



# THE THERAPIST

JOURNAL OF THERAPIES & REHABILITATION SCIENCES

<https://thetherapist.com.pk/index.php/tt>

Volume 4, Issue 2 (April-June 2023)



## Original Article

# Neck Pain Among Occupational Bike Riders Wearing Helmet in Twin Cities: A Cross Sectional Survey

Aoun Hassan<sup>1</sup>, Sidra Hanif<sup>2\*</sup>, Ishaq Ahmed<sup>2</sup>, Faryal Zaidi<sup>2</sup>, Amir Aslam<sup>1</sup>, Afshan Kayani<sup>1</sup>, Reema Altaf<sup>3</sup> and Rizmi Naseer<sup>4</sup>

<sup>1</sup>The University of Lahore Islamabad Campus, Islamabad, Pakistan

<sup>2</sup>Ibadat International University, Islamabad, Pakistan

<sup>3</sup>Shaheed Zulfiqar Ali Bhutto Medical University (SZABMU), Islamabad, Pakistan

<sup>4</sup>Hamza Medical Center, Islamabad, Pakistan

## ARTICLE INFO

### Key Words:

Neck Pain, Bike Riders, NP

### How to Cite:

Hassan, A., Hanif, S., Ahmed, I., Zaidi, F., Aslam, A., Kayani, A., Altaf, R., & Naseer, R. (2023). Neck Pain Among Occupational Bike Riders Wearing Helmet in Twin Cities: A Cross Sectional Survey: Neck Pain Among Occupational Bike Riders. *THE THERAPIST (Journal of Therapies & Rehabilitation Sciences)*, 4(02).

<https://doi.org/10.54393/tt.v4i02.129>

### \*Corresponding Author:

Sidra Hanif

Ibadat International University, Islamabad, Pakistan

[drsidrahaneefpt@gmail.com](mailto:drsidrahaneefpt@gmail.com)

Received Date: 21<sup>st</sup> May, 2023

Acceptance Date: 25<sup>th</sup> June, 2023

Published Date: 30<sup>th</sup> June, 2023

## ABSTRACT

Neck pain is a pain, stress, and fatigue of the muscles in or around the spine beneath head. Sometimes this pain may continue from the neck region into the shoulders, arms and upper back. Bike riders wearing helmet are more prone to neck pain due to prolonged use of helmet.

**Objective:** To find the frequency of neck pain in bike riders who wear helmet in Twin Cities.

**Methods:** A descriptive cross-sectional survey was conducted among bike riders wearing helmet working with Careem, Bykea and InDriver considering non-probability convenient sampling. 227 participants were selected agreeing to inclusion and exclusion criteria. Data were collected from bike riders at different locations of Rawalpindi and Islamabad. Association of neck pain to the use of helmet and weight was observed in this study. Pain intensity was measured by Neck Pain and Disability Scale. Data were analyzed by using SPSS 26. **Results:** Out of 370 participants, 227 were helmet users, 149 (65.6%) had neck pain. 78 participants wearing helmet did not feel neck pain. **Conclusions:** This study concluded that there was 65.6% frequency of neck pain among bike riders wearing helmet in Twin Cities.

## INTRODUCTION

The most convenient means of transportation are motorcycles and helmets use while riding on a bike is the required for safe travel. It is determined that helmets are the necessary item to wear to be safe in a possible occurrence of road traffic incident. Helmets save its user from serious head, brain and facial injury [1]. Motorcycle accidents are considered one of the main risk factors of road fatalities in developing countries. Helmet wearing is the most operational and nominal way of preventing head injuries, moreover, in case of injury it also reduces the intensity and severity of the injury among bike riders [2].

Although an economical source of transportation, however the motorcycles bear a remarkable risk of fall because, in most two-wheelers, the center of gravity is not consistent. The second major cause of calamities is the speediness of the vehicle. The chance of fatal collision becomes greater at higher speed [3]. Nevertheless discussed, neck pain is one of the frequently come across problem in motorcyclists because of recurrent use helmets while riding. Neck pain is a pain, stress, and fatigue of the muscles in or around the spine beneath head. There exist inadequate literature concerning the uneasiness among

motorcyclists and the manifestation of neck pain because of helmet use. Distress and uneasiness in the body throughout the ride can be due to the seat ergonomics that include, height of seat, hardness of seat, bad postural habits, and bike suspension for smooth ride and handle position adjustments. People may experience neck and upper back pain even during short distance rides [3]. The weight of helmet is an additional burden on the head. This may lead to the head and neck problems in terms of pain and decreased range of motion [4]. Sometimes the motorcyclists avoid the use of helmet as it causes discomfort if they wore it for extended period [4]. Other reasons for not wearing helmet are hair loss, neck discomfort, pain in the neck and occasional headache [5]. Driving bike for long durations causes fatigue in the paraspinal muscles that hold the spine. Postural muscles are prone to fatigue and helmet weight further increases it. The use of helmet for longer durations also causes restriction in neck movements [2]. Motorcyclists stated remarkable restriction in their head and neck ranges of motion if the use of a helmet is prolonged [6]. The helmet usage in adults is not same throughout the world, it varies in countries; 8.6% to 75% in Iran [6] 56% in Pakistan, 19.7% in Spain, and in Vietnam it is 90% [7]. Some researchers have suggested that the neck pain reported by the motorcyclists can be due to the seating posture during ride [8]. However, limited studies have been commenced to find the level of neck pain during the ride while wearing the helmet. Sometimes neck pain may continue from the neck region into the shoulders, arms and upper back. Types of neck pain by causing include mechanical, non-mechanical, and referred pain. Nonspecific musculoskeletal pain, compressed nerve roots, joint diseases, bone and joint degenerative disease come under the category of mechanical pain whereas non mechanical neck pain includes inflammatory diseases pain, tumor and infectious pain. Referred pain of organs i.e. Heart, esophagus and other seemingly unrelated organ system [9]. Mechanical is the most prevalent which contribute for most of neck pain cases which have no known cause but it is believed to be caused by muscle strain and injury to ligaments [10]. Neck pain is very uncommon from any systemic and psychological problems e.g. fibromyalgia [11]. On the basis of signs and symptoms, it is further classified as diffuse and localized which accounts for the most used classification describing neck pain. Diffuse pain is that which does not respond to movement while localized means non-radiating and specific to the neck region. Radiating pain that radiates down the neck to arms in one or both sides which response to specific positions [11]. Middle aged adults are mostly affected while the mean age is 47.9 years at the time of diagnosis. The incidence rates

are highest in 50-54 age group. Men are most prone to cultivate cervical radiculopathy than women; lower nerve roots are more at risk to get compressed [11]. Neck pain with red flags accounts for a serious and emergency condition which needs immediate consideration [12, 13]. It can classify on the basis of span as acute, sub-acute, and chronic. Usually, the time duration for acute neck pain is less than six weeks, for sub-acute between six to twelve weeks is sub-acute and more than twelve weeks is chronic [14]. Soft tissues of the neck back and abdomen provide stability to the spine. Facet joints inhibit as well as control spinal movements. Multifidus muscles play an important role in keeping the spine erect and provide stability during movements of the spine. Chronic low neck pain patients have issues in multifidus muscles because of improper posture and movement. Complications to multifidus and other extensor muscles remain constant even without pain due to poor biomechanics and are the most common cause of returning of neck pain after it disappears for some period [15]. Neck pain is highly related to the increasing age of bike drivers, prolonged times spent while driving and, improper posture and hours of helmet use [16]. The pain usually felt on movements like cervical extension, lateral bending, and Para spinal contact. Radiological imaging is important in diagnosing problems with mediated pains [17]. The probable incidence of neck pain in 1 year is 10.4% and 21.3% with a spike incidence rate in office workers and most computer users [18]. Per year, 0.6% of the populace is prone to establish disabling neck pain and the rate of recovery of neck pain is 36.6%. Among subjects with prevalent neck pain at baseline, 37.3% report stubborn complications with neck pain and 9.9% showed increase in symptoms during follow up. Lastly, 22.8% of those with prevalent neck pain at baseline show a repeated episode. Neck pain is the most familiar pain found in motorcyclists. With the increasing age, prolonged sitting for riding and longer rides are the most prevalent risk factors among motorcyclists. Repeated lifting and without spinal support of rider's seat, weight of helmet and vibration caused by the engine are also associated with neck pain among motorcyclists [19]. Prolong sitting while driving for 4 or more hours without a change in posture is found to prevalent and related to the cause of neck pain [19]. Adjustment to change and improper head posture while riding bikes leads to neck pain. Improper fitting helmets may also contribute towards the cause of neck pain [6]. Neck pain is prevalent in riders with a history of more than 5 years of driving. It was also more prevalent among those who spent on riding with 8 or more hours riding per day. Age of rider, education level, stress, the posture adopted while riding, condition of motorcycle shock absorbers were highly related to neck pain among motorcyclists [3]. The

aim of this study was to find out frequency of neck pain in occupational motor bike riders due to excessive use of helmet. There are very limited studies conducted on occupational motorcyclists all over the world. Neck pain affects the daily working of riders and this may lead to absence from job and less productivity of work as well. This research was conducted to provide information regarding neck pain due to prolong use of helmet among bike riders.

## METHODS

This was a descriptive cross sectional study carried out in twin cities of Pakistan in the occupational bike riders of Bykea, Careem and Indriver within the duration of 6 months from February 2022 to July 2022. Sample was raised by Slovin formula i.e. Confident interval (CI): 95% Margin of error (a-error): 0.05

$$n = N / (1 + Ne^2)$$

Where n= sample size, N= actual population, e= margin of error Number of registered riders in Rawalpindi and Islamabad is 5000, so N= 5000 n= 5000/1+5000(0.05)<sup>2</sup> n=5000/13.5 n=370

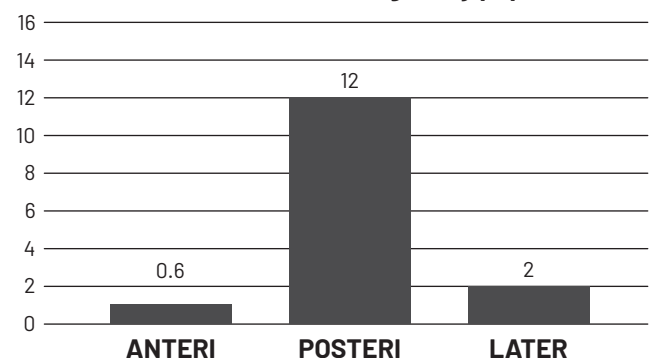
Non probability convenient sampling technique was used and data were collected after informed consent through a semi structured questionnaire and NPAD scale. Occupational bike riders aged 18–45 years who use helmet during the bike ride for more than 4 hours a day, more than 3 days a week, using helmet for more than 6 months along with more than 10km distance travelled per day by riders were included in this study. All those with history of neck fracture or trauma, neck surgery, diagnosed cervical pathology and individuals who do not use helmet during bike ride and were not willing to be a part of the study was excluded from the sample. Data were collected using a self-structured questionnaire which consists of 34 questions recording data over the last 6 weeks. Questions regarding age, helmet weight, riding time per day, posture affecting rider's daily life over the past 6 weeks are asked in this questionnaire. The intensity of pain was measured using a Neck Pain and Disability scale i.e. NPAD. The 20-item scale is used to find out the complications with neck pain intensity, neck movements, the level of effect on daily life accomplishments and, effect of neck pain on emotion and cognition. The NPAD is an authenticated tool to determine results in patients with neck pain. The tool is a go to and smooth tool in terms of completion and evaluation for both patients and evaluators respectively [20]. It can measure reliably the vocational, social, leisure and functional activities of life. The Cronbach's alpha scores of NPAD-d its subscales pain debility and nek function were 0.97, 0.95 and 0.87 respectively. Test retest reliability of NPAD-d was found by Bremerich et al., and it was provided that NPAD is a reliable and valid to use in

further studies on neck pain in future. The tool is found to be patient oriented and easy to execute [21].

## RESULTS

The research was carried out in Rawalpindi and Islamabad. On the basis of inclusion and exclusion criteria, 143 participants were excluded out of 370 sample. Data of 227 participants were analyzed to formulate results. Mean age of population was 29±7.6 years. The results showed that the 65% occupational bike riders have neck pain. In current study 95 participants were wearing a helmet of weight ranging from 0.25–1.29 kg and 1 of them was having severe pain, 41 participants were wearing a helmet of weight ranging from 1.30–1.90 kg and 2 of them were having severe pain, 13 participants were wearing a helmet of weight ranging from 2.0–3.0 kg and 1 of them was having severe neck pain, hence concluded that increasing helmet weight leads to severity of pain in neck. Most of the participants were of age group 26 years to 29 years with 51(34.2%) were driving bike daily 71–100 Km. The figure 1 shows that the pain is localized in the posterior neck area in most 123 of the bike riders.

**Location of Neck Pain among study population**



**Figure 1:** Graph representing the location of neck pain in study population

It was observed that more participants (72%) were wearing the helmet of weight ranging from 0.25–1.29kg. Out of 227 participants 34 (15%) were between the age of 18–21, 35 (15%) were between age of 22–25, 52 (22%) were between age of 26–29, 32 (14%) were between the age of 30–33, 28(12%) were between the age of 34–37, 21(9%) were between the age of 38–41 and 25(11%) participants were between the age of 42–45. Out of 227 participants, 149 (65.6%) were having neck pain and 78 (34.4%) were not having neck pain. Out of 149 participants 8(5.4%) had pain while neck flexion 109 (73.2%) had neck pain during extension, 21(14.1%) were had pain while side bending and 11(7.4%) had pain while rotating their neck. Table 1 is showing BMI (body mass index) distribution of the study population and it represents that 113 participants were normal while 35 were obese and only 8 were underweight.

**Table 1:** BMI distribution of study population

BMI Category	Frequency (%)
Under Weight	8 (3.5)
Normal Weight	113 (49.8)
Over Weight	71 (31.3)
Obese	35 (15.4)
Total	227 (100.0)

Table 2 is showing that out of 149 participants having neck pain, 1(7%) had no stiffness, 47(31.5%) had very mild stiffness, 66(44.3%) had mild stiffness, 30(20.1%) had moderate stiffness and 5(3.4%) had severe stiffness.

**Table 2:** Neck stiffness statistics among those having pain in neck

Neck Stiffness	Frequency (%)
Not Stiff	1(0.7)
Very Mild Stiffness	47(31.5)
Mild Stiffness	66(44.3)
Moderate Stiffness	30(20.1)
Severe Stiffness	5(3.4)
Total	149(100.0)

Table 3 is representing that out of 95 participants wearing helmet having weight of 0.25-1.29kg, 42 participants had pain of moderate intensity on NPAD. 41 participants wearing helmet of weight of 1.30-1.90kg, 23 participants had pain of moderate intensity on NPAD while 13 of those wearing helmet of 2-3kg, 7 had moderate pain on NPAD scale.

**Table 3:** Cross tabulation of weight of helmet with intensity of neck pain

Weight of helmet in KG	Pain Intensity using NPAD			Total
	Mild Pain	Moderate Pain	Severe Pain	
0.25-1.29	52	42	1	95
1.30-1.90	16	23	2	41
2.0-3.0	5	7	1	13
Total	73	72	4	149

It was reported that 149 participants 2(1.3%) were riding bike daily 10-40 Km, 48(32.2%) were driving bike daily 41-70 Km, 51(34.2%) were driving bike daily 71-100 Km and 48(32.2%) were driving bike daily more than 100 Km.

## DISCUSSION

This study shows that out of 370 motorcyclists 227 were helmet users and 149(65.6%) had neck pain while the previous study on neck pain due to helmet use conducted on 260 students in Pakistan in February 2020 by Arslan et al., concludes that out of 190 helmet users 54(28.42%) have neck pain associated with helmet use [22]. Bike riders are prone to fatigue, stress and injuries due to work related factors. These factors are occupational and non-occupational. This study evaluated the neck pain in occupational bike riders [19]. The occupational factors are posture, long riding position and years of bike riding [19].

This study concluded that the pain is strongly associated with posture of bike riding and long hours of bike riding. A total of 93 participants who were riding bike for more than 6 hours reported pain in the neck. In current study 95 participants were wearing a helmet of weight ranging from 0.25-1.29kg and 1 of them was having severe pain, 41 participants were wearing a helmet of weight ranging from 1.30-1.90 kg and 2 of them were having severe pain, 13 participants were wearing a helmet of weight ranging from 2.0-3.0 kg and 1 of them was having severe neck pain, hence concluded that increasing helmet weight leads to severity of pain in neck. This study shows that out of 227 participants, 149(65.6%) have neck pain while previous study conducted by Faryabi et al., in September 2014 in Iran, states that (69.4%) out of 377 participants were avoiding wearing helmet because of neck pain [3]. Research study performed by Khan I et al., shows that out of 300 participants 44% were not using helmet because of physical discomfort and results of this study are almost similar to current study which states 65.6% of helmet users have neck pain. It concludes that helmet use leads to neck pain which might be caused by improper fitting, size or weight of helmet [7]. The findings of the study suggests that out of 227 participants 149(65.6%) majority of the helmet users had neck pain while a study conducted on students of University of Lahore by Jafari et al., in August 2018 in Lahore concluded that out of 184 bike riders wearing helmet, 58(31.2%) were having neck pain. Further they reported that neck pain is moderately positive correlated with neck pain and disability [23]. Kumar et al., found out the relationship between cervical discomfort and neck pain in bike riders and reported that there was strong correlation of neck pain with the kinds of helmet and duration of the ride [24] while Jafari et al., reported negative correlation of size and type of the helmet with neck pain and discomfort [23]. It is reported in this study that out of 227 helmet using occupational motorcyclist 78(34.4%) were not having neck pain while the previous study on neck pain due to helmet use conducted on 260 students in Pakistan in February 2020 by Arslan et al., concludes that out of 190 helmet using participants 136(71.57%) were not having neck pain [22]. However the study also reported a remarkable risk factor of neck pain with extended distances and length of helmet use. Chance of developing neck pain increases with more motorcycle use [22]. Most of the participants were of age group 26 years to 29 years with 51(34.2%) were driving bike daily 71-100KM. It means most of bike riders with neck pain are in their productive age, the findings are consistent with the findings of study performed in Iran by Faryabi et al., [3]. While age of the bike riders had no significant association with the age of the rider reported by this study. The same

findings were determined by Brown *et al.*, [25] and McCartt *et al.*, study [26]. This study determined that 149 participants were having neck pain and 123(82.5%) of them were having posterior neck pain while the previous study performed by Misailidou *et al.*, states that neck pain is usually perceived posteriorly [15]. The findings of this study showed that among neck pain 85(57%) reported very mild emotional effects due to pain while previous study performed by Young *et al.*, [27] reported remarkably increased depression, anxiety/insomnia and somatic symptoms in patients having moderate to severe neck pain [27].

## CONCLUSIONS

This study concluded that among occupational bike riders, frequency of neck pain due to helmet use is high. While weight of the helmet was causing pain of higher intensity.

## Authors Contribution

Conceptualization: AH, IA

Methodology: AA, AK, RA

Formal analysis: SH

Writing-review and editing: SH, FZ, RA

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

## Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

## REFERENCES

- [1] Liu BC, Ivers R, Norton R, Boufous S, Blows S, Lo SK. Helmets for preventing injury in motorcycle riders. *Cochrane Database of Systematic Reviews*. 2008 Jan; 1: CD004333. doi: 10.1002/14651858.CD004333.pub3.
- [2] Senthilnathan CV, Gurulakshmi A, Mohan KG. Effects of isometric neck exercises in improving cervical range of motion in long time helmet wearers. *TJPRC: International Journal of Physiotherapy & Occupational Therapy*. 2015 Jun; 1(1): 9-16.
- [3] Faryabi J, Rajabi M, Alirezaee S. Evaluation of the use and reasons for not using a helmet by motorcyclists admitted to the emergency ward of shahid bahonar hospital in kerman. *Archives of Trauma Research*. 2014 Sep; 3(3): e19122. doi: 10.5812/at.19122.
- [4] Akinbo SR, Odebiyi DO, Osasan AA. Characteristics of back pain among commercial drivers and motorcyclists in Lagos, Nigeria. *West African Journal of Medicine*. 2008 Apr; 27(2): 87-91.
- [5] Chiu TT and Lo SK. Evaluation of cervical range of motion and isometric neck muscle strength: reliability and validity. *Clinical Rehabilitation*. 2002 Dec; 16(8): 851-8. doi: 10.1191/0269215502cr5500a.
- [6] Zargar M, Khaji A, Karbakhsh M. Pattern of motorcycle-related injuries in Tehran, 1999 to 2000: a study in 6 hospitals. *EMHJ-Eastern Mediterranean Health Journal*. 2006; 12(1-2): 81-7.
- [7] Khan I, Khan A, Aziz F, Islam M, Shafqat S. Factors associated with helmet use among motorcycle users in Karachi, Pakistan. *Academic Emergency Medicine*. 2008 Apr; 15(4): 384-7. doi: 10.1111/j.1553-2712.2008.00049.x.
- [8] Pervin A, Passmore J, Sidik M, McKinley T, Hong Tu NT, *et al.* Viet Nam's mandatory motorcycle helmet law and its impact on children. *Bulletin of the World Health Organization*. 2009 May; 87(5): 369-73. doi: 10.2471/BLT.08.057109.
- [9] Grimes DA and Schulz KF. Compared to what? Finding controls for case-control studies. *The Lancet*. 2005 Apr; 365(9468): 1429-33. doi: 10.1016/S0140-6736(05)66379-9.
- [10] Scherer M, Blozik E, Himmel W, Laptinskaya D, Kochen MM, Herrmann-Lingen C. Psychometric properties of a German version of the neck pain and disability scale. *European Spine Journal*. 2008 Jul; 17: 922-9. doi: 10.1007/s00586-008-0677-y.
- [11] Boissonnault WG and Bass C. Pathological origins of trunk and neck pain: part I—pelvic and abdominal visceral disorders. *Journal of Orthopaedic & Sports Physical Therapy*. 1990 Nov; 12(5): 192-207. doi: 10.2519/jospt.1990.12.5.192.
- [12] Ylinen J. Physical exercises and functional rehabilitation for the management of chronic neck pain. *Europa Medicophysica*. 2007 Mar; 43(1): 119.
- [13] Bogduk N. The anatomy and pathophysiology of neck pain. *Physical Medicine and Rehabilitation Clinics*. 2003 Aug; 14(3): 455-72. doi: 10.1016/S1047-9651(03)00041-X.
- [14] Crette S and Fehlings MG. Cervical radiculopathy. *New England Journal of Medicine*. 2005 Jul; 353(4): 392-9. doi: 10.1056/NEJMcp043887.
- [15] Misailidou V, Malliou P, Beneka A, Karagiannidis A, Godolias G. Assessment of patients with neck pain: a review of definitions, selection criteria, and measurement tools. *Journal of Chiropractic Medicine*. 2010 Jun; 9(2): 49-59. doi: 10.1016/j.jcm.2010.03.002.
- [16] Cohen SP and Hooten WM. Advances in the diagnosis and management of neck pain. *BMJ*. 2017 Aug; 358: j3221. doi: 10.1136/bmj.j3221.

- [17] Gardiner MD. The principles of exercise therapy. Bell & Hyman; 1957.
- [18] Ferreira SH. Prostaglandins, aspirin-like drugs and analgesia. *Nature New Biology*. 1972 Dec; 240: 200-3. doi: 10.1038/newbio240200a0.
- [19] Diyana MA, Karmegam K, Shamsul BM, Irniza R, Vivien H, Sivasankar S, *et al.* Risk factors analysis: Work-related musculoskeletal disorders among male traffic policemen using high-powered motorcycles. *International Journal of Industrial Ergonomics*. 2019 Nov; 74: 102863. doi: 10.1016/j.ergon.2019.102863.
- [20] Thoomes EJ, van Geest S, van der Windt DA, Falla D, Verhagen AP, Koes BW, *et al.* Value of physical tests in diagnosing cervical radiculopathy: a systematic review. *The Spine Journal*. 2018 Jan; 18(1): 179-89. doi: 10.1016/j.spinee.2017.08.241.
- [21] Bremerich FH, Grob D, Dvorak J, Mannion AF. The Neck Pain and Disability Scale: cross-cultural adaptation into German and evaluation of its psychometric properties in chronic neck pain and C1-2 fusion patients. *Spine*. 2008 Apr; 33(9): 1018-27. doi: 10.1097/BRS.0b013e31816c9107.
- [22] Arslan HR, Butt MS, Badar HM. Relative Odds of Neck Pain to Helmet Use Among Motorcyclists: a Case-Control Study. *Pakistan Journal of Surgery and Medicine*. 2020 Apr; 1(1): 35-41. doi: 10.37978/pjasm.v1i1.97.
- [23] Jafri MR, Nisa ZU, Zaheer A, Khan Z, Perveen I, Zahid S, *et al.* Correlation between Neck Pain and Disability among People Wearing Helmet. *Pakistan Journal of Physical Therapy (PJPT)*. 2021 Aug; 3(2): 25-9. doi: 10.52229/pjpt.v3i02.1166.
- [24] Kumar PRK, Arun B, Clifford SL. Relationship between the Different Variable and Neck Pain among Helmet Users. *International Journal of Innovative Science and Research Technology*. 2019 May; 5: 925-29.
- [25] Brown CV, Hejl K, Bui E, Tips G, Coopwood B. Risk factors for riding and crashing a motorcycle unhelmeted. *The Journal of Emergency Medicine*. 2011 Oct; 41(4): 441-6. doi: 10.1016/j.jemermed.2009.07.024.
- [26] McCartt AT, Blanaar L, Teoh ER, Strouse LM. Overview of motorcycling in the United States: A national telephone survey. *Journal of Safety Research*. 2011 Jun; 42(3): 177-84. doi: 10.1016/j.jsr.2011.05.003.
- [27] Young SB, Aprill C, Braswell J, Ogard WK, Richards JS, McCarthy JP. Psychological factors and domains of neck pain disability. *Pain Medicine*. 2009 Mar; 10(2): 310-8. doi: 10.1111/j.1526-4637.2009.00571.x.