

# Impact of Different Types of Bikes on Post-ride Pain and Insights into Strategies Adopted by Recreational Cyclists from Gurugram to Alleviate Pain: A Cross-sectional Survey

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## ABSTRACT

**Introduction:** Non-traumatic injuries are prevalent among long-distance cyclists. However, there is a lack of studies analysing the impact of different types of bikes on the pain experienced by cyclists or the physiotherapy measures commonly adopted by cyclists post-ride.

**Aim:** To understand the impact of different types of bikes on the pain experienced by cyclists and to identify the physiotherapeutic measures commonly adopted by Indian cyclists.

**Materials and Methods:** A cross-sectional survey was conducted on 120 cyclists (94 males and 26 females) from three different cycling groups in Gurugram, Haryana, India. Data was collected from August 2022 to September 2022. A self-structured questionnaire was used to collect information on sociodemographic profile, type of bike used, duration of cycling, average distance and speed covered, areas and types of pain experienced, and measures taken to address pain. The data was analysed using Statistical Package for Social Sciences (SPSS) version 24.0. The level of significance was set at  $p \leq 0.05$ . Data was presented as frequencies and percentages, and comparisons were made using Kruskal-Wallis and Chi-square tests.

**Results:** The mean age of the study participants was  $39.36 \pm 11.88$  years. The average speed and distance covered in one ride were  $22.52 \pm 4.73$  km/hour and  $43.50 \pm 15.32$  km, respectively. A statistically significant association between the type of bike used and pain status ( $p < 0.05$ ) was observed. 65% of riders reported experiencing pain in some part of their body in the last six months. Pain was more prevalent among hybrid bike users compared to mountain and road bike users. Male cyclists had a faster average speed compared to female cyclists by 5 km/hour. The average distance covered by male and female cyclists was similar, with just a 1 km difference. Cyclists commonly experienced pain in the wrists, legs, back, and neck. 19.1% of riders did nothing or only rested to address pain, while 21.66% opted for muscle stretching, 9.16% engaged in exercises, and 3.33% used cycling gloves for wrist and hand pain. Other measures included Transcutaneous Electrical Nerve Stimulation (TENS), dry needling, icing, refitting or changing the bike, and taking supplements.

**Conclusion:** Among different types of bikes, hybrid bike users showed a higher incidence of pain. Cyclists in Gurugram tend to utilise limited physiotherapy measures to alleviate pain and enhance performance.

**Keywords:** Hybrid bike, Mountain bike, Non-traumatic injuries, Physiotherapy

## INTRODUCTION

In the post-pandemic era, people have increasingly turned to cycling as a recreational activity. It not only enhances their aerobic capacity but also allows them to exercise without coming into contact with others. Cycling has gained popularity due to its ease of indulgence, low maintenance requirements, and the independence it offers to cyclists [1]. There are three commonly used types of bikes: road bikes, hybrids, and mountain bikes. Each of these bikes serves different purposes and has distinct designs. Cyclists choose their preferred type based on their individual preferences [2]. For example, if a cyclist's goal is to build strength, they may opt for a mountain bike. If their aim is to cycle at high speeds, they may choose a road bike, which is designed to be aerodynamic and lightweight. Hybrids, on the other hand, offer a combination of features from both designs, allowing for relatively high speeds while being more sturdy compared to road bikes. In the context of Indian roads, hybrids have been found to work well for long rides. Although their design and performance characteristics, such as the interim design of their tires between road bikes and mountain bikes, are known, it is yet to be explored which type of bike causes the most pain in riders [3].

The best way to avoid injuries when riding a bicycle is to encourage people to wear helmets. Other preventive measures include wearing

protective gear and clothing and following general safety guidelines [4]. The majority of mountain bike accidents occur in riders between the ages of 20 and 39 [5]. In the event of a crash, the saddle and seat-post may cause genital and rectal injuries [6], while landing on the handlebars can lead to visceral and vascular penetration [7]. Bicyclists who regularly ride their bikes, especially those involved in professional racing, are at risk of developing overuse injuries. These can be mostly prevented by ensuring that the bicycle's handlebars, pedals, seat (saddle), and size are all properly adjusted [4,8]. The cyclist's upper body position, which places the neck in a hyperextended position and the lower back in a flexed position, often leads to neck and back pain [9,10]. Recommendations for addressing these issues include shortening the handlebar reach and creating a slight upward tilt of the saddle (10 to 15 degrees). Regularly changing hand and arm positions on the handlebars, while keeping the elbows slightly flexed, is also advised. Rest, stretching exercises, and anti-inflammatory medications are additional measures [8-10]. Compression neuropathies in the hands may occur due to persistent pressure on the handlebars and improper wrist positioning [11]. The deep palmar branch of the ulnar nerve, located near the Guyon tunnel (ulnar tunnel) and anterior to the palmar fascia, is most commonly affected [8,12]. Research on elite

professional cyclists suggests a higher prevalence of overuse injuries and a different pattern of lesions compared to other demographics. Clavicle fractures are among the most common traumatic injuries [13]. In otherwise healthy individuals with risk factors for hip discomfort, an improper bicycle fit can contribute to hip complaints [14]. Myofascial and intra-articular discomfort are frequent issues experienced by cyclists [15]. The knee, neck/shoulder, hands, hip, and perineum are the body parts most commonly injured in non-traumatic cycling accidents [16,17].

There is a lack of literature regarding the prevalence of non-traumatic or gradual onset injuries in recreational road cyclists, particularly in the Indian terrain. Although many studies have been conducted worldwide to investigate non-traumatic injuries in cyclists [1-4], there are no studies on the Indian population that provide an overview of the effect of different types of bikes on post-ride pain in riders. Furthermore, the present study highlights the gap in knowledge regarding the physiotherapy measures adopted by cyclists to prevent or treat these gradual onset non-traumatic injuries. The aim of this study was to understand which bike design can lead to more post-ride pain and to identify prevalent physiotherapeutic measures among Indian cyclists.

## MATERIALS AND METHODS

A cross-sectional survey was conducted on 120 cyclists from three different cycling groups in Gurugram, Haryana, India. The survey responses were collected from August 2022 to September 2022. Both male and female riders between the ages of 20 and 60 years were included in the study.

**Inclusion criteria:** Riders who had been regularly cycling with their respective groups for a minimum of one year, riding at least four days a week for a minimum of two hours a day, were included in the study.

**Exclusion criteria:** Riders who were not willing to participate and those who were unable to read and write in English were excluded from the study.

### Study Procedure

Convenience sampling was used to select participants. In Gurugram, there were approximately less than 1000 riders, out of which around 150 were regular riders meeting the study's inclusion criteria. A total of 120 regular cyclists responded to the survey. Data compilation, statistical analysis, and report writing were completed within two months, by November 2022. The questionnaire consisted of four sections with a total of 14 questions. Six questions were open-ended, and eight questions were multiple-choice questions. The first section collected sociodemographic data, the second section focused on the type of bike used, distance and speed of the cyclist. The third section included questions about post-ride pain (excluding trauma) and body type, categorised as endomorph (short stature with a wide frame and higher BMI), ectomorph (tall and slim), and mesomorph (strong and solid, neither underweight nor overweight). Participants were asked to select the most painful area from multiple options in the last six months. The fourth section explored the treatment strategies chosen for pain management, as shown in [Table/Fig-1]. The questionnaire was self-structured, and a pilot test was conducted on 50 cyclists to assess reliability and validity. The Cronbach's  $\alpha$ -value was 0.700, indicated acceptable internal consistency with a reasonable degree of correlation between different items of the questionnaire. The questionnaire was prepared in English. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist was followed for this cross-sectional study [18]. Data collection was conducted in accordance with the principles of the Declaration of Helsinki. The responses from these cyclists highlight a gap in incorporating physiotherapy into their regular fitness routines for managing pain and injuries.

S. No.	Sections	Questions	Response (open-ended or multiple choice)
1	1	What is your age?	
2		Select your gender?	Male/female
3		What is your occupation?	
4	2	How long do you ride every day?	
5		How long has it been since you started riding?	
6	2	Which cycle do you ride?	Roadie Hybrid Mountain bike
7		What is your average distance covered in every day cycling?	
8		What is your average speed covered in every day cycling?	
9	2	How do you prefer to cycle?	Solo/group
10		When do you prefer to cycle?	Early morning (4 am)
			Morning (6 am-8 am)
			Afternoon (3 pm-5 pm)
		Evening (5 pm-7 pm)	
11	2	What is your body type?	Endomorph (short stature with wide frame and higher BMI) Ectomorph (tall and slim) Mesomorph (strong solid neither underweight nor overweight)
12		Select the most painful area post-ride in last three months.	Back
	Hips		
	Knees		
	Ankle/feet		
	Legs		
	Headache		
	Neck		
	Shoulder		
	Wrist/hand		
	Elbows		
13	2	Describe your pain; What type of pain you feel?	Diffuse
			Numbness
			Heaviness
			Intermittent/consistent
			Burning
		Dull aching	
14	4	What measures do you take to deal with this pain?	Nothing Rest Stretching Exercises Pain relief ointment and spray Massage with oil TENS Dry needling Icing Wrist band/cycling gloves Refitting the cycle Change the cycle Supplements

**[Table/Fig-1]:** Questions presented to the recreational cyclists in Gurugram.  
BMI: Body mass index

## STATISTICAL ANALYSIS

The Statistical Package for Social Sciences (SPSS) version 24.0 was used for statistical analysis with a significance level set at 5% ( $p=0.05$ ). Variables were analysed based on percentages. The independent t-test was used for quantitative data analysis. The Kruskal-Wallis test and Chi-square test were employed to analyse non-parametric data and determine any statistically significant differences among the three types of bikes used.

## RESULTS

The mean age of the study participants was 39.36±11.88 years. The average speed and distance covered in one ride were 22.52±4.73 km/hour and 43.50±15.32 km, respectively, as shown in [Table/Fig-2]. Speed distribution of speed across the population ranged from 7.64 km/hr to 38.36 km/hr. Approximately 99% of cyclists in Gurugram covered distances on their bikes ranging from 9.12 km to 62.8 km in one day. The survey indicated that 78.33% of the total sample population were male riders, while 21.7% were female riders, as shown in [Table/Fig-3]. Among the participants, 65% reported experiencing pain in some part of their body after recreational rides, while 35% of regular cyclists did not experience any pain. Out of the 65% who suffered from pain, 31.6% did not take any measures to alleviate it. Only 19.16% opted for rest to overcome the pain, while 21.66% engaged in muscle stretching during warm-up and cool-down periods or if they felt pain in a specific muscle. Additionally, 9.16% of cyclists used exercise as a means to relieve pain, while 3.33% used cycling gloves for wrist and hand pains. A small percentage (1.66%) of the population tried various approaches, including massage with oil, supplements, changing their bike, refitting their bike, icing, and dry needling. Among the cyclists who reported pain, 33.33% described it as diffuse, while 30.8% experienced numbness and heaviness in the affected body part.

Variables	N	Mean±SD
Age (in years)	120	39.36±11.88
Average speed (km/hr)	120	22.52±4.73
Average distance (km)	120	43.50±15.32

[Table/Fig-2]: Mean values of age, distance and speed of riders.

Variables	Category	Frequency (n)	Percentage (%)
Gender	Male	94	78.3
	Female	26	21.7
Occupation	Job (private/government)	52	43.3
	Business	14	11.6
	Student	14	11.6
	Homemaker	6	5
	Retired	8	6.6
	Lawyer	4	3.3
	Dentist	4	3.3
	Baker	4	3.3
	Associate professor	2	1.6
	Architect	2	1.66
	Painter	2	1.66
	Physiotherapist	2	1.66
	Medical doctor	2	1.66
	Soldier	2	1.66
	Writer	2	1.66
Duration of ride	Two hours everyday	83	69.1
	Two hours four times a week	17	14.1
	Three hours everyday	20	16.6
Duration since you started riding	More than a year	120	100
Preference in cycling	Solo	38	31.6
	Group	82	68.3
Preferred time of cycling	Early morning (4 am)	42	35
	Morning (6 am-9 am)	63	52.5
	Afternoon (3 pm-5 pm)	4	3.3
	Evening (5 pm-7 pm)	11	9.1

Kind of cycle	Roadie	56	46.7
	Mountain bike	28	21.7
	Hybrid	36	30.0
Body type	Ectomorph	24	20
	Endomorph	30	25
	Mesomorph	66	55
Pain status	Pain	78	65
	No pain	42	35
Painful area	Back	16	13.33
	Hips	7	5.83
	Legs	26	21.66
	Headache	3	2.5
	Neck	16	13.33
	Shoulder	8	6.66
	Wrist/hand	43	35.83
Nature of pain	Diffuse pain	40	33.33
	Numbness and heaviness	37	30.8
	Burning pain	17	14.16
	Throbbing pain	10	8.33
	Intermittent pain	8	6.66
	Consistent pain	8	6.66
Strategy to overcome pain	Nothing	38	31.66
	Rest	26	19.16
	Stretching	23	21.66
	Exercises	11	9.16
	Pain relief ointment and spray	4	3.33
	Wrist band/cycling gloves	4	3.33
	Massage with oil	2	1.66
	TENS	2	1.66
	Dry needling	2	1.66
	Icing	2	1.66
	Refitting the cycle	2	1.66
	Change the cycle	2	1.66
	Supplements	2	1.66

[Table/Fig-3]: Table depicting frequency distribution of study variables (gender, kind of cycle, body type, pain status, painful area, strategies to overcome pain). TENS: Transcutaneous electrical nerve stimulation

According to the current study, there was no statistically significant difference in the distances covered, but there was a significant difference in the speeds traveled by male and female riders, with higher mean values observed in male riders, as shown in [Table/Fig-4]. The average speeds of the three types of bikes showed a statistically significant difference. Although more distance was covered by road cyclists compared to hybrid and mountain bikers, this difference could not be proven statistically [Table/Fig-5]. A statistically significant association between the types of bikes used and pain status ( $p < 0.05$ ), with pain being more prevalent among hybrid bikers compared to mountain and road cyclists, as shown in [Table/Fig-6].

Variables	Gender	Mean±SD	t-value	p-value
Average distance	Male	43.75±14.30	0.35	0.72 <sup>ns</sup>
	Female	42.50±19.16		
Average speed	Male	22.97±4.28	4.34	0.001*
	Female	18.66±4.574		

[Table/Fig-4]: Comparison on average distance and speed between male and female riders using independent t-test. ns: Non significant; \*significant

Variables	Bike category	n	Mean rank	p-value
Average speed	Roadie	58	73.68	<0.001*
	Mountain bike	26	49.50	
	Hybrid	36	44.67	
Average distance kilometres	Roadie	58	65.79	0.057 <sup>ns</sup>
	Mountain bike	26	47.42	
	Hybrid	36	58.44	

**[Table/Fig-5]:** Kruskal-Wallis test to compare average speed and distance between three groups with different bikes.  
\*significant; ns: Non significant

Pain status	n (%)	Bike category			$\chi^2$	p-value
		Road bike n (%)	Motor bike n (%)	Hybrid n (%)		
No pain	42 (35)	20 (35.7)	15 (51.7)	7 (20)	7.03	0.03*
Pain	78 (65)	36 (30)	14 (11.7)	28 (85)		

**[Table/Fig-6]:** Chi-square test to see association of bike categories with pain status.

## DISCUSSION

The present study was conducted on 120 cyclists from Gurugram, India, to understand the impact of different types of bicycles on the pain experienced by cyclists and to determine the commonly adopted physiotherapeutic measures among Indian cyclists. This study is the first of its kind and one of the few conducted within the Indian context specifically for the cyclist community.

According to the information collected and analysed from the survey, the average age of the cyclists was 39.36 years, and the average speed was 22.51 km/hr. The speed distribution across the population ranged from 7.64 km/hr to 38.36 km/hr. A study conducted in Sweden in 2019 analysed the average speed of cyclists, which varied between 12.5 and 26.5 km/hr [19]. The present study reflects a similar scenario in terms of speed.

The data collected from the 120 cyclists in Gurugram revealed that the average distance covered in one day was 43.5 km. Evidence on cycling behavior has been analysed by Goel R et al., through surveys across 17 countries on six continents from 2009 to 2019, and it was found that the majority of cyclists fall into the category of covering 0-5 km distance per day [20]. However, in the present study, 99% of the cyclists covered distances ranging from 9.12 km to 62.8 km in one day. Literature highlights that Germany, Japan, and the Netherlands are nations that enable greater distances in cycling, along with good representation in terms of gender and age among cyclists [20]. It has been estimated that 46.7% of riders choose road bikes, 30% choose hybrid bikes, and only 21.7% opt for mountain bikes.

The present survey indicates that the most commonly affected areas after cycling in recreational cyclists are the wrists (35.8%) and legs (21.6%), followed by the neck and back (13.3% each). Approximately 6% of cyclists complain of headaches and pain in the hip, ankle, and shoulder. Mosimann R et al., suggested that hypertrophy of the psoas muscle leads to the bending of the external iliac artery, which can eventually cause claudication [21].

It is evident from the analysis that the common practices to relieve pain among cyclists are either to do nothing or simply rest. Stretching and exercises are also prevalent practices among cyclists. In 2002, Farrell KC et al., analysed foot pedal force, knee flexion angle, and crank angle and found them to be related to the cause of Iliotibial Band Friction Syndrome (ITBFS) [22]. Repeated knee flexion in the impingement zone during cycling is a major contributor to ITBFS and knee pain. The present study suggests that a very small population utilises oil massage, icing, TENS, pain relieving sprays or ointments, supplements, or changes their bike or fitting in order to reduce pain. Only 3% of cyclists use dry needling as a pain relieving technique. The survey highlights the need to educate cyclists about the various options available for physiotherapy treatments to alleviate

post-cycling pain. Some of these treatments can be done weekly, once every 10 days, or fortnightly.

Battista S et al., reported that 47.3% of cyclists suffer from lower back pain, and only 35.8% of cyclists use pain relief medications, with Non-Steroidal Anti-inflammatory Drugs (NSAIDs) being the most popular choice [23]. This is consistent with a study by Outram and Stewart, which found that amateur cyclists commonly use NSAIDs and caffeine to manage pain [24]. Muscle energy techniques, positional release techniques, nerve mobilisation, myofascial release, and cupping therapy are some effective techniques used in physiotherapy, which can benefit contemporary recreational cyclists.

It was observed that males cover a greater distance, around 43.4 km, compared to female cyclists who cover an average of 42.6 km in one day. However, there is a significant difference in average speeds between males and females, with males having a higher average speed by 5 km/hr. A cluster analysis done on cyclists in Europe revealed that 50% of female riders had a mean age of 43 years, of whom 67% were employed [25]. Despite the low infrastructure and poor policies for road users in India, the present study indicates a good proportion of female riders. There is a statistically significant difference in average speed and pain status among the three types of bikes available: road bikes, mountain bikes, and hybrids. Road bikes offer the highest speed, and there is no significant difference in the distance covered. A statistically significant association between the types of bikes used and pain status was observed, with hybrid bikers experiencing more pain compared to mountain and road cyclists. This finding is consistent with a previous study conducted in 2022, which showed that mountain bikes do not significantly contribute to lower extremity pain [26]. Further research comparing the effectiveness of various physiotherapy treatments is recommended.

## Limitation(s)

A larger geographical area would have done more justice to the population. Further research is warranted to understand cyclists' response to different physiotherapy strategies and their effect on their performance.

## CONCLUSION(S)

Among the different kinds of bikes, hybrid users complain more about pain post-ride, while mountain bike users complain the least. There is a lack of awareness among the young cyclist group regarding the available contemporary physiotherapy measures, which can not only effectively alleviate pain but also improve their performance. The information from the present study can therefore be used as a reference to infer which kind of cycle a cyclist should use depending on his or her purpose.

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**PLAGIARISM CHECKING METHODS:** [Jain H et al.]

- Plagiarism X-checker: Mar 22, 2023
- Manual Googling: May 26, 2023
- iThenticate Software: Jun 30, 2023 (3%)

**ETYMOLOGY:** Author Origin**EMENDATIONS:** 6**AUTHOR DECLARATION:**

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Mar 19, 2023**Date of Peer Review: **Apr 25, 2023**Date of Acceptance: **Jul 03, 2023**Date of Publishing: **Aug 01, 2023**