Iran J Psychiatry Behav Sci. 2023 September; 17(3):e138142. https://doi.org/10.5812/ijpbs-138142.

Published online 2023 September 20. **Research Article**

Association Between Opium Smoking and Neck and Upper Spine Posture Disorders

Omid Massah [1,*], Amir Masoud Arab [2], Ali Farhoudian [3], Mahdi Noroozi [1,4,5] and Fahimeh Hashemirad [1]

[1] Substance Abuse and Dependence Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
[2] Department of Physiotherapy, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
[3] Department of Psychiatry, Tehran University of Medical Sciences, Tehran, Iran
[4] Department of Psychiatry, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
[5] Psychosis Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

[*] *Corresponding author*: Substance Abuse and Dependence Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran. Email: omchomch@gmail.com

Received 2023 June 10; **Revised** 2023 August 10; **Accepted** 2023 August 12.

Abstract

Background: Many studies have shown that non-ergonomic positioning of the spine is one of the main causes of postural deformity. In this regard, opium smoking requires sitting in non-ergonomic positions, which increases the possibility of posture disorders due to exposure for several hours a day and over many years.
Objectives: This study aimed to compare neck pain and disability, forward head posture (FHP), and the curvature of the thoracic spine (thoracic hyperkyphosis [THK]) in opium users and non-drug users.
Methods: In this comparative cross-sectional study, 80 opium smokers were compared with 74 non-drug users in terms of craniovertebral angle (FHP), THK, and neck pain (Visual Analog Scale [VAS]) and disability (neck disability index [NDI]). Data were analyzed by Kolmogorov-Smirnov and independent *t*-tests using SPSS version 23.
Results: The difference between the 2 groups was significant in all variables, including VAS ($P = 0.004$), NDI ($P < 0.001$), craniovertebral angle ($P = 0.003$), and THK ($P = 0.006$).
Conclusions: Forward head posture, THK, neck pain, and neck disability are more prevalent in opium smokers than non-drug users. This could be due to the long hours of the non-ergonomic position while smoking opium.

Keywords: Drug Use Disorder, Forward Head Posture, Hyperkyphosis, Opium Smoking, Neck Pain, Neck Disability

1. Background

According to the 2022 World Drug Report, Iran has the highest seizures of opium, morphine, and heroin in the world. In fact, Iran has ranked first in terms of seizures for all three of these mentioned opiates. In fact, 98% of the world's opium seizures, 59% of the world's morphine seized, and 27% of the heroin seized are in Iran, and the comparison of these numbers is a sign and reason for the historical and cultural interest of Iranians in opium smoking. On the other hand, regional geopolitics of narcotic drugs cause a great desire to transit opium from Iran (1, 2). The smoking of raw opium, which is called 'Taryak' (Opium has been consumed in Iran in various forms: the dried resin, called "Taryak" (raw opium), is the most commonly used form of opium. Another form of opium used in Iran is called "Shireh," which is obtained by dissolving the residue of smoked opium (or low morphine type of raw opium) in water and heating it to produce a thick concentrate that has more morphine than raw opium (3). Iran is rooted in the historical and cultural beliefs of Iranians. It is mistakenly considered a mythical medicine and treatment for many pains and diseases (it is considered the elixir of life), and most Iranian drug users prefer smoking use of opium (2). Iran holds the distinction of being the second-largest opium-consuming country globally. Specifically, when considering opium use through smoking consumption, Iran has ranked first in opium smoking. Astonishingly, approximately 74% of the world's smoked opium is found in Iran (1). With the outbreak of the COVID-19 pandemic, the unfounded idea that opium smoking is effective in inhibiting the growth of the virus in the lungs (a proverb became popular

that addicts do not get COVID-19) caused an increase in opium smoking in Iran (4-6). Opium smoking is done using its special tools (such as "Vafour," "Gholgholi," and "Sikh-o-Sang") (Vafour is a tool for opium smoking, which is made of a wooden (or clay) tube and a small clay pot. Gholgholi is a small water pipe that is used for opium smoking. Sikh-o-Sang is a method of opium smoking in which a hot and melted spoke is touched to a piece of opium that is placed on a small metal pin). In non-ergonomic positions, while the head is forward, the thoracic vertebrae are in a hyperkyphosis state and usually deviate to one side (3, 7). In this regard, there is a high possibility that this repeated situation, if it continues for years, will cause musculoskeletal disorders.

Posture is a position in which someone holds his body in a standing or sitting position and is the position of bones, muscles, and joints. In fact, it is better to say that it is a habitual position (8) and maintained by passive and active components and their interaction and synergy. Components such as tendons, ligaments, muscles, and connective tissue (9). The assessment of posture and its correction is considered an important indicator of musculoskeletal health (10). In the optimal posture, the curvature of the spine is natural. This posture is created and maintained through the proper functioning of body structures and musculoskeletal balance with minimal muscle force, exerting minimal stress and strain on the body (11). Non-ergonomic positions that are repeated over days and hours, in the long term, create changes in the musculoskeletal system, which have been proven in various jobs and sports (12, 13). For example, we can mention kyphosis in professional cyclists due to many hours of training in a kyphotic position (14) or the occurrence of FHP, kyphosis, and lordosis in ping pong players and Wushu athletes (15, 16). Being in such non-ergonomic positions is very common in people who use drugs through the long-term smoking method. A study in Iran showed that more than half of heroin users had forward head posture (FHP) (17). Another study on prisoners with a history of drug abuse in Iran stated that 98% of them had at least one postural abnormality (18).

Although the posture assessment and musculoskeletal disorders caused by it have been researched all over the world in many occupational, age, and gender groups and in accordance with the culture and traditions of the countries, surprisingly, this issue has not been researched in a large statistical population (such as substance abusers) or ignored. Perhaps in European and American countries, people do not smoke drugs for long hours a day because the dominant substances they smoke are marijuana, methamphetamine, cocaine, and heroin, which have a short smoking time, but in Iran, this issue is a health concern and needs research.

2. Objectives

This study aimed to compare neck disability, FHP, and the curvature of the thoracic spine in opium smokers and non-drug users.

3. Methods

This comparative cross-sectional study was conducted in Tehran in 2022. With the snowball sampling method, 80 substance abusers whose chief complaint was opium smoking were selected from 4 outpatient substance abuse treatment centers (as the 4 branches of the sampling clusters) and compared with 74 on-drug users who were selected with the same snowball method from friends and relatives of the first group based on matching with them. Considering that there was no similar comparative study, we were very careful to choose the samples with the least problems. For this reason, after determining the main branches of sampling using the snowball method, we asked each person to introduce one drug user and one non-drug user from their friends and relatives; thus, the samples of the two groups are as similar as possible in terms of age, occupation, socioeconomic level, and psycho-cultural status. A confidence level of 95% and a test power of 80% were considered to estimate the sample size. According to the prevalence rates of FHP and thoracic hyperkyphosis (THK) reported in previous studies on drug users (17, 18) and healthy subjects (19), the minimum number of samples required for each group was estimated to be 70 subjects. Due to the possibility of participant dropout, a higher number of participants was considered for each group.

Inclusion criteria for both groups were age between 25 and 50 years, ability to stand, ability to speak Persian, minimum reading and writing literacy, body mass index (BMI) less than 27.5 (according to the literature review and the relationship between the occurrence of musculoskeletal disorders and overweight and obesity, a BMI less than 27.5 was considered in this study) (20). Following the International Statistical Classification of Diseases, 11th Revision (ICD-11) criteria, the diagnosis of drug use disorder and dependence were the main inclusion criteria for the first group (21). Also, at least a 5-year history of opium smoking was the other inclusion criteria because, according to the literature, usually, it takes 3 to 5 years for the posture to change significantly and visibly, and sitting in a non-ergonomic position creates a posture deformity (22). The main inclusion

criterion for non-drug users was to be relatively similar to drug users in terms of age, sex, occupation, and BMI. Exclusion criteria were a history of known and chronic neuromuscular or musculoskeletal disease in participants or their families, history of surgery in the spine and shoulder girdle, history of championship or regular exercise, any imbalance caused by a specific disease, and any clear postural imbalance.

Data were collected using a demographic questionnaire, Maudsley Addiction Profile, Persian version of the Leeds Dependence Questionnaire, Visual Analog Scale (VAS), and neck disability index (NDI).

In this study, photography from a lateral view was used to evaluate FHP; its reliability and validity have been confirmed in a previous study (23). The photography was performed using a digital camera (Canon PowerShot G11 10MP, Japan), which was placed at a distance of 265 cm from the wall and aligned with the shoulder of the subject. Then, the images were transferred to AUTOCAD 2013, and the craniovertebral angle was measured.

To measure THK, a flexible ruler (Staedtler Mars 24-inch, Germany) was used, which was placed entirely on the spine T2-T12, and then the curvature was drawn on A3 paper. The kyphosis angle was measured using the following equation:

$$\alpha = arctan\left(\frac{2h}{l}\right)$$

The reliability and validity of this method have been previously confirmed (24).

The reliability of the measurement method was confirmed by a primary test-retest. Ten participants were rated in an extra 4 testing sessions of the FHP and THK test in 2 weeks.

3.1. Ethical Considerations

This study was approved by the Ethics Committee of the University of Social Welfare and Rehabilitation Sciences (code: IR.USWR.REC.1398.120). This article is extracted from the doctoral thesis of the first author.

3.2. Data Analysis

The resulting data were analyzed by Kolmogorov-Smirnov and Independent *t*-tests using SPSS version 23 (SPSS Inc, Chicago, IL, USA).

4. Results

There were no significant differences in inter-rater and intra-rater reliability tests, suggesting that the measurement methods were reliable. For inter-rater reliability, the intraclass correlation coefficient (ICC) was 0.6 (CI, 0.18 - 0.86) for measuring the craniovertebral angle (FHP; P = 0.48). Regarding the thoracic kyphosis angle (THK), ICC was 0.64 (CI, 0.22 - 0.91; P = 0.78). For intra-rater reliability, ICC was 0.68 (CI, 0.20 - 0.90) for FHP (P = 0.37). For THK, ICC was 0.68 (CI, 0.20 - 0.89; P = 0.71).

The anthropometric characteristics of the 2 groups are presented in Table 1. According to Table 1, there was no significant difference between the 2 groups. Therefore, any possible differences in the dependent variables between the 2 groups were not caused by demographic differences and basic variables, such as age and BMI.

Table 1. Comparison of the Demographic Variables Between the 2 Groups

Variables and Groups	Mean ± SD	P-Value
Age		0.912
Opium smokers	38.20 ± 6.55	
Non-drug users	37.80 ± 5.88	
Height, m		0.884
Opium smokers	1.74 ± 0.07	
Non-drug users	1.75 ± 0.08	
Weight, kg		0.818
Opium smokers	73.37 ± 7.15	
Non-drug users	72.67 ± 7.78	
BMI, kg/m^2		0.866
Opium smokers	24.05 ± 2.05	
Non-drug users	23.67 ± 1.98	

Abbreviation: BMI, body mass index.

To investigate the possible confounding effect of job on the results, a comparison was made between employees and people with administrative jobs and workers (drivers, technical and industrial workers, gardeners, and cooks). The results of the NDI, neck pain, FHP, and THK were not significantly different between the 2 groups.

The results of the comparison of study variables between the 2 groups are shown in Table 2. As can be seen, there was a significant difference in all variables between the 2 groups. Neck pain and disability, FHP, and THK were more prevalent in opium smokers than in non-drug users.

5. Discussion

As stated in the introduction section, opium smoking requires sitting in non-ergonomic positions, which increases the possibility of posture disorders due to exposure for several hours a day and over many years.

Fortunately, the results of the comparison of the 2 groups in terms of basic demographic indicators showed that the 2 groups did not differ significantly.

Table 2. Comparison of the Neck Pain and Disability, Forward Head Posture, and Thoracic Kyphosis Between the 2 Groups

Variables and Groups	Mean ± SD	P-Value
Neck pain (VAS)		0.004
Opium smokers	52.46 ± 21.8	
Non-drug users	23.66 ± 14.4	
Craniovertebral angle		0.003
Opium smokers	44.54 ± 1.88	
Non-drug users	52.26 ± 2.13	
Thoracic kyphosis		0.006
Opium smokers	44.42 ± 3.16	
Non-drug users	35.33 ± 1.82	
NDI		
Pain intensity		0.001
Opium smokers	2.82 ± 0.7	
Non-drug users	0.88 ± 0.8	
Personal care		0.002
Opium smokers	2.65 ± 1.20	
Non-drug users	0.74 ± 0.83	
Lifting		0.004
Opium smokers	3.40 ± 1.1	
Non-drug users	1.46 ± 0.75	
Reading		0.002
Opium smokers	3.05 ± 1.02	
Non-drug users	0.86 ± 0.64	
Headache		0.004
Opium smokers	3.27 ± 1.16	
Non-drug users	1.39 ± 0.92	
Concentration		0.035
Opium smokers	1.28 ± 1.08	
Non-drug users	0.66 ± 0.73	
Work		0.007
Opium smokers	2.34 ± 0.95	
Non-drug users	0.83 ± 0.82	
Driving		0.011
Opium smokers	2.04 ± 0.87	
Non-drug users	0.89 ± 0.47	
Sleeping		0.031
Opium smokers	1.96 ± 1.17	
Non-drug users	1.23 ± 0.72	
Recreation		0.009
Opium smokers	1.81 ± 0.96	
Non-drug users	0.73 ± 0.63	
NDI score		<0.001
Opium smokers	23.28 ± 5.48	
Non-drug users	8.24 ± 5.86	
Percentage score		0.001
Opium smokers	48.68 ± 12.15	
Non-drug users	18.38 ± 10.16	

Abbreviations: VAS, Visual Analog Scale; NDI, neck disability index.

In this study, neck pain was correlated with prolonged sitting in a non-neutral position. Similarly, in the study by Rahmani et al., neck pain in dentists was correlated with prolonged sitting, improper postures, and repetitive motions (25). Another study considered working in a non-ergonomic position as a risk factor for neck pain in employees who work with computers and have keyboards placed in an inappropriate position. In the same study, smoking also showed a correlation with neck pain, which confirms the results of this study (26).

Forward head posture was more prevalent in opium smokers. It may be due to their position while smoking opium. Similar results have been obtained in other groups and other studies. For example, the prevalence of FHP is more common in employees who spend long hours on a desktop or in gamers who, like opium smokers, have their head and neck in a non-neutral position for many hours (27, 28). Since the correlation of neck pain with FHP has been shown in previous studies, and FHP is more common in people with chronic neck pain than in healthy people, the higher prevalence of neck pain and FHP in opium smokers is not far from expected (29).

In this study, THK was more common in opium smokers than in non-drug users. Since the two groups were matched as much as possible and the only independent variable that had a significant difference between the two groups was opium smoking and sitting in a non-ergonomic position for opium smoking, the difference in hyperkyphosis can be considered as a result of non-neutral position during opium smoking. Similarly, posture deformities (such as THK) occur in similar groups (such as dentists) who experience similar positions (30, 31).

It seems that neck disability, which was more in the group of opium smokers, is also the result of the non-ergonomic position while smoking opium. In this regard, the correlation between the daily duration of opium smoking and the number of years of opium smoking with neck musculoskeletal disorders has been shown in previous studies (32). In addition, a similar relationship between the number of hours working at the computer and the higher occurrence of neck disability in office workers has been shown (33). Studies conducted on dentists and farmers have also confirmed the effect of harmful positions due to work-related posture with a higher probability of neck pain and disability (34, 35). Considering that in the previous studies, there has been no correlation between neck pain and disability and FHP with the drug use duration (36), it seems that the causal relationship with opium smoking duration is strengthened.

5.1. Study Limitations

Previously, no research has been conducted on the common and possible musculoskeletal disorders and posture deformities in drug users (especially in opium smokers) and the potential effects of drug smoking positions. This was the biggest limitation we faced in this research, and the literature review did not help us much. Based on the experiences of this study, it is recommended to design more and more detailed studies for the target population of this study (especially in Iran). Another limitation was the reluctance of women to participate in this study, and we had to limit the samples to men. It is crucial to include women in future studies.

5.2. Conclusions

After several years, opium smokers are more prone to FHP, THK, and neck pain and disability than non-drug users due to the non-ergonomic position of several hours of daily opium smoking.

Acknowledgments

We thank the participants of both groups for participating in this study.

Footnotes

Authors' Contribution: The study concept and design were performed by AM.A., A.F., O.M., and M.N. Data gathering and data analysis were performed by O.M. All the authors contributed to drafting, writing, and editing of the article.

Conflict of Interests: There is no conflict of interest.

Data Reproducibility: The dataset presented in the study is available on request from the corresponding author during submission or after publication. The data are not publicly available due to privacy or ethical restrictions and to avoid the stigma that addiction has in our society.

Ethical Approval: This study was approved by the Ethics Committee of the University of Social Welfare and Rehabilitation Sciences under the ethical code of IR.USWR.REC.1398.120. This article was extracted from the doctoral thesis of the first author.

Funding/Support: This study did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

Informed Consent: All the patients signed an informed consent form. They were informed of voluntary participation in the study and could withdraw whenever they wished.

References

1. UNODC. *World Drug Report 2022*. Vienna, Austria: United Nations Publication; 2022. Available from: https://www.unodc.org/unodc/en/data-and-analysis/world-drug-report-2022.html.
2. Zarghami M. Iranian Common Attitude Toward Opium Consumption. *Iran J Psychiatry Behav Sci*. 2015;**9**(2). e2074. [PubMed ID: 26288642]. [PubMed Central ID: PMC4539585]. https://doi.org/10.17795/ijpbs2074.
3. Regavim RB. *The most sovereign of masters: The history of opium in modern Iran, 1850–1955*. University of Pennsylvania; 2012.
4. Pirnia B, Dezhakam H, Pirnia K, Malekanmehr P, Soleimani AA, Zahiroddin A, et al. COVID-19 pandemic and addiction: Current problems in Iran. *Asian J Psychiatr*. 2020;**54**:102313. [PubMed ID: 32738562]. [PubMed Central ID: PMC7377711]. https://doi.org/10.1016/j.ajp.2020.102313.
5. Saeedi M, Omrani-Nava V, Maleki I, Hedayatizadeh-Omran A, Ahmadi A, Moosazadeh M, et al. Opium Addiction and COVID-19: Truth or False Beliefs. *Iran J Psychiatry Behav Sci*. 2020;**14**(2). e103509. https://doi.org/10.5812/ijpbs.103509.
6. Farhoudian A, Radfar SR. How Substance Use Treatment Services in Iran Survived Despite a Dual Catastrophic Situation. *Am J Public Health*. 2022;**112**(S2):S133–5. [PubMed ID: 35349327]. [PubMed Central ID: PMC8965175]. https://doi.org/10.2105/AJPH.2022.306794.
7. Ghiabi M. *Drugs Politics: Managing Disorder in the Islamic Republic of Iran*. Cambridge (UK): Cambridge University Press; 2019. p. 33–4.
8. Conroy VM, Murray Jr BN, Alexopulos QT, McCreary J. *Kendall's Muscles: Testing and Function with Posture and Pain*. Lippincott Williams & Wilkins; 2022.
9. Falla D. Unravelling the complexity of muscle impairment in chronic neck pain. *Man Ther*. 2004;**9**(3):125–33. [PubMed ID: 15245706]. https://doi.org/10.1016/j.math.2004.05.003.
10. Widana I, Sumetri NW, Sutapa I, Suryasa W. Anthropometric measures for better cardiovascular and musculoskeletal health. *Comput Appl Eng Educ*. 2020;**29**(3):550–61. https://doi.org/10.1002/cae.22202.
11. Porter K. *Natural Posture for Pain-Free Living: The Practice of Mindful Alignment*. Simon and Schuster; 2013.
12. Gallagher S. Physical limitations and musculoskeletal complaints associated with work in unusual or restricted postures: A literature review. *J Safety Res*. 2005;**36**(1):51–61. [PubMed ID: 15752483]. https://doi.org/10.1016/j.jsr.2004.12.001.
13. Grabara M. Comparison of posture among adolescent male volleyball players and non-athletes. *Biol Sport*. 2015;**32**(1):79–85. [PubMed ID: 25729154]. [PubMed Central ID: PMC4314608]. https://doi.org/10.5604/20831862.1127286.
14. Muyor JM, López-Miñarro PA, Alacid F. Comparison of sagittal lumbar curvature between elite cyclists and non-athletes. *Sci Sports*. 2013;**28**(6):e167–73. https://doi.org/10.1016/j.scispo.2013.04.003.
15. Bagherian S, Rahnama N, Mahmudi F. Investigation of Curves of the spinal cord of the table tennis athletes. *Proceedings of the 6th National Conference on Physical Education Students*. 2011. p. 24–6.
16. Sadeghi M, Ghasemi GA, Iraj F. Comparing selected spinal column postural abnormalities of professional and amateur Wushu athletes with those of non-athletes. *J Res Rehabil Sci*. 2012;**8**(3):582–9. https://doi.org/10.22122/jrrs.v8i3.466.
17. Kamali-Sarvestani F, Motiallah T, Ghaffarinejad F. The Prevalence of Musculoskeletal Pain and Forward Head Posture among Heroin Users during their Withdrawal with Methadone. *Addict Health*. 2014;**6**(1-2):30–5. [PubMed ID: 25140215]. [PubMed Central ID: PMC4137442].
18. Daneshmandi H, Rahmani F, Neshati A. [The Study of Posture and Aerobic Power of Addicts]. *J Appl Exerc Physiol*. 2007;**3**(6):11–21. Persian.

19. Griegel-Morris P, Larson K, Mueller-Klaus K, Oatis CA. Incidence of common postural abnormalities in the cervical, shoulder, and thoracic regions and their association with pain in two age groups of healthy subjects. *Phys Ther*. 1992;**72**(6):425–31. [PubMed ID: 1589462]. https://doi.org/10.1093/ptj/72.6.425.
20. Viester L, Verhagen EA, Oude Hengel KM, Koppes LL, van der Beek AJ, Bongers PM. The relation between body mass index and musculoskeletal symptoms in the working population. *BMC Musculoskelet Disord*. 2013;**14**:238. [PubMed ID: 23937768]. [PubMed Central ID: PMC3751130]. https://doi.org/10.1186/1471-2474-14-238.
21. Poznyak V, Reed GM, Medina-Mora ME. Aligning the ICD-11 classification of disorders due to substance use with global service needs. *Epidemiol Psychiatr Sci*. 2018;**27**(3):212–8. [PubMed ID: 29198240]. [PubMed Central ID: PMC6998967]. https://doi.org/10.1017/S2045796017000622.
22. Putri BA. The Correlation between Age, Years of Service, and Working Postures and the Complaints of Musculoskeletal Disorders. *Int J Occup Saf Health*. 2019;**8**(2):187–96. https://doi.org/10.20473/ijosh.v8i2.2019.187-196.
23. Mylonas K, Tsekoura M, Billis E, Aggelopoulos P, Tsepis E, Fousekis K. Reliability and Validity of Non-radiographic Methods of Forward Head Posture Measurement: A Systematic Review. *Cureus*. 2022;**14**(8). e27696. [PubMed ID: 35935117]. [PubMed Central ID: PMC9354067]. https://doi.org/10.7759/cureus.27696.
24. Khakhali-Zavieh M, Parnian-Pour M, Karimi H, Mobini B, Kazem-Nezhad A. The validity and reliability of measurement of thoracic kyphosis using flexible ruler in postural hyper kyphotic patients. *Arch Rehabil*. 2003;**4**(3):18–23.
25. Rahmani N, Amiri M, Mohseni-Bandpei MA, Mohsenifar H, Pourahmadi MR. Work related neck pain in Iranian dentists: An epidemiological study. *J Back Musculoskelet Rehabil*. 2013;**26**(1):9–15. [PubMed ID: 23411643]. https://doi.org/10.3233/BMR-2012-0343.
26. Korhonen T, Ketola R, Toivonen R, Luukkonen R, Hakkanen M, Viikari-Juntura E. Work related and individual predictors for incident neck pain among office employees working with video display units. *Occup Environ Med*. 2003;**60**(7):475–82. [PubMed ID: 12819280]. [PubMed Central ID: PMC1740578]. https://doi.org/10.1136/oem.60.7.475.
27. Ashok K, Purushothaman VK, Muniandy Y. Prevalence of forward head posture in electronic gamers and associated factors. *Int J Aging Health Mov*. 2020;**2**(2):19–27.
28. Mahmoud NF, Hassan KA, Abdelmajeed SF, Moustafa IM, Silva AG. The Relationship Between Forward Head Posture and Neck Pain: a Systematic Review and Meta-Analysis. *Curr Rev Musculoskelet Med*. 2019;**12**(4):562–77. [PubMed ID: 31773477]. [PubMed Central ID: PMC6942109]. https://doi.org/10.1007/s12178-019-09594-y.
29. Taheri H, Mahdavinejad R, Bagherian Dehkordi S, Omidali Z. Comparison of forward head in persons with chronic neck pain and healthy persons. *J Res Rehabil Sci*. 2011;**7**(2). https://doi.org/10.22122/jrrs.v7i2.188.
30. Alexopoulos EC, Stathi IC, Charizani F. Prevalence of musculoskeletal disorders in dentists. *BMC Musculoskelet Disord*. 2004;**5**:16. [PubMed ID: 15189564]. [PubMed Central ID: PMC441388]. https://doi.org/10.1186/1471-2474-5-16.
31. Onety GC, Leonel DV, Saquy PC, Silva GP, Ferreira B, Varise TG, et al. Analysis of endodontist posture utilizing cinemetry, surface electromyography and ergonomic checklists. *Braz Dent J*. 2014;**25**(6):508–18. [PubMed ID: 25590197]. https://doi.org/10.1590/0103-6440201302438.
32. Massah O, Arab AM, Farhoudian A, Noroozi M, Hashemirad F. The correlation between strength and range of motion of the neck muscles and opium smoking in Iran. *Front Psychiatry*. 2023;**14**:1200091. [PubMed ID: 37324814]. [PubMed Central ID: PMC10262083]. https://doi.org/10.3389/fpsyt.2023.1200091.
33. Medin-Ceylan C, Korkmaz MD, Sahbaz T, Cigdem Karacay B. Risk factors of neck disability in computer-using office workers: a cross-sectional study. *Int J Occup Saf Ergon*. 2023;**29**(1):44–9. [PubMed ID: 34952560]. https://doi.org/10.1080/10803548.2021.2021712.
34. Zhou Y, Zhou W, Aisaiti A, Wang B, Zhang J, Svensson P, et al. Dentists have a high occupational risk of neck disorders with impact on somatosensory function and neck mobility. *J Occup Health*. 2021;**63**(1). e12269. [PubMed ID: 34390307]. [PubMed Central ID: PMC8363657]. https://doi.org/10.1002/1348-9585.12269.
35. Jain R, Meena ML, Dangayach GS. Prevalence and risk factors of musculoskeletal disorders among farmers involved in manual farm operations. *Int J Occup Environ Health*. 2018:1–6. [PubMed ID: 30451600]. https://doi.org/10.1080/10773525.2018.1547507.
36. Massah O, Arab AM, Farhoudian A, Noroozi M, Hashemirad F. The Correlation between Neck Pain and Disability, Forward Head Posture and Hyperkyphosis with Opium Smoking in the Most Prevalent Opium Smoking Persian Gulf Country: A Cross-sectional Study from Iran. Preprint. *Preprints Org*. 2023. https://doi.org/10.20944/preprints202307.1256.v1.