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Correlation between Helmet Weight and Neck Pain Intensity in Two-Wheeler Riders

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ABSTRACT

BACKGROUND: Two-wheeler riding is one of the most common modes of transportation in many countries due to its affordability and convenience. The use of helmets is mandatory in most regions to reduce the risk of head injury during road traffic accidents. While helmets play a crucial role in protecting riders from life threatening injuries, prolonged helmet use especially helmets with greater weight may contribute to musculoskeletal discomfort, particularly in the cervical spine region.

OBJECTIVE: The objective of the study is to find the correlation between helmet weight and neck pain intensity in two-wheeler riders.

METHODOLOGY: This study was conducted with 40 participants who use helmets regularly while riding two-wheeler. Participants were enlisted based on inclusion and exclusion criteria. Helmet weight was recorded based on the weight mentioned at the back of each helmet and neck pain intensity was assessed using Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). Data were analyzed using Pearson's correlation coefficient and Spearman's rank correlation to determine relationship between helmet weight and neck pain intensity.

RESULT: This study showed weak positive relationship between helmet weight and neck pain intensity in two-wheeler riders who use helmets while riding, indicating that a greater helmet weight slightly increases the chances of neck pain.

CONCLUSION: Increased helmet weight may contribute to neck discomfort. Measures to prevent neck pain may be beneficial in regular helmet users.

KEYWORDS: Cervical Pain, Ergonomics, Motorcyclists, Musculoskeletal Disorders, Neck Discomfort, Pain Intensity.

INTRODUCTION

Two-wheeler riding is one of the most common modes of transportation in many countries due to its affordability and convenience. The use of helmets is mandatory in most regions to reduce the risk of head injury during road traffic accidents. While helmets play a crucial role in protecting riders from life threatening injuries, prolonged helmet use especially helmets with greater weight may contribute to musculoskeletal discomfort, particularly in the cervical spine region.

During two-wheeler riding, the neck muscles are required to continuously stabilize the head against gravitational forces, road vibrations, and postural demands. An increase in helmet weight may further increase the load on cervical structures, potentially leading to muscle fatigue, altered posture and neck pain.[1] Riders who travel long distances or ride for extended durations may be at a higher risk of developing neck discomfort due to sustained static postures combined with additional external load.

Neck pain is a common musculoskeletal complaint among two-wheeler riders and can negatively impact daily activities, work productivity and overall quality of life. From a physiotherapy perspective, understanding the contributing factors to neck pain is essential for prevention, early intervention and ergonomic education. Despite the widespread use of helmets, limited research has focused on relationship between helmet weight and neck pain intensity among two-wheeler riders.[2]

It has been found that motorcycle riders wearing helmets had higher odds of experiencing neck pain than non-helmeted riders, and greater helmet weight and prolonged helmet use were significantly associated with an increased likelihood of neck pain, even after adjusting for potential confounding factors.[1]

It has also been debated that the biomechanical effects of helmet mass on neck load were significant.[3]

Research has shown that increased helmet weight is significantly associated with greater neck pain and forward head posture among motorcycle riders. Riders using heavier helmets exhibited higher neck pain scores and altered cervical posture, suggesting a biomechanical relationship between helmet load, neck pain, and postural changes.[4]

Evidence suggests that increasing helmet weight was associated with greater severity of neck pain, particularly among riders covering longer distances. Riders using heavier helmets experienced more severe pain, predominantly in the posterior neck region.[5]

A well-fitting helmet with ergonomic cushioning reduces strain on the neck and ill-fitting helmets can bob up and down with movement and wind. This movement cannot be controlled by the rider and the resulting discomfort can add to pressure on the neck causing pain and discomfort.[6] A reanalysis of previous research found that motorcycle helmet uses significantly reduced the risk of head injuries and fatalities, with no strong evidence that helmet use increased the risk of neck injuries. Helmets were seen to improve rider safety and that earlier claims linking helmet use to increased cervical injury risk were not supported.[7] A survey-based study found that neck pain was common among motorcycle riders using helmets. Factors such as helmet weight, improper helmet fit, riding posture, wind resistance, and prolonged helmet use were identified as major contributors to cervical muscle strain and neck discomfort. The study emphasized the importance of ergonomic helmet design and proper fit to reduce neck pain while maintaining rider safety.[8] Sustained load of the head and helmet on the cervical spine contributes to cervical discomfort and emphasized the need for ergonomic measures to reduce neck pain among occupational helmet users.[9]

A need was identified to investigate the correlation between helmet weight and neck pain intensity in two-wheeler riders. Identifying this relationship may help in increasing awareness regarding appropriate helmet selection and may contribute to the development of preventive strategies and physiotherapy management protocols for riders experiencing neck pain.

MATERIALS AND METHODS

The study used a correlational study design. Participants were selected using inclusion and exclusion criteria and were informed about the study, and written consent was obtained from each of them. Participants included 30 men and 10 women aged between 18 to 45 years, who met the inclusion and exclusion criteria. Exclusion criteria included subjects with cervical spine injury, fractures or surgeries.

Neck pain intensity of the participant was obtained using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) and helmet weight was recorded according to the value mentioned at the back of the helmet.

PROCEDURE

After enrollment of participants in the study, a brief introduction about the study procedure was explained. Subjects were assessed for neck pain intensity by Cornell Musculoskeletal Discomfort Questionnaire and helmet weight was recorded from the back of the helmet. The analysis of these measures was conducted using Pearson's correlation and Spearman's rank correlation with a p value less than 0.05 considered statistically significant to examine relationship between neck pain intensity and helmet weight.

OUTCOME MEASURES

Cornell Musculoskeletal Discomfort Questionnaire (CMDQ):

The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) is a 54-item questionnaire containing a body map diagram and questions about the prevalence of musculoskeletal ache, pain or discom- fort in 18 regions of the body during the previous week. Respondents indicated the frequency of discomfort on an ordinal scale from 0 (none) to 4 (daily) and severity of discomfort from 1 (slightly uncomfortable) to 3 (very uncomfortable). A pain level of at least "moderately uncomfortable" was selected as a severity threshold for determining prevalence and frequency. The level at which the discomfort interfered with work was scored from 0 (no interference) to 2 (substantial interference). Total discomfort score was calculated by using the following formula: frequency × discomfort × interference = discomfort score.[10]

Helmet weight:

The helmet weight of the participants was measured in grams according to the weight mentioned at the back of helmet.[11]

RESULT

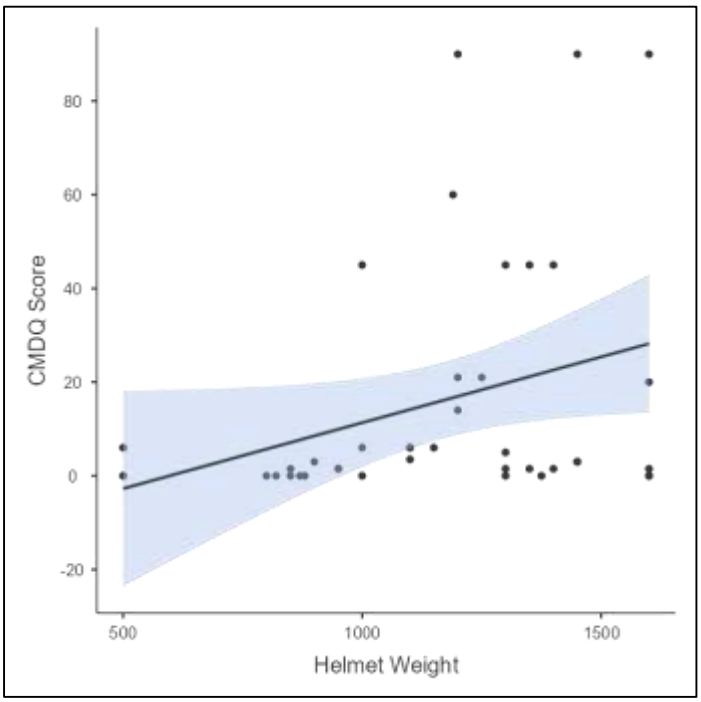

Figure 1.1 Correlation between helmet weight and neck pain intensity

This statistical analysis demonstrates a slight upward trend between helmet weight and CMDQ score, indicating a positive relationship, which is not statistically significant. ($r = 0.307$, $p = 0.054$). As helmet weight increases, there is a general tendency for the CMDQ score (neck discomfort) to increase. However, the data points are widely scattered, showing considerable variability in CMDQ scores at different helmet weights. The regression line suggests a mild positive correlation, but the spread of the data indicates that the relationship is weak. Additionally, the wide confidence interval further reflects variability and uncertainty in the association.

DISCUSSION

The study aimed to evaluate the correlation between helmet weight and neck pain intensity among two-wheeler riders using the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) which demonstrated a mild positive correlation between helmet weight and neck discomfort, indicating that as helmet weight increases, the level of neck pain tends to increase. However, this relationship was not statistically significant.

The lack of statistical significance suggests that although helmet weight may contribute to neck discomfort, it may not be the sole or dominant factor influencing neck pain among riders. This could be due to the small sample size ($n = 40$) and the high variability in CMDQ scores ($SD = 26.5$), which indicates that other factors such as posture, riding duration, physical fitness, and ergonomics may also play a significant role.

Despite the non-significant result, the observed positive trend is consistent with previous studies. For instance, Khan et al. reported increased odds of neck pain among helmet users, particularly with increased helmet weight and duration of use.[1] Similarly, Baruah et al. found a significant relationship between helmet weight, neck pain, and forward head posture, suggesting that increased load alters cervical biomechanics.[4] The findings are also supported by Hassan et al., who reported a high prevalence of neck pain among riders using heavier helmets and covering longer distances daily.[5] Biomechanical explanations suggest that additional weight on the head increases the moment arm and load on cervical muscles, leading to fatigue and discomfort over time.[12]

However, in contrast to some studies that found strong statistical significance, the present study showed only a weak correlation, which may be attributed to differences in methodology, smaller sample size, and absence of control over confounding variables such as duration of riding, type of helmet, and posture during riding. The scatter plot analysis further supports this interpretation, showing a wide distribution of CMDQ scores across different helmet weights, indicating that individuals with similar helmet weights experienced varying levels of discomfort. This points towards the multifactorial nature of neck pain, where helmet weight is only one contributing factor among many.

From a clinical perspective, these findings suggest that while heavier helmets may increase cervical strain, interventions should not focus solely on helmet weight reduction but also consider ergonomic education, posture correction, and limiting prolonged riding duration.

Overall, the study indicates that there is a tendency for increased helmet weight to be associated with greater neck discomfort, but further research with larger sample sizes and controlled variables is required to establish a statistically significant relationship.

CONCLUSION

Though not strongly conclusive, the findings indicate a trend suggesting that increased helmet weight may

contribute to greater neck discomfort.

Declaration of the patient's consent

The authors attest to having obtained all necessary consent from the caregivers of the participants for inclusion in this study. The participants have granted permission for the use of their clinical information to be published in this journal. They acknowledge that neither their name nor initials will be disclosed. Confidentiality of the participants' personal and medical information was strictly maintained throughout the study, and all data was used solely for research purposes.

REFERENCES

1. Arslan HRM, Butt MS, Badar HMJ. "Relative odds of neck pain to helmet use among motorcyclists: a case control study." Pak J Surg Med.2020;1(1):35-41. Available from: doi: 10.5281/zenodo.3595070.
2. Aafreen A, Khan AR, Khan A, Ahmad A, Alzahrani AH, Alhusayni AI, et al. "Neck health metrics and quality of life: a comparative study in bike drivers with and without neck pain." J Multidiscip Healthc. 2023; 16:3575–3584. doi:10.2147/JMDH.S437826.
3. Page PS, Wei Z, Brooks NP. "Motorcycle helmets and cervical spine injuries: a 5-year experience at a Level 1 trauma center." J Neurosurg Spine. 2018;28(6):607–611. doi:10.3171/2017.7. SPINE17540.
4. Baruah P, Samuel J. "Evaluation of neck pain and posture of cervical spine among helmet users riding motor bike." Cardiometry. 2023;(26):430–436. doi:10.18137/cardiometry.2023.26.430436
5. Hassan A, Hanif S, Ahmed I, Zaidi F, Aslam A, Kayani A, et al. "Neck pain among occupational bike riders wearing helmet in twin cities: a cross-sectional survey." The Therapist (Journal of Therapies & Rehabilitation Sciences). 2023;4(2). doi:10.54393/tt. v4i02.129.
6. https://timesofindia.indiatimes.com/city/pune/helmets-dont-need-to-be-a-pain-in-the-neck-for-riders/articleshow/67785023.cms
7. Rice TM, Troszak LK, Ouellet JV, Erhardt T, Smith GS, Tsai BW. "Motorcycle helmets and neck injuries: revisiting the Hurt Study." Accid Anal Prev. 2016;91:200–207. doi:10.1016/j.aap.2016.02.031.
8. Salvi SD. "Prevalence of neck pain due to helmet use among motor cyclists." Int J Sci Dev Res. 2023;8(6):1515–1530.
9. Bongoni MR, Zore L, Honkalas P, Kumar A. "Prevalence of neck pain in quick service provider helmet users using Neck Disability Index." Int J Curr Adv Res. 2018;7(9):15564–15566.
10. Hedge A, Morimoto S, McCrobie D. "Effects of keyboard tray geometry on upper body posture and comfort." Ergonomics. 1999;42(10):1333–1349. doi:10.1080/001401399184983.
11. Punitha Kumar RK, Arun B, Clifford SL. "Relationship between the different variables and neck pain among helmet users." Int J Innov Sci Res Technol. 2019;4(5):925-928.
12. Barrett JM, McKinnon CD, Dickerson CR, Laing AC, Callaghan JP. "Posture and helmet configuration effects on joint reaction loads in the middle cervical spine." Aerosp Med Hum Perform. 2022;93(5):458–466. doi:10.3357/AMHP.5830.2022