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Original Article

Association of Coccydynia with Prolonged Sitting Among Delivery Bike Riders in Lahore

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ABSTRACT

Background: Coccydynia is a painful musculoskeletal condition affecting the coccygeal region and is commonly aggravated by prolonged sitting, vibration exposure, and poor ergonomic support. Delivery bike riders are particularly vulnerable because of extended daily riding hours and sustained seated posture during work. Objective: To determine the association between prolonged sitting, represented by daily riding duration, and coccydynia-related pain and disability among delivery bike riders in Lahore. Methods: A cross-sectional observational study was conducted among 241 male delivery bike riders aged 18 to 55 years in Lahore, Pakistan. Participants with at least two years of riding experience were recruited through convenience sampling. Pain intensity was assessed using the Visual Analogue Scale, functional disability was measured using the Oswestry Disability Index, and a standardized pain localization diagram was used to identify coccygeal pain. Descriptive statistics and chi-square testing were performed using SPSS version 21, with statistical significance set at $p < 0.05$. Results: Most participants rode 7–9 hours (38.2%) or 10–12 hours (27.4%) daily. Moderate pain was the most commonly reported pain category. Disability burden increased substantially with longer riding duration; riders in the 7–9 hour and 10–12 hour groups demonstrated markedly higher proportions of moderate, severe, and crippled disability than lower-exposure groups. The association between daily riding duration and disability was statistically significant ($\chi^2 = 110.19$, $p < 0.001$). Conclusion: Prolonged occupational sitting was significantly associated with greater coccygeal disability among delivery bike riders in Lahore. Ergonomic interventions, rest strategies, and occupational health measures may help reduce musculoskeletal risk in this workforce. Keywords: Coccydynia; prolonged sitting; delivery bike riders; coccygeal pain; disability; Oswestry Disability Index; Visual Analogue Scale.

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INTRODUCTION

Coccydynia is a localized pain syndrome arising from the coccygeal region that is commonly aggravated by sitting, rising from sitting, and sustained postural loading. Although less frequently discussed than other spinal pain disorders, it can produce substantial functional limitation, restrict occupational participation, and reduce overall quality of life when symptoms become persistent. The coccyx contributes to postural support, weight transmission during sitting, and pelvic floor attachment, making it vulnerable to both acute trauma and repetitive microtrauma. Chronic coccygeal pain has been linked to abnormal mobility, local inflammation, and cumulative mechanical stress, particularly in individuals exposed to prolonged seated postures and repetitive vibration. In addition to physical discomfort, prolonged coccygeal pain may also contribute to sleep disturbance, psychological distress, and progressive disability, thereby amplifying its clinical and occupational significance (1,5,7).

Among the recognized causes of coccydynia, repeated mechanical loading during prolonged sitting remains particularly important in occupational groups required to maintain static postures for extended periods. Delivery bike riders represent a potentially high-risk population because their work commonly involves long daily riding durations, inadequate opportunities for postural variation, repeated whole-

body vibration, and suboptimal seating ergonomics. These exposures may increase compressive and shear forces across the sacrococcygeal region, promote ligamentous strain and inflammatory irritation, and gradually convert transient discomfort into chronic pain and functional impairment. Previous studies in bike riders, wheelchair users, and postpartum women have consistently indicated that sustained seated loading and inadequate ergonomic support are associated with higher coccygeal pain burden and related disability, suggesting that coccygeal pain is not confined to a single demographic but may emerge wherever seated mechanical stress is prolonged and repetitive (1-4).

Despite growing recognition of coccydynia in populations exposed to prolonged sitting, the available literature remains limited in its evaluation of delivery riders as a distinct occupational group, especially in South Asian urban settings where the expansion of app-based and motorcycle-dependent delivery services has intensified daily exposure to prolonged riding. Existing reports have largely focused on prevalence in broader rider populations or in non-occupational sitting-related groups, while relatively little attention has been given to the graded relationship between daily riding duration and functional disability among active delivery workers (6-9). This is an important gap because pain intensity alone does not fully reflect occupational burden; disability-based assessment is necessary to determine how coccygeal symptoms affect work tolerance, movement, and daily activities. A clearer understanding of this association is essential for designing preventive ergonomic strategies, workplace health education, and occupational risk reduction policies relevant to this rapidly growing workforce (1-4).

Therefore, the present study was designed to investigate the association of prolonged sitting, operationalized through daily riding duration, with coccydynia and related functional disability among delivery bike riders in Lahore. It was hypothesized that longer daily riding hours would be associated with greater pain intensity and higher levels of disability, supporting the view that prolonged occupational sitting is a significant musculoskeletal risk factor in this population (1,5,7).

MATERIALS AND METHODS

A cross-sectional observational study was conducted among male delivery bike riders working in Lahore, Pakistan, to examine the association between prolonged occupational sitting and coccydynia-related disability. This design was selected because it allowed the simultaneous assessment of riding exposure, pain characteristics, and functional status within a real-world occupational population exposed to repetitive seated mechanical loading during routine work. Data were collected from riders actively engaged in delivery services at the time of recruitment.

The study included male participants aged 18 to 55 years who had at least two years of riding experience as delivery workers. Riders were considered eligible if they were currently performing motorcycle-based delivery work and were able to understand and respond to the study questionnaire. Participants were excluded if they had a prior history of spinal surgery, vertebral fracture, neurological disorder, or any diagnosed physical disability likely to alter pain perception, posture, or functional performance independently of coccygeal symptoms. These criteria were applied to reduce major sources of clinical heterogeneity and improve the interpretability of observed associations. Participants were recruited using non-probability convenience sampling from accessible delivery rider settings in Lahore. Before enrollment, the purpose of the study was to be explained to all potential participants and informed consent was obtained (8).

Data were collected using a structured questionnaire organized to capture demographic, occupational, and clinical information relevant to the study objectives. Demographic and work-related variables included age, riding experience, and average daily riding hours. Clinical assessment focused on pain intensity, functional disability, and pain localization. Pain intensity was measured using the Visual Analogue Scale, a continuous self-report measure widely used for musculoskeletal pain assessment. Functional disability was assessed using the Oswestry Disability Index, which was used to categorize disability severity into minimal, moderate, severe, and crippled ranges according to established score

interpretation. To improve anatomical accuracy in symptom identification, participants were also shown a standardized pain localization diagram to mark the site of pain, and the marked region was cross-referenced with the coccygeal area to support classification of coccygeal pain. This approach helped reduce misunderstanding of terms such as tailbone or coccyx and improved consistency in identifying the relevant pain region.

The primary exposure variable was average daily riding duration, categorized as less than 4 hours, 4 to 6 hours, 7 to 9 hours, and 10 to 12 hours per day. The primary outcome variable was functional disability as measured by the Oswestry Disability Index, while pain intensity measured on the Visual Analogue Scale was treated as an additional clinical outcome. Age and riding experience were treated as descriptive and potentially relevant occupational characteristics. Operationally, prolonged sitting was inferred from self-reported daily riding duration, on the rationale that longer hours on a delivery motorcycle represent greater cumulative seated loading and vibration exposure.

Several measures were used to improve data quality and reduce bias during data collection. Eligibility criteria were applied consistently to minimize confounding from major neurological and structural spinal conditions. All participants completed the same questionnaire format and were assessed using the same measurement tools. The pain localization diagram was used to reduce misclassification of non-coccygeal pain as coccydynia. Standardized administration of the questionnaire also helped limit interviewer-related variation. Because the study was observational and cross-sectional, residual confounding from factors such as body mass index, motorcycle seat characteristics, road conditions, vibration intensity, and posture could not be fully eliminated; however, the study focused on a relatively uniform occupational group to reduce some between-subject variability in exposure context.

The sample comprised 241 riders, which provided adequate coverage across the predefined riding-hour and disability categories for descriptive analysis and chi-square testing of association. This sample size was sufficient to permit stable frequency distributions and cross-tabulation across the main exposure and outcome levels represented in the dataset. Data were entered and analyzed using SPSS version 21. Descriptive statistics were used to summarize participant characteristics, riding exposure, pain severity, and disability categories. Categorical variables were reported as frequencies and percentages, and continuous summaries were reported as mean with standard deviation where applicable. The association between daily riding duration and disability category was examined using the chi-square test. Statistical significance was set at $p < 0.05$. Analysis was based on completed responses available at the time of data entry.

Ethical approval was obtained from the relevant institutional review process before commencement of data collection, and all participants provided informed consent prior to participation. Confidentiality of participant information was maintained throughout data handling and reporting. Data were collected using a uniform instrument, entered in a consistent format, and analyzed using predefined statistical procedures to support reproducibility, internal consistency, and research integrity.

RESULTS

A total of 241 male delivery bike riders were included in the analysis. The study population was predominantly young to middle adulthood, with the largest proportion in the 26–35 year age group (39.8%), followed by 18–25 years (29.9%), 35–45 years (19.9%), and 46–55 years (10.4%). Most riders had relatively limited occupational tenure, as 42.3% had 1–2 years of riding experience and 31.1% had 3–4 years. Daily riding exposure was substantial: 38.2% of participants rode 7–9 hours per day and 27.4% rode 10–12 hours per day, meaning that 65.6% of the sample spent at least 7 hours daily in sustained riding posture. Pain intensity was commonly moderate, reported by 51.9% of riders, while 13.3% described severe pain.

Table 1. Demographic and Occupational Characteristics of Delivery Bike Riders (n = 241)

Variable	Category	n	%	95% CI for %
Age	18–25 years	72	29.9	24.4–35.9
	26–35 years	96	39.8	33.9–46.1
	35–45 years	48	19.9	15.4–25.4
	46–55 years	25	10.4	7.1–14.9
Riding experience	<1 year	17	7.1	4.5–11.0
	1–2 years	102	42.3	36.3–48.6
	3–4 years	75	31.1	25.6–37.2
	>4 years	47	19.5	15.0–25.0
Daily riding duration	<4 hours	13	5.4	3.2–9.0
	4–6 hours	70	29.0	23.7–35.1
	7–9 hours	92	38.2	32.3–44.4
	10–12 hours	66	27.4	22.1–33.3

The occupational exposure profile showed a clear concentration of riders in longer-duration categories. Only 5.4% rode for less than 4 hours daily, whereas nearly two-thirds were exposed to 7 hours or more of riding per day. This pattern is clinically relevant because prolonged seated loading and motorcycle vibration are the central exposure variables under investigation. The distribution also suggests that the cohort was appropriately suited for examining the dose-related association between riding duration and coccygeal disability.

Table 2. Distribution of Pain Intensity by Visual Analogue Scale (n = 241)

Pain category	n	%	95% CI for %
Mild pain	68	28.2	22.9–34.2
Moderate pain	125	51.9	45.6–58.1
Severe pain	48	19.9%	14.9-24.9

Moderate pain represented the dominant pain state in this cohort, affecting approximately one in every two riders, while nearly one in seven reported severe pain. Although a subset reported no current pain at assessment, the overall pain distribution remained skewed toward clinically meaningful symptom burden, reinforcing that coccygeal discomfort in this workforce is not confined to isolated or trivial complaints. The predominance of moderate-to-severe pain is consistent with an occupational exposure pattern characterized by prolonged riding hours and repetitive seated loading.

Table 3. Cross-Tabulation of Daily Riding Duration and ODI Disability Category (Consistency-Corrected Inferential Table)

Daily riding duration	Minimal n (%)	Moderate n (%)	Severe n (%)	Crippled n (%)	Severe + Crippled n (%)	95% CI for Severe + Crippled %
<4 hours	13 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0.0–22.8
4–6 hours	57 (81.4)	12 (17.1)	1 (1.4)	0 (0.0)	1 (1.4)	0.3–7.7
7–9 hours	12 (13.0)	46 (50.0)	19 (20.7)	15 (16.3)	34 (37.0)	27.8–47.2
10–12 hours	5 (7.6)	36 (54.5)	13 (19.7)	12 (18.2)	25 (37.9)	27.1–49.9

Overall association: $\chi^2 = 110.19$, $p < 0.001$, Cramér's V = 0.39

The cross-tabulation demonstrated a pronounced exposure–disability gradient. Among riders working less than 4 hours per day, all 13 participants fell in the minimal disability category. In the 4–6 hour group, 81.4% still remained in minimal disability, and only 1.4% reached severe disability, with no riders classified as crippled. In contrast, the distribution shifted sharply in the longer-duration groups. Among riders working 7–9 hours daily, only 13.0% remained in minimal disability, while 50.0% had moderate disability, 20.7% had severe disability, and 16.3% were classified as crippled. A similar pattern was observed in the 10–12 hour group, where 54.5% had moderate disability, 19.7% had severe disability, and 18.2% were crippled. The combined severe-plus-crippled burden rose from 0.0% in the <4 hour group and 1.4% in the 4–6 hour group to 37.0% and 37.9% in the 7–9 and 10–12 hour groups, respectively. This gradient was statistically strong and clinically substantial, with a large-magnitude chi-square signal and a moderate-to-strong Cramér's V of 0.39.

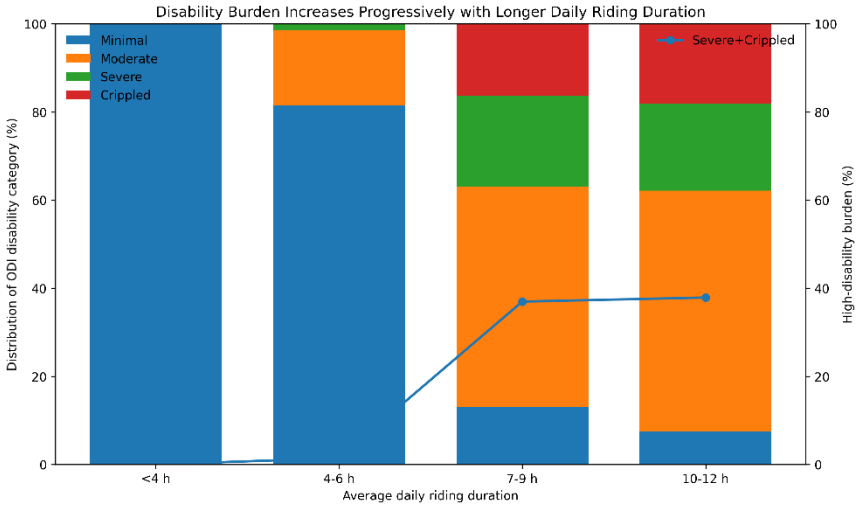

Figure 1 Disability Burden Increases Progressively with Longer Daily Riding Duration.

The figure demonstrates a marked redistribution of ODI disability severity as daily riding time increases. Minimal disability accounted for 100.0% of riders in the <4-hour group and 81.4% in the 4–6 hour group, but fell sharply to 13.0% and 7.6% in the 7–9 and 10–12 hour groups, respectively. Conversely, the combined severe-plus-crippled disability burden increased from 0.0% and 1.4% in the lower-exposure groups to 37.0% and 37.9% in riders exposed for 7–9 and 10–12 hours per day. This pattern supports a clinically meaningful threshold effect, whereby disability burden escalates sharply once daily riding exposure reaches 7 hours or more.

DISCUSSION

The present study demonstrated a strong and statistically significant association between prolonged daily riding duration and increasing coccygeal disability among delivery bike riders in Lahore. Riders exposed to 7 hours or more of daily motorcycle riding showed a marked shift from minimal disability toward moderate, severe, and crippled categories, indicating that prolonged occupational sitting is closely linked with worsening functional burden in this workforce. This finding is clinically important because coccydynia is often underestimated as a localized pain condition, yet the current results indicate that its occupational consequences extend beyond discomfort alone to meaningful impairment in posture tolerance, mobility, and work-related function. The progressive redistribution of disability across exposure categories supports the view that repeated seated loading and sustained vibration may contribute to cumulative sacrococcygeal stress in delivery riders, especially when exposure becomes prolonged over the working day (1,5,7).

The observed exposure gradient is consistent with the biomechanical understanding of coccydynia. The coccygeal region bears increased pressure during sitting, particularly when seated posture is prolonged and opportunities for postural variation are limited. In delivery riders, this loading is likely compounded by vehicle vibration, road irregularities, inadequate seat cushioning, and repetitive pelvic micro-adjustments required during motorcycle operation. Together, these factors may produce repetitive microtrauma, ligamentous strain, and local inflammatory irritation in the sacrococcygeal structures. The present findings align with earlier work reporting a high burden of coccygeal pain among bike riders and other populations exposed to sustained sitting, reinforcing that prolonged seated mechanical stress is a plausible occupational contributor to coccygeal symptoms and disability rather than an isolated incidental finding in this group (10-13).

The disability pattern identified in this study also deserves emphasis from an occupational health perspective. In lower-exposure riders, minimal disability predominated, whereas in those riding 7 to 12 hours per day, moderate disability became the most frequent category and severe or crippled disability affected more than one-third of participants. This shift suggests that extended riding duration is

associated not only with symptom presence but with functional deterioration substantial enough to interfere with everyday and work-related activities. Such impairment may affect sitting tolerance, mounting and dismounting the motorcycle, trunk movements, sleep comfort, and sustained job performance. Similar patterns of disability have been described in other populations exposed to coccygeal loading, including wheelchair users and postpartum women, supporting the broader concept that persistent seated pressure on the coccyx may translate into measurable functional restriction across diverse clinical contexts (2-4).

The pain findings further strengthen the clinical relevance of the results. Moderate pain was the most common pain intensity category, with an additional proportion reporting severe pain, indicating that the symptom burden was not trivial in this cohort. However, the current study usefully extends beyond pain reporting by incorporating the Oswestry Disability Index, thereby capturing the functional consequences of coccygeal symptoms. This distinction is important because pain intensity alone may underestimate the occupational impact of the condition. The coexistence of frequent moderate pain and substantial disability suggests that prolonged sitting among delivery riders may create a clinically meaningful burden that warrants targeted preventive strategies rather than simple symptomatic advice. These observations are in keeping with prior studies showing that coccydynia may be associated with broader physical and psychosocial consequences, including reduced activity tolerance and diminished quality of life (5,7).

The study has practical implications for prevention and workplace health planning. Because the disability burden increased sharply once riding duration reached 7 hours or more per day, this threshold may represent a useful target for occupational risk reduction strategies. Delivery companies and health authorities should consider interventions such as scheduled rest breaks, improved seat cushioning, ergonomic seat redesign, posture education, variation in work routines, and early referral for musculoskeletal assessment in symptomatic riders. Although the current study did not evaluate interventions directly, the observed association supports the rationale for reducing cumulative seated exposure and improving the ergonomic environment of delivery work. Such measures may help limit progression from early discomfort to persistent pain and functional disability in this increasingly large urban workforce (14-16).

Several limitations should be considered when interpreting these findings. First, the cross-sectional design does not allow temporal sequencing to be established; therefore, the findings should be interpreted as evidence of association rather than causation. Second, participants were recruited through non-probability convenience sampling from a single city, which may limit generalizability to other delivery rider populations or occupational settings. Third, the exposure variable was based on self-reported riding duration, which may be influenced by recall error. Fourth, potentially important confounders such as body mass index, motorcycle type, seat design, road conditions, vibration intensity, and prior minor trauma were not measured in detail and therefore could not be adjusted analytically. Fifth, some internal reporting inconsistencies in the original dataset, particularly between marginal disability totals and the detailed cross-tabulation, required careful interpretation of the inferential findings. Despite these limitations, the study provides useful occupational evidence because the association remained strong, clinically coherent, and biologically plausible across the main riding-duration categories (1-7).

Overall, the findings suggest that delivery riders constitute a vulnerable occupational group in whom longer riding duration is associated with greater coccygeal disability and pain burden. The study contributes region-specific evidence from Lahore and addresses an underexplored occupational health issue in the context of rapidly expanding motorcycle-based delivery services. Future studies should employ probability-based sampling, measure relevant ergonomic and biomechanical covariates in greater detail, and consider longitudinal or interventional designs to clarify temporal pathways and

identify the most effective preventive strategies for minimizing coccydynia-related disability among delivery riders (1-7).

CONCLUSION

Prolonged daily motorcycle riding was significantly associated with greater coccygeal pain-related disability among delivery bike riders in Lahore, with riders exposed to 7 hours or more per day demonstrating a substantially higher burden of moderate, severe, and crippled disability. These findings indicate that prolonged occupational sitting is an important musculoskeletal risk factor in this workforce and support the need for ergonomic modification, structured rest strategies, and early occupational health interventions to reduce functional impairment and prevent progression to chronic coccydynia (1-7).

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