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The craniovertebral angle and the incidence of tension-type headache among office workers

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Abstract

Purpose: This study aimed to analyze the correlation between the craniovertebral angle and the occurrence of tension-type headache among office employees. **Methods:** This study employed a cross-sectional, analytical observational design, involving 50 office workers selected using a stratified random sampling method. The craniovertebral angle was measured using photogrammetry with Kinovea software, and the incidence of tension-type headache was identified through the Headache Screening Questionnaire. Data were analyzed using the Spearman correlation test. **Results:** The average craniovertebral angle among participants was 37.2 degrees, indicating a tendency toward poor head posture. Among the workers, 30% experienced tension-type headache, 44% were considered probable cases, and 26% had no symptoms. The majority of participants spent 8 to 12 hours per day working on computers. Statistical analysis showed a significant negative correlation between craniovertebral angle and tension-type headache. Workers with lower angles—reflecting more forward head posture—were more likely to experience headaches. Although the strength of the correlation was weak, the association remained statistically significant. **Conclusion:** A reduced craniovertebral angle, indicating poor head posture, is associated with a higher likelihood of tension-type headache in office workers. These findings highlight the importance of implementing ergonomic interventions in the workplace to prevent posture-related health problems.

Keywords: craniovertebral angle; ergonomics; tension-type headache; workplace health

INTRODUCTION

The rapid development of technology has led to increased use of electronic devices in daily activities and work environments [1]. Computers have become essential in many job sectors, including administration and industrial operations [2]. Office workers now spend more than 79% of their working hours sitting in front of a computer [3]. This prolonged sedentary activity has contributed to a high incidence of musculo-skeletal disorders, especially among those who rely heavily on computers for administrative tasks [4].

One of the common health issues faced by office workers is tension-type headache, which can result from prolonged computer use and non-ergonomic postures [5–7]. These problems are often caused by static and awkward sitting positions that lead to fatigue and pain in the neck and head muscles [2,7].

Tension-type headache is a primary type of headache categorized by the International Classification of Headache Disorders and is closely linked to poor posture [8]. It affects about 26% of the global population and is associated with reduced work performance and social functioning [9,10]. One of the contributing factors is forward head posture, which can be evaluated through the craniovertebral angle—a photogrammetry-based method for assessing head and neck alignment [11,12].

A craniovertebral angle below 50 degrees indicates abnormal posture and may increase the risk of headaches [12]. Poor head posture can lead to muscle tension and discomfort, affecting both physical and occupational health [13]. Understanding the relationship between posture and headache can help improve ergonomic interventions at work. Therefore, this study aims to examine the correlation between the craniovertebral angle and the incidence of tension-type headache among office workers.

Recent research has explored the role of posture in the development of tension-type headaches; however, few studies have explicitly focused on office workers in Indonesian occupational settings, using objective measurements such as photogrammetry. This study contributes to the growing body of evidence by combining validated headache screening tools and precise craniovertebral angle assessments to highlight ergonomic risks in modern work environments. It provides an important contextual understanding for workplace health promotion strategies.

METHODS

This study employed an analytical observational design with a cross-sectional approach. The study was conducted in November 2024 at PT X 1 Malang, a state-owned water company based in East Java, Indonesia. A total of 50 participants were selected using a stratified random sampling technique to ensure proportional representation across nine divisions within the company [14]. The divisions included the Corporate Secretary (CS), Accounting and Finance Division (AFD), Legal and Corporate Communication Division (LCCD), Human Capital Division (HCD), Corporate Planning Division (CPD), Business Operations Division (BOD), Procurement and Asset Management Division (PAMD), Environmental Natural Resources Infrastructure Performance Division (ENRIRD), and Information and Communication Technology Division (ICT).

Inclusion criteria required participants to be actively employed, able to provide informed consent, and undergo complete screening based on the International Classification of Headache Disorders (ICHD). The dependent variable is tension-type headache (TTH), while the independent variable is craniovertebral angle (CVA). Craniovertebral angle measurements were conducted using photogrammetry, with markers placed on the tragus of the ear and the C7 spinous process. Participants were seated with their knees and hips at a 90-degree angle, their feet flat on the floor, and instructed to maintain a natural posture while looking forward. Once stabilized, a lateral photograph was taken. The angle was calculated using Kinovea software [12]. To assess the presence of tension-type headache, researchers administered the Indonesian-translated and validated version of the Headache Screening Questionnaire [15]. Based on ICHD-3 criteria, participants were classified into three categories: score of 8 indicating tension-type headache, scores of 6–7 as probable tension-type headache, and scores less than 6 as non-headache cases [16].

Statistical analyses were performed using SPSS version 25. The Kolmogorov–Smirnov test was applied to determine data normality, which indicated non-normal distribution ($p<0.05$). Consequently, the Spearman rho test was used to evaluate the correlation between craniovertebral angle and tension-type headache. Statistical significance was defined as $p \leq 0.05$ [17,18]. Ethical approval was granted by the Ethics Committee of the University of Muhammadiyah Malang (Approval No. E.5.a/279/KEPKUMM/X/2024).

RESULTS

Table 1 describes the distribution of participants' sociodemographic and occupational characteristics. The data show a predominance of participants in the productive age group, with a higher proportion of female workers. Participants were drawn from various office divisions, ensuring representation across departments. Most individuals reported extended computer usage during working hours, indicating a sedentary work pattern. The classification of headache symptoms reveals a noticeable presence of tension-type headache and related complaints among the sample, which may reflect the ergonomic and postural challenges faced in their daily work routines.

Table 2 presents a descriptive summary of the respondents' ages and craniovertebral angles. The variation in age confirms that the sample comprises a mix of young to middle-aged adults actively engaged in office work. Meanwhile, the craniovertebral angle values suggest deviations from ideal postural alignment, implying the presence of forward head posture in several individuals.

Table 1. Characteristics of participants (n=50)

Variable	n	%
Age (years)		
17-25	10	20
26-35	24	48
36-45	13	26
46-55	3	6
Gender		
Male	20	40
Female	30	60
Division		
ENRIPD	6	12
LCCD	6	12
AFD	7	14
CPD	7	14
PAMD	5	10
HCD	9	18
ICT	4	8
BOD	3	6
CS	3	6
Duration of computer use (hours)		
<2	1	2
2-4	0	0
4-8	15	30
8-12	30	60
>12	4	8
Tension-type headache		
Yes	15	30
Probable	22	44
No	13	26

Table 2. Mean, range, and standard deviation of age and craniovertebral angle

Characteristics	Statistics		
	Range	Mean	Standard Deviation (SD)
Age (years)	21 - 54	32,8	7,94
Craniovertebral angle	22,4 - 58	37,2	8,85

Table 3. The correlation between craniovertebral angle and tension-type headache (n=50)

Variable	n	*r*	*p-value*
Craniovertebral angle Tension-type headache	50	-0,363	0,01*

r = correlation coefficient, * *p<0,05*

Table 3 shows the results of the correlation analysis between craniovertebral angle and tension-type headache. The findings indicate a statistically significant inverse relationship, suggesting that individuals with a more forward head posture tend to report a higher incidence of tension-type headache. A weak correlation indicates that while the two variables are related, other factors also influence tension-type headache, and craniovertebral angle alone does not strongly predict headache occurrence. This means the correlation should be interpreted cautiously and does not imply a causal relationship [18].

DISCUSSION

This study highlights the occupational health challenges faced by office workers who are routinely exposed to prolonged sitting and computer use. The findings are consistent with broader evidence indicating that static postures and prolonged screen time can lead to musculoskeletal discomfort, a condition commonly referred to as "office syndrome" [19,20]. The participants in this study, drawn from various divisions of PT X 1 Malang, exemplify the typical digital-era workforce, where sedentary behavior is routine and prolonged engagement with computer screens is common.

The posture adopted while working at a computer requires individuals to adjust their cervical alignment, often extending the upper cervical spine and flexing the lower cervical and thoracic regions [21]. Over time, this repetitive posture can lead to muscular imbalances and anterior displacement of the cervical spine, resulting in increased tension in the suboccipital, neck, and shoulder muscles [22]. Such biomechanical strain may disrupt the alignment between the spine and the line of gravity, resulting in an increased load on surrounding soft tissues.

The average craniovertebral angle observed in this study reflects a tendency toward forward head posture, which supports previous findings that prolonged computer use contributes to postural abnormalities [4,23]. Restricted circulation to neck and shoulder muscles due to prolonged static posture may lead to accumulation of lactic acid and subsequent pain and discomfort [24]. Anatomically, afferent signals from the upper cervical spinal nerves (C1–C3) converge with those of the trigeminal nerve, which may explain the referral of cervical-origin pain to the frontal region of the head—a known characteristic of tension-type headache [8].

Tension-type headache is characterized by a dull, bilateral tightening sensation in the head and is strongly linked to poor posture, excessive screen exposure, and muscular fatigue [11]. In this study, the prevalence of tension-type headache was particularly noticeable among individuals aged 26–35 years, and women reported higher rates of symptoms. This aligns with previous literature indicating that women, due to lower muscle mass and physiological capacity, are more susceptible to such conditions [4,9].

While the statistical analysis confirmed a significant negative correlation between craniovertebral angle and tension-type headache, the relationship was weak. This suggests that although poor head posture is associated with headache symptoms, it may not be the

sole contributing factor. Other variables—such as stress, workplace ergonomics, and individual lifestyle—are also likely to influence headache occurrence [25,26]. These findings support a biopsychosocial understanding of headache etiology, where postural mechanics interact with psychosocial and environmental conditions.

Enhancing ergonomic awareness and implementing preventive strategies are essential in minimizing the risk of musculoskeletal complaints among office workers [4]. Organizations should prioritize workplace ergonomics by ensuring appropriate desk and chair setups, providing rest breaks, and incorporating physical activity to support musculoskeletal health [27]. Additionally, educational programs to improve workers' posture and awareness of early symptoms may be beneficial.

This study emphasizes the significance of public health initiatives in addressing posture-related health concerns in office settings. Tension-type headache, although often overlooked, can reduce work productivity and increase the burden on healthcare services. Public health programs should include ergonomic education, early screening for postural issues, and promotion of healthy work environments. Collaboration among health professionals, employers, and policymakers is crucial for developing supportive workplace policies that prevent musculoskeletal disorders and promote workers' overall well-being.

One limitation of this study is that the craniovertebral angle was assessed only in the seated position, which may not fully represent postural variation throughout the day. Furthermore, the use of head markers on hijab-wearing female respondents may have introduced slight measurement inaccuracies. Future studies should consider multiple postural positions and evaluate additional factors such as psychological stress, physical activity levels, and workstation design.

CONCLUSION

The results of this study indicate a significant association between craniovertebral angle and the occurrence of tension-type headache in office workers. Individuals with a smaller craniovertebral angle—reflecting poor head and neck posture—were more likely to experience tension-type headache. This highlights the role of postural alignment in occupational health.

Based on these findings, it is recommended that workplace health programs incorporate ergonomic assessments and interventions. Simple measures such as optimizing workstation setup, encouraging micro-breaks, and providing posture education can help minimize the risk of posture-related headaches. Future studies should consider assessing posture in multiple positions and explore additional contributing factors such as stress, workload, and physical activity levels.

REFERENCES

1. Matos M, Arezes PM. Ergonomic evaluation of office workplaces with rapid office strain assessment (ROSA). Procedia Manufacturing. 2015;3:4689–94.
2. Hamdani D, Kurniawan N, Ernawati T. Computer vision syndrome and tension-type headache in computer workers. Journal of Widya Medika Junior. 2021;3(2):110–5.
3. Ojo SO, Bailey DP, Chater AM, Hewson DJ. Workplace intervention for reducing sitting time in sedentary workers: protocol for a pilot study using the behavior change wheel. Frontiers in Public Health. 2022;10:1–13.
4. Aulianingrum P, Hendra. Risk factors of musculoskeletal disorders in office workers. The Indonesian Journal of Occupational Safety and Health. 2022;11(Special Issue):68–77.
5. Salahzadeh Z, Maroufi N, Ahmadi A, Behtash H, Razmjoo A, Gohari M, et al. Assessment of forward head posture in females: Observational and photogrammetry methods. Journal of Back and Musculoskeletal Rehabilitation. 2014;27(2):131–9.
6. Jiriwibhakorn S. Prevention and treatment of office syndrome of royal thai air force personnel with holistic approach. Royal Thai Air Force Medical Gazette. 2022;68(1):40–8.
7. Rajabi R, Minoonejad H, Ardakani Mohammad, Sheikh ZD, Omidvar E. Comparison of craniovertebral angle of students based on gender and field of study differences. Journal of Kerman University of Medical Sciences. 2017;1(24):93–102.
8. Madsen BK, Søgaard K, Andersen LL, Skotte JH, Jensen RH. Neck and shoulder muscle strength in patients with tension-type headache: A case-control study. Cephalalgia. 2015;36(1):29–36.
9. Repiso-Guardeño A, Moreno-Morales N, Armenta-Pendón MA, Rodríguez-Martínez M del C, Pino-Lozano R, Armenta-Peinado JA. Physical therapy in tension-type headache: a systematic review of randomized controlled trials. International Journal of Environmental Research and Public Health. 2023;20(5):1–19.
10. Waldie KE, Buckley J, Bull PN, Poulton R. Tension-type headache: a life-course review.

Journal of Headache & Pain Management. 2015;1(1):1–9.
11. Gallego-Izquierdo T, Arroba-Díaz E, García-Ascoz G, Val-Cano MDA, Pecos-Martin D, Cano-De-la-cuerda R. Psychometric proprieties of a mobile application to measure the craniovertebral angle a validation and reliability study. International Journal of Environmental Research and Public Health. 2020;17(18):1–9.
12. Titcomb DA, Melton BF, Bland HW, Miyashita T. Evaluation of the craniovertebral angle in standing versus sitting positions in young adults with and without severe forward head posture. International Journal of Exercise Science. 2024;17(1):73–85.
13. Prastowo B, Baruna AH, Nurfani MY, Watini W. Musculoskeletal disorders mapping among workers of community health center. Physical Therapy Journal of Indonesia. 2023 Jun 20;4(2):116–20.
14. Duc Nguyen T, Shih MH, Srivastava D, Tirthapura S, Xu B. Stratified random sampling from streaming and stored data. International Conference on Extending Database Technology (EDBT); 2019. Available from: [Website]
15. Mahendra AK, Murlina N. Hubungan kecemasan dengan kejadian tension-type headache pada mahasiswa Kedokteran Univeristas Muhammdiyah Sumatera Utara. Jurnal Ilmiah Maksitek. 2021; 6:11–6.
16. Van Der Meer HA, Visscher CM, Engelbert RHH, Mulleners WM, Nijhuis – van der Sanden MWG, Speksnijder CM. Development and psychometric validation of the headache screening questionnaire – Dutch Version. Musculoskeletal Science and Practice. 2017;31:52–61.
17. Ghasemi A, Zahediasl S. Normality tests for statistical analysis: a guide for non-statisticians. International Journal Endocrinology and Metabolism. 2012;10(2):486–9.
18. Schober P, Schwarte LA. Correlation coefficients: Appropriate use and interpretation. Anesthesia and Analgesia. 2018;126(5):1763–8.
19. Lazko O, Byshevets N, Plyeshakova O, Lazakovych Y, Kashuba V, Grygus I, et al. Determinants of office syndrome among working age women. Journal of Physical Education and Sport. 2021;21(5):2827–34.
20. Jongprasithporn M, Yodpijit N, Ketkratuk P, Panichtamrong P, Ratanajarusiri N. Analysis and prevention of office syndrome of people in Thailand. Thailand: Applied Human Factors and Ergonomics International; 2021. Available from: [Website]
21. Anand B, Singhal V, Kulshrestha S, Raj S. Impact of smartphone addiction on craniovertebral angle in healthy adults. Acta Scientific Orthopaedics. 2021;4(10):87–91.
22. Çobanoğlu G, Demirkan MY, Ecemiş ZB, Atalay Güzel N. Forward head posture and its effect on muscle activation. Gazi Sağlık Bilimleri Dergisi. 20241;9(1):85–93.
23. Shaghayegh-fard B, Ahmadi A, Maroufi N, Sarrafzadeh J. Evaluation of forward head posture in sitting and standing positions. European Spine Journal. 2016;25(11):3577–82.
24. Tanjung R, Mahyuni EL, Sinaga J, Syaputri D, Manalu SMH, Soedjadi TTB. Ergonomic risk factors and their effects on musculoskeletal disorders (MSDs) among Karo's Uis Weavers. Jurnal Kesehatan Lingkungan Indonesia. 2023; 22(2):195–201.
25. Söderlund A, Lagerlöf H. An individually tailored behavioral medicine treatment in physical therapy for tension-type headache - Two experimental case studies. Journal of Pain Research. 2016;9:1089–99.
26. Abbaszadeh Amirdehi M, Hosseini S, Sam S, Irani S, Mirasi S. Evaluation of head position using craniovertebral angle in two sitting and standing positions in the elderly. Journal of Babol University of Medical Sciences. 2020;22:31–8.
27. Bullo V, Favro F, Pavan D, Bortoletto A, Gobbo S, De Palma G, et al. The role of physical exercise in preventing musculoskeletal disorders in manual workers: a systematic review and meta-analysis. La Medicina del Lavoro. 2024;115(1):1–5.