Prevalence and Contributing Factors of Musculoskeletal Pain among App-Based Food Delivery Riders in Tamil Nadu: A Cross-Sectional Analysis

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Abstract

In recent years, the food delivery sector has expanded quickly due to evolving consumer behaviors, technological progress, and the emergence of external delivery platforms. This expansion has opened up employment possibilities for gig workers, particularly those delivering meals. Nevertheless, issues regarding their employment terms, which affect their well-being, security, and employment protections, have arisen. The primary aims of this research were to determine the occurrence of discomfort, pain, and injuries experienced by platform-based meal delivery workers in Tamil Nadu, along with the related contributing elements. This survey-based research involved 425 male platform-dependent food delivery workers across four key urban areas in Tamil Nadu: Chennai, Coimbatore, Villupuram, and Cuddalore. Information was gathered between June and July 2023 via the Nordic Musculoskeletal Questionnaire to evaluate bodily discomfort, pain, and injuries.

Out of 425 meal delivery workers, ongoing pain lasting more than 12 months was common, especially in the lower back (49.18%), upper back (39.53%), neck (28.71%), and shoulders (26.12%). Recent pain within the past seven days was noted by 56% of participants in the lower back. Habits involving substances, lack of hydration, and operational area showed notable links to both prolonged and recent pains. Injuries frequently occurred in the knees, ankles, and wrists, with omitting meals while on shift showing a clear connection to injury occurrence. Investigations into pain and injuries faced by meal delivery workers remain scarce. This research significantly advances knowledge on the well-being consequences of dedicated food delivery roles by highlighting substantial rates of bodily discomfort, especially in the lower back region.

Keywords: Musculoskeletal pain, Food delivery riders, Tamil nadu, Well-being consequences

Introduction

The past few years have witnessed a dramatic surge in the online meal ordering sector, fueled by altered buying patterns, digital innovations, and the involvement of external logistics providers [1]. A 2022 Statista report projects the worldwide online food ordering market to rise from $115.07 billion in 2020 to $223.77 billion by 2025 [2]. As noted in the 2021 International Labour Organization report, this sector's expansion has generated fresh employment for gig workers, such as those

delivering food [3]. NITI Aayog's 2022 findings emphasized challenges in gauging the scale of gig workers and developing suitable regulations due to insufficient data. Extensive debates surround gig workers, especially food transporters, concerning their earnings, perks, job classification, protections, medical coverage, and additional entitlements [4]. In contrast to typical shared-economy fields, food delivery platforms typically classify these workers as independent contractors rather than permanent staff, viewing them as replaceable gig participants [5]. Reports from Janata Daily indicate that food delivery personnel earn approximately Rs. 15,000 to Rs. 20,000 monthly. Achieving higher earnings requires them to work over 10 hours daily, typically six days weekly. Incentives demand covering 150 km daily, compelling greater physical strain and prolonged road exposure. Rewards also depend on rapid completions, encouraging unsafe

riding practices that heighten accident and injury risks [6]. Research on road crashes involving food delivery workers in southern Chennai revealed that 32.36% (n = 56) encountered incidents during work [7]. These workers often suffer from physical complaints like aches. Prolonged engagement in food delivery and daily motorcycle travel exceeding 51 km could contribute to pain development, as suggested by Shanghai-based research in China [8]. A comprehensive analysis pooling 18,882 occupational vehicle operators reported musculoskeletal discomfort rates from 43.1% to 93%. Lower back issues dominated, with a combined prevalence of 53% (n = 9998), alongside frequent complaints in the neck, shoulders, and upper back [9].

Despite the booming platform-driven food ordering business in India, which boosts jobs for delivery personnel, domestic research on their well-being remains absent. This data gap hinders effective medical guidelines and support measures. Accordingly, the current investigation assessed musculoskeletal discomfort rates and related elements among platform-based food delivery workers in four prominent Tamil Nadu cities, India.

Objectives

The key aims of this research were the following:

- To evaluate how commonly musculoskeletal pain and injuries occur among food delivery personnel operating in Tamil Nadu, and
- To pinpoint the variables connected to such pain and injuries in these delivery workers across the state.

Materials and Methods

Study samples, location, design and time lines

This investigation adopted a cross-sectional format, gathering self-reported details about musculoskeletal pain and injuries from 425 delivery personnel aged 18–40 years, selected from several cities in Tamil Nadu, specifically Chennai, Coimbatore, Villupuram, and Cuddalore. As depicted in **Figure 1**, the project idea took shape in March 2023 after an in-depth examination of prior studies. During that same period, a thorough survey instrument was developed. Four of the paper's authors, doubling as on-site data collectors, underwent training for the fieldwork under the direction of academic staff from the School of Public Health at SRM IST, Chennai. A trial run of the survey was executed, followed by a review of preliminary outcomes by a panel of specialists,

who approved the approach for full data gathering in May 2023. The core fieldwork occurred over June and July 2023, with subsequent processing of results and compilation of the final report taking place from August through October 2023.

Figure 1. Timeline of research

Sample size

Given that the true prevalence of musculoskeletal issues among food delivery workers was unknown, it was taken as 50% for the purpose of calculation. The sample size was determined assuming a 95% confidence interval and a 5% margin of error. The calculation for the required sample size (n) was performed as

$$n = (z^2 \times p \times (1 - p))/(e^2) \qquad (1)$$

substituting,
n = (1.96^2 * 0.5 * (1 − 0.5))/(0.05^2) = 385 with an assumption of 10% rejection rate; n = 385 + 39 = 424 which rounded off to 425.

Criteria for participant selection and exclusion

The research encompassed male individuals aged between 18 and 40 years who had at least three months of involvement as riders delivering food via mobile applications from various platforms. Individuals with prior records of musculoskeletal conditions or those who did not rely on motorcycles for their delivery tasks were not eligible for participation.

Instrument employed in the research

This investigation utilized the Nordic Musculoskeletal Questionnaire. The instrument comprises two primary parts. The initial part includes 40 mandatory-response questions designed to pinpoint body regions affected by

musculoskeletal issues, supported by a diagram of the body highlighting nine specific areas: neck, shoulders, upper back, elbows, lower back, wrists/hands, hips/thighs, knees, and ankles/feet. Respondents were queried about experiencing musculoskeletal difficulties over the previous 12 months and the past 7 days that interfered with their routine activities. The subsequent part features 25 mandatory-response items focused on the neck, shoulders, and lower back, exploring related concerns in greater depth, including any incidents impacting those regions, effects on daily life and employment (such as job modifications), length of the issue, consultations with healthcare providers, and difficulties with musculoskeletal symptoms in the preceding week [10].

Approval from the ethics review board

On April 26, 2023, the Institutional Ethical Committee at SRMIST (Deemed University) granted approval for the research protocol. The assigned IEC reference number is 0036/IEC/2023. Every participant provided written informed consent.

Approach to gathering data

Data were gathered through direct interactions with food delivery personnel in multiple locations throughout Tamil Nadu. Participants received an explanation of the research aims in their native tongue, and informed consent was secured prior to administering the questionnaire. Researchers visited numerous food outlets in the selected areas and recruited participants using a convenience sampling method.

Variables for outcomes and exposures
Variables measuring outcomes

From the gathered information, three key variables related to musculoskeletal discomfort were derived and used in the evaluation: recent body discomfort in the past week (none, issues in 1–4 areas, issues in 5–9 areas); extended discomfort over the past year (none, issues in 1–4 areas, issues in 5–9 areas); and reported injuries to the body incurred in the previous year (none, injury at one location, injuries at two or more locations).

Variables for exposures

Eighteen potential exposure factors were incorporated into the evaluation. These included sociodemographic and behavioral elements like participant age (≤25 years, 26–29 years, 30–34 years, ≥35 years), level of education

(up to secondary, higher secondary or diploma, graduate or postgraduate), current enrollment as a student (no, yes), marital situation (single/widowed/other, married), status as a migrant (no, yes), monthly household income per person (in Indian Rupees) (≤10,000, 10,001–15,000, >15,000), engagement in substance use (no, yes), employment in additional jobs (no, yes), duration of experience as a rider (≤1 year, 1–2 years, >2 years), skipping meals while on duty (no, yes), unease with wearing the required uniform (no, yes), experiencing dehydration (no, yes), temptation to consume delivered food items (no, yes), individual monthly earnings from delivery work (in Indian Rupees) (≤15,000, 15,001–25,000, >25,000), and primary work location (district) (Chennai, others). Additionally, mental health factors were assessed, including burnout (low/medium, high), anxiety (minimal/mild, moderate, severe), and depression (minimal/mild, moderate, moderate-severe/severe). These were measured using the Generalized Anxiety Disorder-7 (GAD-7) scale, Patient Health Questionnaire-2 (PHQ-2), and Oldenburg Burnout Inventory (OLBI), respectively. Selection of all variables drew from existing literature, a preliminary pilot investigation, and validation by an expert group consisting of four specialists in public health, biostatistics, epidemiology, and health economics.

Analytical procedures for data

Initial data preparation and table creation were performed in Microsoft Excel. Both descriptive and inferential summaries were generated using Excel. Associations among categorical factors were examined via the Chi-square test in STATA (version SE-17, StataCorp, Texas, USA). This statistical method was selected given the substantial sample and the categorical nature of the data, enabling evaluation of variable independence.

Findings

Among the 425 riders surveyed, the average age was 29.93 years (standard deviation 6.926), with the highest proportion (33.88%) falling in the 26–30 age group, closely followed by those aged 18–25 (30.12%). Regarding marital status, 46.8% were married, 48.7% unmarried, and 3.8% divorced, separated, or other. In terms of experience, 12.71% had under one year, 47.76% had 1–2 years, 34.59% had more than 2 years up to 5 years, and 4.94% exceeded 5 years. Additional sociodemographic and work-related characteristics of the participants are detailed in **Table 1**.

Table 1. Sociodemographic, occupational, lifestyle, and psychological profile of the participants (n = 425)

Variable	Category	Percentage (%)	Frequency (n)
Age (years)	≤25	30.1	128
	26–29	25.2	107
	30–34	23.8	101
	≥35	20.9	89
Education level	Secondary or lower	13.7	58
	Higher secondary or diploma	30.4	129
	Graduate or postgraduate	56.0	238
Current student status	Yes	18.1	77
	No	81.9	348
Marital status	Married	46.8	199
	Unmarried/divorced/separated/other	53.2	226
Migrant status	Yes	52.2	222
	No	47.8	203
Monthly household per capita income (₹)	≤10,000	50.6	215
	10,001–15,000	21.7	92
	≥15,001	27.8	118
Substance use	Yes	47.1	200
	No	52.9	225
Employment type	Part-time	28.2	120
	Full-time	71.8	305
Duration of experience as delivery rider (years)	≤1	30.1	128
	1–2	30.4	129
	>2	39.5	168
Skipping meals during work shifts	Yes	66.8	284
	No	33.2	141
Discomfort from wearing uniform	Yes	43.5	185
	No	56.5	240
Experiencing dehydration	Yes	63.3	269
	No	36.7	156
Temptation to eat delivered food	Yes	64.9	276
	No	35.1	149
Monthly personal earnings from delivery work (₹)	≤15,000	36.2	154
	15,001–25,000	28.0	119
	≥25,001	35.8	152
Work location (district)	Chennai	74.4	316
	Other districts	25.7	109
Burnout level	Low/medium	89.2	379
	High	10.8	46
Anxiety level	Minimal/mild	63.8	271
	Moderate	23.8	101
	Severe	12.5	53
Depression level	Minimal/mild	56.9	242
	Moderate	26.8	114
	Moderately severe/severe	16.2	69

To assess the prevalence of musculoskeletal discomfort, the investigation employed the well-established and validated Nordic Musculoskeletal Questionnaire, which distinguishes between acute (recent) and chronic (persistent) forms of body pain. Additionally, the study examined the incidence of injuries reported among the app-based food delivery riders.

Figure 2 presents a body map diagram [11] illustrating the distribution of pain and injuries across various anatomical regions experienced by the delivery riders.

Figure 3 displays the locations affected by recent (past 7 days) and extended (past 12 months) pain that interfered with their ability to perform regular work activities due to discomfort.

Figure 4 shows the frequency of injuries occurring at different body sites among the participants.

Details regarding the prevalence rates of both recent and extended musculoskeletal pain, as well as their statistical associations with sociodemographic, work-related, and psychological factors, are provided in **Table 2**. Long-term pain demonstrated significant associations with educational level, substance use, employment type (part-time/full-time), duration of experience as a rider, experiencing dehydration, temptation to consume the food being delivered, and primary work district.

Short-term pain was significantly linked to age group, current enrollment as a student, marital status, substance use, dehydration, temptation to eat delivered food, work location (district), and level of burnout.

Notably, substance use, feelings of dehydration, and work district emerged as factors significantly associated with both short-term and long-term pain.

Table 3 outlines the prevalence of reported injuries, revealing a significant association between skipping meals while on duty and the occurrence of injuries.
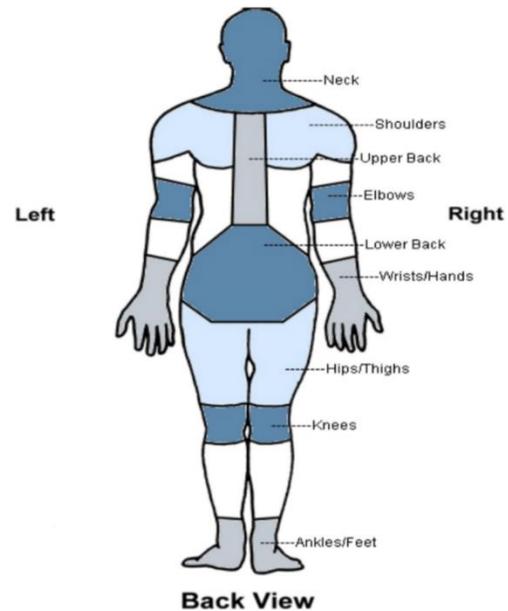

Figure 2. Source: iridiastadi dan yassierli, 2015

Body map of musculoskeletal pain as assessed through the Nordic musculoskeletal questionnaire.
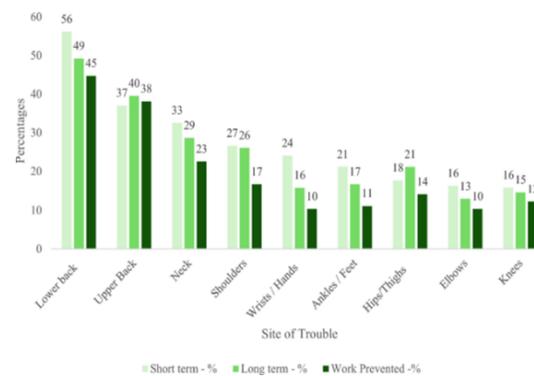

Figure 3. Trouble suffered for the last 12 months and last 7 days (n = 425)
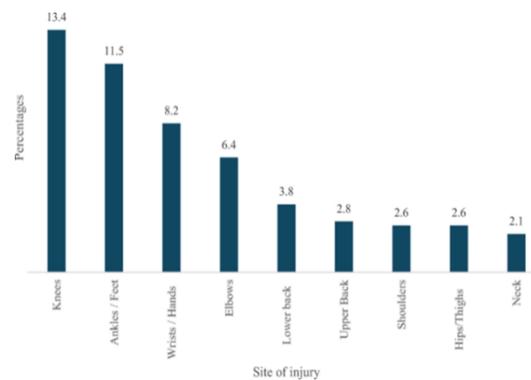
Figure 4. Prevalence of injuries as per the sites of the body

Table 2. Trouble in body parts because of short-term pain (last 7 days) and long-term pain (last 12 months) (n = 425)

Name of the variable	Categories	Short term pain					Long term pain				
		No Trouble	Trouble on 1–4 sites of the body	Trouble on 5–9 sites of the body	Chi-2	*p*-value	No Trouble	Trouble on 1–4 sites of the body	Trouble on 5–9 sites of the body	Chi-2	*p*-value
Age	25 and below	22.66	65.63	11.72	9.34	0.155	35.16	55.47	9.38	22.20	0.001
	26–29	29.91	59.81	10.28			36.45	57.01	6.54		
	30–34	17.00	65.00	18.00			15.84	72.28	11.88		
	35 and above	17.98	62.92	19.10			17.98	65.17	16.85		
Educational status	Secondary OR Below	22.41	60.34	17.24	10.57	0.032	20.69	67.24	12.07	3.22	0.522
	H-Secondary OR Diploma	30.23	53.49	16.28			31.01	56.59	12.40		
	Graduate OR Post-graduate	17.72	69.62	12.66			26.89	63.45	9.66		
Currently student	No	21.90	63.11	14.99	0.57	0.752	23.85	64.37	11.78	11.89	0.003
	Yes	23.38	64.94	11.69			42.86	50.65	6.49		
Marital status	Unmarried/Widowed/other	23.01	64.16	12.83	1.01	0.605	33.19	58.41	8.41	9.68	0.008
	Married	21.21	62.63	16.16			20.60	65.83	13.57		
Migrant status	No	25.74	60.40	13.86	2.86	0.239	28.57	61.08	10.34	0.35	0.838
	Yes	18.92	66.22	14.86			26.13	62.61	11.26		
Household monthly per capita income (in Rs.)	10,000 and below	18.22	65.42	16.36	5.20	0.267	23.72	64.19	12.09	3.45	0.486
	10,000–15,000	23.91	61.96	14.13			31.52	57.61	10.87		
	15,000 and above	27.97	61.02	11.02			30.51	61.02	8.47		
Substance abuse	No	20.89	68.44	10.67	6.86	0.032	25.33	69.33	5.33	18.28	0.000
	Yes	23.62	57.79	18.59			29.50	53.50	17.00		
Job status	Part-time	11.67	78.33	10.00	16.42	0.000	29.17	65.00	5.83	4.32	0.115
	Full time	26.32	57.57	16.12			26.56	60.66	12.79		
Years of experience	1 year and below	21.88	69.53	8.59	11.51	0.021	26.56	64.06	9.38	4.71	0.318
	1 year–2 years	26.36	62.02	11.63			33.33	57.36	9.30		
	Above 2 years	19.16	59.88	20.96			23.21	63.69	13.10		
Skip meal during duty hours	No	22.70	60.28	17.02	1.38	0.502	34.04	57.45	8.51	5.23	0.073
	Yes	21.91	65.02	13.07			23.94	64.08	11.97		
Feel discomfort at wearing uniform	No	22.18	64.02	13.81	0.16	0.925	25.00	62.92	12.08	1.97	0.374
	Yes	22.16	62.70	15.14			30.27	60.54	9.19		
Feel dehydration	No	30.13	60.26	9.62	11.35	0.003	37.82	61.54	0.64	33.62	0.000
	Yes	17.54	65.30	17.16			21.19	62.08	16.73		
Tempted to have food delivered	No	20.73	69.82	9.45	18.98	0.000	24.28	68.12	7.61	15.09	0.001
	Yes	24.83	51.68	23.49			32.89	50.34	16.78		

					χ²	p				χ²	p
Personal monthly income from food delivery (in Rs.)	15,000 and below	22.73	63.64	13.64			37.01	53.25	9.74		
	15,000–25,000	23.53	57.98	18.49	3.36	0.500	25.21	61.34	13.45	14.26	0.007
	25,000 and above	20.53	67.55	11.92			19.08	71.05	9.87		
Place of work (District)	Chennai	18.67	69.62	11.71	20.50	0.000	20.89	68.04	11.08	26.15	0.000
	Other	32.41	45.37	22.22			45.87	44.04	10.09		
Burnout	Low/medium	23.81	62.17	14.02	5.44	0.066	29.02	59.89	11.08	6.29	0.043
	High	8.70	73.91	17.39			13.04	78.26	8.7		
Anxiety	Minimal/mild	24.72	61.62	13.65			27.31	60.52	12.18		
	Moderate	23.00	63.00	14.00	7.80	0.099	32.67	61.39	5.94	6.72	0.151
	Severe	7.55	73.58	18.87			16.98	69.81	13.21		
Depression	Minimal/mild	21.99	64.32	13.69			26.86	62.81	10.33		
	Moderate	24.56	60.53	14.91	1.08	0.898	31.58	56.14	12.28	2.95	0.567
	Moderate Severe/severe	18.84	65.22	15.94			21.74	68.12	10.14		

The sites mentioned here are in chronological order as depicted in **Figure 2**

Table 3. Reported injuries sustained in the previous 12 months among participants (n = 425)

Variable	Category	Injuries at two or more sites (%)	Injury at one site (%)	No injury (%)	χ² value	p-value
Age (years)	≤25	14.1	14.1	71.9		
	26–29	14.0	12.2	73.8	2.89	0.823
	30–34	14.9	18.8	66.3		
	≥35	18.0	14.6	67.4		
Education level	Secondary or lower	13.8	13.8	72.4		
	Higher secondary or diploma	16.3	15.5	68.2	0.41	0.982
	Graduate or postgraduate	14.7	14.7	70.6		
Current student status	No	16.7	13.8	69.5	4.76	0.092
	Yes	7.8	19.5	72.7		
Marital status	Unmarried/widowed/separated/other	15.9	14.6	69.5	0.29	0.866
	Married	14.1	15.1	70.9		
Migrant status	No	16.3	15.8	68.0	0.85	0.652
	Yes	14.0	14.0	72.1		
Monthly household per capita income (₹)	≤10,000	14.9	13.5	71.6		
	10,001–15,000	15.2	9.8	75.0	6.17	0.187
	≥15,001	15.3	21.2	63.6		
Substance use	No	15.6	14.7	69.8	0.09	0.954
	Yes	14.5	15.0	70.5		
Employment type	Part-time	11.7	17.5	70.8	2.10	0.350
	Full-time	16.4	13.8	69.8		
Duration of experience as delivery rider (years)	≤1	7.8	18.0	74.2		
	1–2	15.5	13.2	71.3	9.43	0.051
	>2	20.2	13.7	66.1		
	No	9.9	19.9	70.2	7.30	**0.026**

Skipping meals during work shifts	Yes	17.6	12.3	70.1		
Discomfort from wearing uniform	No	16.3	15.0	68.8	0.68	0.712
	Yes	13.5	14.6	71.9		
Experiencing dehydration	No	14.7	14.1	71.2	0.14	0.932
	Yes	15.2	15.2	69.5		
Temptation to eat delivered food	No	16.7	13.0	70.3	3.04	0.219
	Yes	12.1	18.1	69.8		
Monthly personal earnings from delivery work (₹)	≤15,000	14.9	16.9	68.2		
	15,001–25,000	14.3	16.8	68.9	2.51	0.643
	≥25,001	15.8	11.2	73.0		
Work location (district)	Chennai	15.2	13.3	71.5	2.31	0.315
	Other districts	14.7	19.3	66.1		
Burnout level	Low/medium	14.3	15.3	70.5	2.13	0.345
	High	21.7	10.9	67.4		
Anxiety level	Minimal/mild	11.8	15.1	73.1		
	Moderate	20.8	14.9	64.4	6.30	0.178
	Severe	20.8	13.2	66.0		
Depression level	Minimal/mild	12.0	14.5	73.6		
	Moderate	15.8	14.0	70.2	8.00	0.092
	Moderately severe/severe	24.6	17.4	58.0		

This investigation evaluated the occurrence of musculoskeletal discomfort and injuries among riders working for app-based food delivery services in multiple cities within Tamil Nadu, India. The results pertaining to motorcycle-based delivery personnel, especially those in food delivery, are in line with various international studies conducted in diverse settings. Nevertheless, research specifically examining associated factors and quantifying the prevalence of musculoskeletal pain remains limited [8].

The research identified the lower back as the most commonly reported site of pain for both recent and extended periods among the delivery riders, followed by the upper back and neck. In a Canadian study involving short- and long-haul industrial gas delivery drivers, the highest rates of pain over the previous 12 months were observed in the lower back (21.1 percent), shoulders (20.3 percent), and neck (14.6 percent), while for recent pain, the most affected areas were similarly the lower back (14.6 percent), shoulders (13.8%), and neck (8.9 percent) [12]. The lower prevalence in that cohort compared to the present study may stem from differences in vehicle type (trucks versus two-wheelers) and associated postural demands.

A study in China involving 137 food delivery riders in the catering sector reported an overall musculoskeletal pain incidence of 67.9 percent, with the highest rates in the neck (35.8 percent, 49/137) and shoulders (35.8 percent, 49/137), followed by the lower back (34.3 percent, 47/137), waist/thighs (34.3%, 47/137), and knees (28.5%, 39/137) [13]. Another investigation in Shanghai among 657 delivery riders documented a musculoskeletal disorder prevalence of 54.91 percent (n = 361), with the leading sites for joint pain being the shoulders, neck, and knees, and for muscle pain the shoulders, upper arms, and neck [8]. The results from this study, alongside evidence from global research, underscore that musculoskeletal disorders represent a substantial public health concern for food delivery riders [8].

The regions most prominently impacted—particularly the shoulders and neck—mirror patterns seen among delivery riders in China [8] and Malaysia [14], indicating a widespread international pattern. Additionally, the elevated rate of lower back pain observed here

corresponds with reports from short-haul delivery drivers, where such pain is frequent but often transient [15]. Comparative analysis with other professions, such as taxi and rideshare drivers in San Diego, reveals a recurring pattern of muscle or joint discomfort predominantly affecting the lower back and neck [16]. A comparable high occurrence of chronic lower back pain has been noted among ambulance nurses in China, suggesting a link to prolonged travel rather than solely to active riding, and pointing primarily to postural factors. The demanding physical requirements of extended motorcycle riding further exacerbate persistent pain in the upper back, neck, and shoulders, paralleling the occupational strains experienced by ambulance nurses in physically intensive roles [17].

The investigation further revealed that the knees, ankles, and wrists were the primary locations for injuries sustained by the food delivery riders. In a parallel Chinese study of 32 riders fully reliant on this occupation, injury prevalence reached 90.6 percent (n = 29), in contrast to 50 percent (2 of 4) among those partially dependent [18]. A scoping review examining injuries among food delivery riders determined that lower-limb musculoskeletal injuries were the most prevalent and highlighted 23 critical risk factors, with younger age, limited driving experience, time pressure during work, and absence of protective equipment emerging as key contributors [19].

The research identified a significant link between skipping meals while on duty and the occurrence of injuries. Comparable results emerged from a study in South Korea, where temporary employees were more prone to missing meals—particularly lunch—than their permanent counterparts [20]. It is widely recognized that irregular eating habits adversely affect health, as omitting meals is associated with reduced nutritional intake and lower acquisition of nutritious foods [21, 22]. This can lead to conditions such as obesity, diabetes, cardiovascular problems, and mental health disorders [23, 24]. Notably, when irregular patterns are examined in detail, inconsistent eating behaviors may exacerbate a wider range of medical and psychological issues by disrupting metabolic processes and anxiety regulation, potentially influencing daily physical activity due to unpredictable access to food [25]. Evidence from studies on surgeons further reinforces the view that erratic meal patterns can trigger hypoglycemia, electrolyte disturbances, psychological strain, sleep deficits, and fatigue [26], all of which heighten the risk of

musculoskeletal injuries. These initial observations in occupational settings warrant confirmation through future investigations. Therefore, it is reasonable to conclude that personal habits, especially maintaining a balanced diet, play a critical role in the overall health of delivery personnel. Implementing compulsory break policies for meals could thus be advocated to reduce the burden of musculoskeletal disorders.

Additionally, the investigation revealed significant connections between dehydration and substance use with both recent and persistent pain experienced by the riders. Dehydration often causes electrolyte disruptions and serves as a primary trigger for musculoskeletal discomfort [27]. Substance misuse has similarly been linked to the development of chronic pain in various studies, partly through dysfunction in the ventromedial prefrontal cortex—a brain region involved in pain and stress modulation—that emerges as a major risk factor when impaired by substance use [28]. This mechanism likely accounts for the observed rates of short- and long-term pain in the present cohort of food delivery riders. Conversely, road infrastructure quality may act as a confounding element in relation to musculoskeletal pain and injuries. For example, one study highlighted how suboptimal road surfaces and dense traffic contribute to higher rates of musculoskeletal issues among drivers in Chennai [29]. Despite ongoing infrastructure improvements in Tamil Nadu cities—including new road construction, flyovers, and widening of existing pathways—the rapid growth in vehicle numbers, commuter volume, land constraints, and natural disruptions such as flooding continue to pose obstacles to sustaining optimal road conditions.

This study has several limitations. First, as a cross-sectional descriptive design, it cannot infer causal relationships. Second, reliance on the unmodified Nordic Musculoskeletal Questionnaire (NMQ) and self-reported data introduced potential recall bias, particularly for recollections of pain over extended periods, which could have resulted in over- or under-reporting of associations between exposures and outcomes. Third, the descriptive approach precluded in-depth exploration of confounding variables and their effects. Moreover, given the self-reported nature of pain and injury data, information on pre-existing medical conditions or non-work-related musculoskeletal issues was not collected separately, which could have refined prevalence estimates. Likewise, details regarding ongoing treatments—such as physiotherapy or medication—that might mitigate pain

severity were not captured. Additionally, no clinical assessments of participants were conducted. Finally, analysis was restricted to bivariate Chi-square tests examining links between self-reported pain/injuries and exposure factors (sociodemographic and lifestyle variables). While more advanced techniques like multivariate logistic regression could have been employed to explore potential causality, they were not applied here due to insufficient theoretical grounding.

Conclusion

Investigations into pain and injuries among food delivery riders remain limited, and this research notably advances knowledge by highlighting the substantial health consequences of full-time engagement in this occupation, including elevated rates of physical discomfort, especially in the lower back region. These insights emphasize the pressing requirement to tackle musculoskeletal problems to safeguard the welfare of individuals in this sector. The alignment of these results with evidence from diverse studies reinforces the need to prioritize health and safety measures for workers in roles involving prolonged driving or riding, across the gig economy and traditional industries alike.

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