though few had 100% LBP, suggesting that psychosocial stress and reduced support networks may amplify pain perception and chronicity. By contrast, single women (75.3%) had a lower LBP rate (74.1%) but a broader dispersion of symptoms (9.5% "other"), perhaps due to more varied recreational activities and support structures that mitigate pure lumbar strain. These patterns highlight marital status as a proxy for caregiving load and psychosocial risk in LBP etiology.

Table 5. Pain Location by Marital Status (%)

Marital Status	Lower Back	Leg	Buttocks	Other
Divorced	100.0	0.0	0.0	0.0
Married	88.2	8.8	2.9	0.0
Other	50.0	50.0	0.0	0.0
Single	74.1	13.8	2.6	9.5
Widowed	100.0	0.0	0.0	0.0

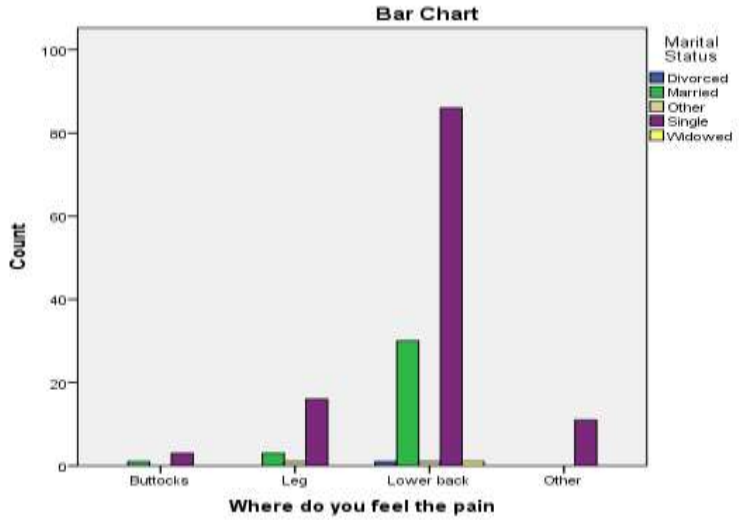

Figure 5: Elevated LBP among married and formerly married women.

Weekly Working Hours:
The relationship between working hours and pain location (Table 6, Figure 6) was non-linear. Part-time workers (< 30 hrs/week) reported the highest LBP (84.0%), suggesting that intermittent but physically demanding tasks without adequate rest may concentrate strain on the lumbar spine. Women working 30–50 hrs/week showed consistent LBP rates (75.0–75.8%) but increased buttocks (12.1%) and leg pain (15.0%), likely reflecting prolonged sitting or standing postures. Those exceeding 50 hrs/week experienced the highest leg pain (26.7%) yet lower LBP (66.7%), indicating that extended hours may shift loading from lumbar to distal structures through compensatory biomechanics. Unemployed participants (39.6%) still reported 78.7% LBP, emphasizing that unpaid domestic work carries significant musculoskeletal risk.

Table 6. Pain Location by Working Hours (%)

Hours/Week	Lower Back	Leg	Buttocks	Other
< 30 hrs	84.0	8.0	0.0	8.0
30–40 hrs	75.8	9.1	12.1	3.0
41–50 hrs	75.0	15.0	0.0	10.0
> 50 hrs	66.7	26.7	0.0	6.7
Not employed	78.7	13.1	0.0	8.2

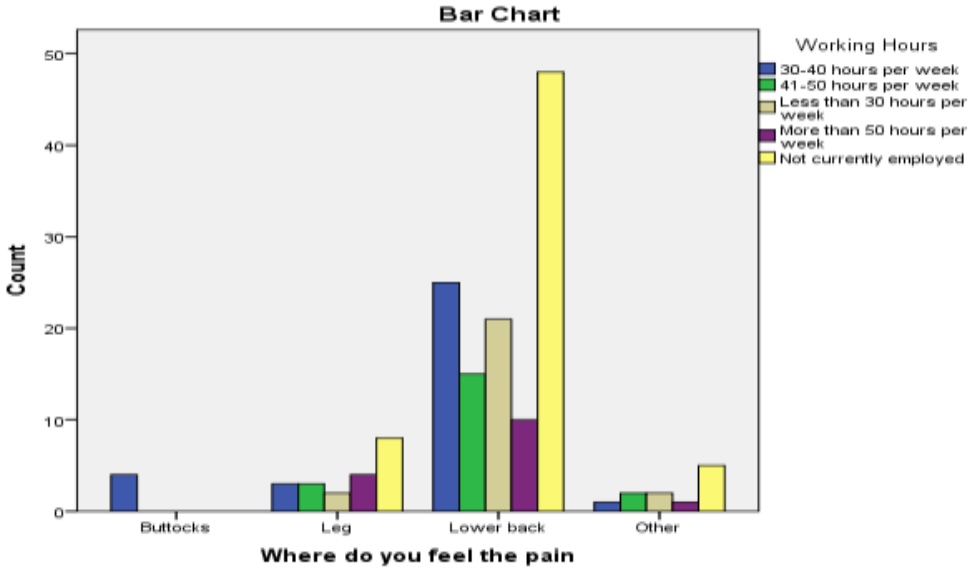

Figure 6: Work-hour category influences pain distribution.

Lifestyle Activity Levels:

Lifestyle exerted a clear, graded impact on LBP (Table 7, Figure 7). "Mostly sedentary" women exhibited the highest LBP prevalence (90.5%), attributable to deconditioning of paraspinal muscles and disc health deterioration. "More home-oriented" individuals engaged in household chores showed 84.2% LBP and 10.5% leg pain, underscoring the physical toll of domestic labor. In contrast, "very active" women had lower LBP (73.0%) but increased distal pain (18.9% leg), suggesting high-impact activities impose mixed spinal and peripheral strain. The lowest LBP (50.0%) occurred in "socially active" women, implying that diversified social and physical engagement optimally balances spinal loading and recovery.

Table 7. Pain Location by Lifestyle (%)

Lifestyle	Lower Back	Leg	Buttocks	Other
Mostly sedentary	90.5	0.0	4.8	4.8
More home-oriented	84.2	10.5	0.0	5.3
Moderately active	76.8	13.0	2.9	7.2
Very active	73.0	18.9	0.0	8.1
Socially active	50.0	25.0	12.5	12.5

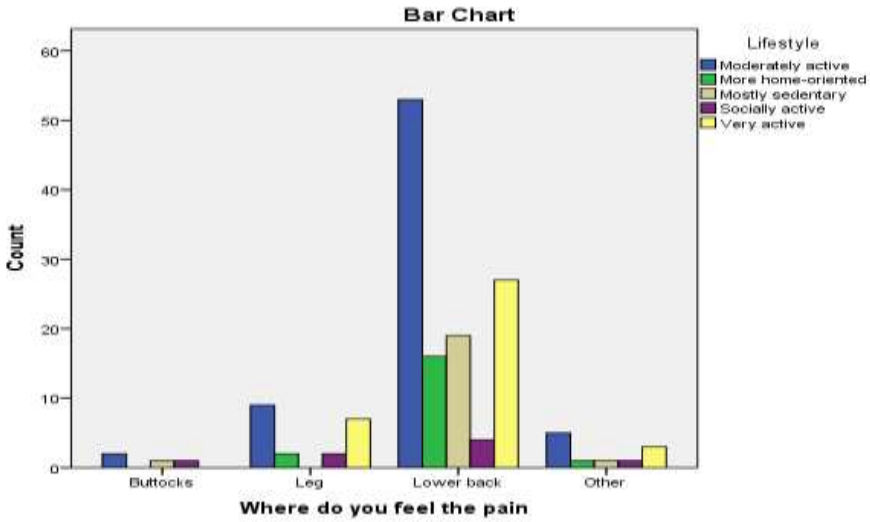

Figure 7: Reduced LBP with increased activity levels.

Sleep Quality and Pain:

Sleep patterns strongly correlated with pain distribution (Table 8, Figure 8). Women sleeping 7–8 hrs/night are considered optimal, reported the lowest LBP (73.8%), highlighting restorative sleep's role in tissue repair. Short sleepers (< 6 hrs) had 79.3% LBP and 17.2% leg pain, consistent with sleep deprivation's pro-inflammatory effects on musculoskeletal pain. Those sleeping > 8 hrs experienced moderate LBP (75.0%) but a surprisingly high "other" pain rate (25.0%), suggesting that prolonged recumbency without movement may induce peripheral stiffness. Irregular sleepers fared worst, with 85.7% LBP and 14.3% non-lumbar pain, underscoring the importance of sleep regularity in modulating pain perception and recovery.

Table 8. Pain Location by Sleep Pattern (%)

Sleep Pattern	Lower Back	Leg	Buttocks	Other
< 6 hrs/night	79.3	17.2	3.4	0.0
6–7 hrs/night	77.2	14.0	3.5	5.3
7–8 hrs/night	73.8	16.7	2.4	7.1
> 8 hrs/night	75.0	0.0	0.0	25.0
Irregular schedule	85.7	0.0	0.0	14.3

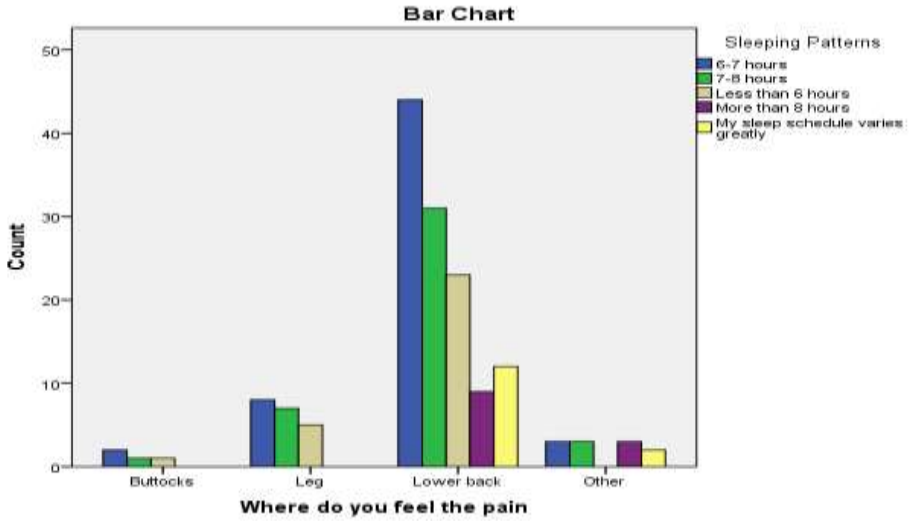

Figure 8: Pain correlates of sleep patterns.

Dairy Intake:

Despite expectations, regular dairy consumers reported the highest LBP (81.7%) compared to non-consumers (72.7%) and those who disliked dairy (50.0%) (Table 9, Figure 9). This counterintuitive finding suggests that dietary calcium and protein alone do not counteract mechanical and postural risk factors, and may reflect reverse causality if women with pain increase dairy intake in hopes of orthopedic benefit. These results caution against simplistic nutritional prescriptions for LBP prevention and underscore the need to address ergonomic, behavioral, and psychosocial determinants.

Table 9. Pain by Dairy Intake (%)

Dairy Intake	Lower Back	Leg	Buttocks	Other
Yes	81.7	14.0	4.3	4.3
No	72.7	10.9	7.3	9.1
Don't like it	50.0	16.7	0.0	33.3

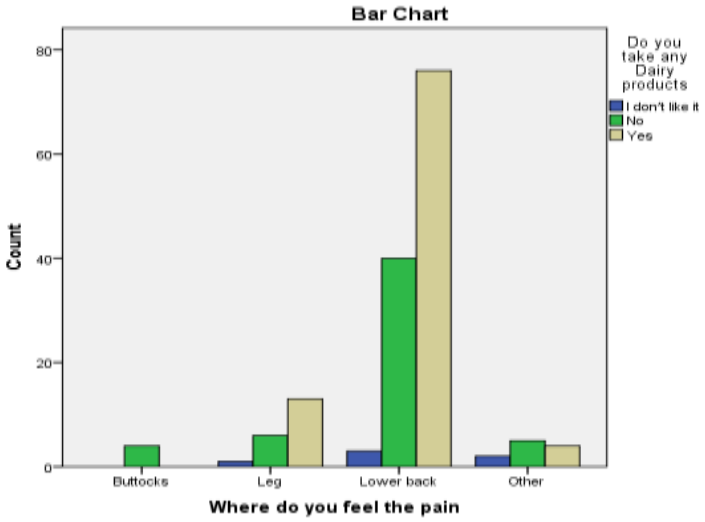

Figure 9: Dairy intake vs. pain location.

Family History:

Unexpectedly, women without a family history of back pain exhibited higher LBP (82.0%) than those with such a history (76.2%) (Table 10, Figure 10). This inverse association suggests that environmental and lifestyle factors such as activity levels, ergonomics, and sleep hygiene exert greater influence on LBP prevalence than genetic predisposition in this population. Moreover, the "don't know" group, reporting 55.6% LBP but 22.2% "other" pain, highlights the role of health literacy and awareness in both pain reporting and management. These insights reinforce the primacy of modifiable risk factors in addressing the LBP epidemic among women.

Table 10. Pain by Family History (%)

Family History	Lower Back	Leg	Buttocks	Other
Yes	76.2	11.9	2.4	9.5
No	82.0	13.1	3.3	1.6
Don't know	55.6	22.2	0.0	22.2

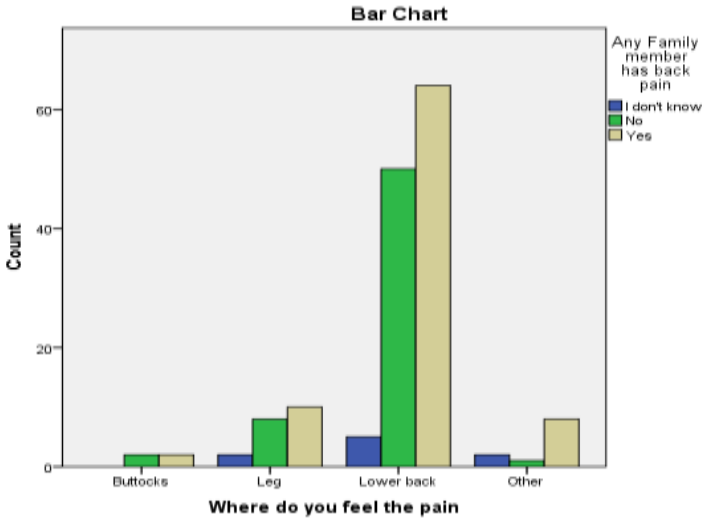

Figure 10: Family history and pain location.

In summary, these results reveal that lower back pain is not only highly prevalent, affecting over three-quarters of women in both rural and urban settings, but also intricately linked to a constellation of demographic, occupational, behavioral, and psychosocial factors. Mid-life adults (25–54 years),

individuals in both manual and sedentary occupations, those with irregular or insufficient sleep, and women leading mostly sedentary lifestyles emerged as the highest-risk groups. Paradoxical findings such as elevated leg and buttocks pain in service workers and part-time employees, and the lack of protective effect from dairy intake or positive family history underscore the multifactorial nature of pain generation, in which modifiable exposures (ergonomics, physical activity, sleep hygiene) dominate over immutable traits. These insights highlight the urgent need for holistic, subgroup-tailored interventions ranging from workplace ergonomic training and structured exercise programs to sleep education and community outreach to effectively mitigate the burden of lower back pain among adult women.

DISCUSSION

The present study highlights a disturbingly high prevalence of lower back pain (LBP) among adult females across both rural and urban settings in Pakistan, with nearly four in five participants reporting lumbar discomfort as their primary musculoskeletal complaint. [12]. This finding reinforces the global understanding that LBP disproportionately affects women, but it also underscores important, context-specific associations with socioeconomic and behavioral determinants. Despite considerable epidemiological data on LBP in developed countries, there remains a paucity of regionally grounded, gender-specific analyses within South Asia, making these findings particularly salient [13].

Across age strata, a clear pattern of increasing burden was observed in midlife, where physical workload often intersects with caregiving responsibilities and reproductive health events. The high prevalence in women aged 25–44 may reflect cumulative strain from occupational demands, household responsibilities, and suboptimal posture during child-rearing or work. Interestingly, the very youngest and oldest participants reported marginally lower rates of LBP, but these groups exhibited relatively higher proportions of leg or neuropathic pain, suggesting either early onset postural deficits or age-related degenerative changes beyond the lumbar spine [14, 15].

Occupation emerged as a strong explanatory factor. Women involved in both physically demanding roles and sedentary professional jobs exhibited very high rates of LBP. This dual vulnerability highlights the paradox of musculoskeletal strain, where both underactivity and overuse contribute significantly [16]. In particular, the prevalence of LBP among skilled manual laborers and retired individuals, both registering 100% in our cohort, may reflect the long-term biomechanical damage associated with repetitive tasks, heavy lifting, and inadequate ergonomic protections. Meanwhile, professionals and students also reported substantial lumbar discomfort, pointing toward prolonged static postures, insufficient physical conditioning, and increasing digital screen exposure as contributory mechanisms [17].

Environmental context offered additional nuance. Although the rural–urban differential in LBP prevalence was modest, rural women experienced a slightly higher burden, likely reflecting increased physical demands in domestic and agricultural work, often performed without mechanized support. Urban women, in contrast, displayed a broader distribution of distal pain sites, especially leg and other regional symptoms, hinting at sedentary lifestyles, psychological stress, and possibly radiculopathy related to spinal alignment issues. These observations support the need for differentiated prevention strategies that account for environmental exposures [18].

The data also bring into focus the roles of lifestyle, sleep, and diet factors often underexplored in musculoskeletal research despite their relevance. Sedentary behavior stood out as one of the most significant correlates of LBP. Women identifying as mostly inactive showed markedly higher pain prevalence than those with moderate or high levels of daily movement. This strongly reinforces the protective role of even minimal physical activity and lends support to public health initiatives promoting non-sedentary routines [19]. Likewise, sleep quality appeared intricately linked with LBP, with irregular sleepers and those getting less than 6 hours per night reporting substantially greater discomfort. These results are consistent with existing models that position sleep as a central modulator of inflammation, muscle repair, and pain threshold. Surprisingly, dietary factors, specifically dairy intake, did not offer the protective effect that might be anticipated from calcium-rich nutrition. This

suggests that without the accompaniment of physical conditioning or appropriate biomechanics, nutritional adequacy alone may not be sufficient to mitigate risk [20, 21].

Another notable finding was the counterintuitive relationship between family history and LBP. Women with no reported family history of spinal pain were not spared; in fact, they exhibited slightly higher rates of LBP than those with known familial predisposition. While genetic vulnerability remains relevant in chronic pain conditions, our findings suggest that environmental and behavioral drivers may override heritable factors in low-resource settings. [22].

This study has several implications. First, it affirms that LBP among females is not only common but deeply rooted in everyday practices shaped by socioeconomic conditions. Second, it indicates that interventions aimed at modifying lifestyle behaviors, particularly increasing physical activity, improving sleep hygiene, and correcting postural habits, may have a greater impact than traditional biomedical approaches alone. Finally, the high burden across all subgroups calls for systematic screening of LBP in primary care settings, integration of musculoskeletal education in community health outreach, and the implementation of cost-effective ergonomic adaptations both at home and in workplaces [23].

While the cross-sectional design limits causal inference, the findings present a valuable snapshot of a widely neglected public health issue in Pakistan. The reliance on self-reported data could introduce bias, although the use of a physician-developed, clinically contextualized questionnaire partially mitigates this concern. Future longitudinal studies are essential to evaluate the temporal relationship between risk factors and symptom progression, and to determine the efficacy of targeted interventions in reducing the burden of LBP in this high-risk population [24].

Finally, this study draws attention to an often-overlooked dimension of women's health and provides a compelling case for integrated, gender-sensitive, and contextually appropriate interventions to prevent and manage lower back pain. Addressing modifiable behavioral and occupational risk factors could substantially reduce disability, improve functional capacity, and enhance the quality of life for millions of women in similar low- and middle-income settings [25].

Conclusion

This study establishes lower back pain as a highly prevalent and impactful health issue among females in both rural and urban areas. With over three-quarters of participants affected, the burden is shaped by modifiable factors such as sedentary lifestyle, poor sleep hygiene, physical workload, and occupational posture. Notably, both high and low levels of physical activity were associated with increased risk, underscoring the importance of balance and ergonomic awareness. Contrary to common belief, neither regular dairy intake nor family history appeared to significantly influence pain prevalence. These findings call for targeted, community-based interventions that promote physical activity, ergonomic education, and healthy sleep patterns. Integrating musculoskeletal health into primary care and public health initiatives is essential to reduce long-term disability and enhance the quality of life for women in diverse settings.

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Conflicts of Interest:

The authors declare no conflicts of interest.

Ethical Approval:

This study was approved by the Institutional Ethics Review Committee. All procedures were conducted by ethical standards and the Declaration of Helsinki.

Informed Consent:
Informed written consent was obtained from all participants before data collection. Confidentiality and anonymity of participant information were strictly maintained.

Author Contributions:
All authors contributed equally to the study conception, design, data collection, analysis, interpretation, and manuscript preparation.

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