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Incidence and impact of neck pain on daily life activities of the student population

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ABSTRACT

Introduction: Neck pain (NP) may have a local mechanical (non-specific) origin caused by dysfunction of the joint, muscle, and ligament structures in the neck or by a discogenic etiology. Most people (50–60%) suffer from NP at some point in their lives. They are more common in highly developed countries and in urban areas. The aim of this study is to determine the prevalence of NP and its impact on daily living activities in the student population.

Methods: The study included students of the University of Sarajevo - Faculty of Health Studies in the period from May 2021 to June 2021. The sample of respondents was formed by the method of random selection and included respondents of both sexes, aged 19–28 years. The study was conducted as a transversal cross-sectional study at a specific time point on the frequency of NP and the ability to perform activities of daily living in the student population.

Results: Out of the total number of 255 respondents, 77 (30.2%) reported that they have NP while 178 (69.8%) respondents reported that they do not feel NP and it was found that there was no statistically significant difference between the age groups of the subjects with and without NP. The study concluded that a higher percentage of respondents with NP did not engage in leisure activities and that respondents with NP had lower mobility in daily life, sleep disturbance, and poorer ability to perform activities of daily living due to NP.

Conclusion: The study conducted revealed that a significant percentage of the student population with NP has a lower ability to perform activities of daily living. Considering the above facts and the current transformation of the educational model, in which static postures dominate, it is necessary to design and implement programs for targeted physical activity and prevention of long-term inactivity that leads to painful musculoskeletal syndromes.

Keywords: Neck pain; incidence of neck pain; daily life activities; student population

INTRODUCTION

Neck pain (NP) may have a local mechanical (nonspecific) origin due to dysfunction of the joint, muscle, and ligament structures in the neck or a discogenic etiology with or without radiation of pain toward the head, shoulders, and arms (1).

NP is more common in populations of highly developed countries and urban areas, more common in women, with a peak in middle age (2).

Most people (50–60%) suffer from NP at some point in their lives, about 10–20% of the adult population suffer from NP at some time, of whom 54% have pain lasting at least 6 months, and the global prevalence of NP in any follow-up period is 4.9% (3,4).

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According to global burden of disease studies, NP is the fourth leading cause of disability (behind back pain, depression, and arthralgias) and the 21st leading cause of total disease burden (5). The estimated annual incidence of NP in population-based studies ranges from 10.4% to 21.3% (6).

In 2017, the number of cases of NP worldwide was 288.7 million/100 000 population. The number of incidental cases of NP since 1990 was 38.2 million and increased to 65.3 million patients in 2017. In 2017, the countries with the most cases per 100,000 population were Norway (6151), Finland (5750), and Denmark (5316), while South Sudan (2449), Djibouti (2443), and Burundi (2450) had the lowest rates. The highest number of cases of annual incidence of NP per 100,000 population from 1990 to 2017 occurred in the United Kingdom (9.1%), Sweden (6.5%), and Kuwait (1.6%) (7).

Epidemiological studies suggest that depression and anxiety are significantly more common in people with

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NP compared with the general population. In addition, comorbidities of NP such as depression and anxiety have been shown to reduce the effectiveness of treatment outcomes (8,9).

Risk factors for NP include genetic predisposition, a sedentary lifestyle, the previous episodes of NP, sports injury or trauma to the neck, and coexisting musculoskeletal conditions (10,11).

The clinical picture is dominated by NP, which is aggravated by isolated or joint movements of the cervical spine and shoulder-scapular girdle. Palpation reveals increased tone and painful tenderness of local muscles and limited range of motion of the cervical spine. The duration of NP is directly related to the cause of the discomfort (12,13).

The intensity, character, and localization of the pain also determine the clinical presentation of nonspecific or neuropathic (radicular) pain. Non-specific pain can be superficial or deep and is usually sharp, stabbing, and extremely localized. It may also spread to adjacent regions. Neuropathic (radicular) pain occurs as a result of compression and/or irritation of the spinal nerve and is sharp or burning in nature (radiculitis) or is accompanied by greater or lesser impairment of sensibility, reflexes, and motor skills (radiculopathy) (14-16).

The diagnosis of NP is made on the basis of a complete history and physical examination. Recognized signs and symptoms may lead to a definitive diagnosis or may lead the patient to additional radiologic, laboratory, and electrodiagnostic procedures, as well as methods for three-dimensional analysis of back shape and reconstruction of spinal deformities without radiation exposure (17-20).

The treatment of NP depends directly on the cause, differs in acute, subacute, and chronic phases, and is generally divided into conservative and surgical. The main goal of treatment is to relieve pain, achieve optimal function of the cervical spine and adjacent regions, and prevent the occurrence of further disability in daily life (6).

The aim of the study is to determine the frequency of NP and the impact on activities of daily living in the student population, based on the hypothesis that NP makes it difficult for the student population to perform activities of daily living.

METHODS

The study included undergraduate students at the University of Sarajevo - Faculty of Health Studies in Sarajevo, Bosnia and Herzegovina in the period from May 2021 to June 2021. The sample of respondents was formed by the method of random selection; it included both sexes and age from 19 to 28 years.

The instruments used in the study are:

- A questionnaire designed specifically for this study to collect data on the general data of the respondents and the frequency of occurrence of NP, which was prepared only for this purpose.
- English version of the Neck Outcome Score (NOOS), a questionnaire analyzing the ability to perform activities of daily living based on NP (21,22).

The criteria for inclusion in the study defined a sample of respondents who were students of both sexes and all years of undergraduate studies at the University of Sarajevo - Faculty of Health Studies, aged 19–28 years, who volunteered to participate in the study. Students who did not agree to the study were automatically excluded from the study, while the criterion for exclusion of respondents from the study was an incomplete or insufficiently completed questionnaire.

The study was conducted as a transversal cross-sectional study at a specific time point on the frequency of NP and the ability to perform activities of daily living in the student population.

The study was approved by the Ethics Committee of the University of Sarajevo - Faculty of Health Studies (No. 04-7-43/21/02-3-614/11). Participation in the study was entirely voluntary, and informed consent was obtained from each respondent. The identity of the respondents is protected in accordance with ethical and data protection principles.

Statistical analysis of the data was performed using the program IBM Statistics SPSS v 23.0. The results are presented in the form of tables and graphs.

The test of data distribution was performed using the Kolmogorov–Smirnov test. When the results showed that the studied data did not meet the criteria of normal distribution, the non-parametric Chi-square test and the Mann–Whitney test were used to test the significance of the differences between the observed groups. Correlation analysis was performed using the Spearman correlation rank test. The results of all these tests were considered statistically significant at the 95% confidence level or at a value of $p < 0.05$.

RESULTS

The study involved 255 students from the University of Sarajevo - Faculty of Health Studies in Sarajevo, Bosnia and Herzegovina. The gender structure of the respondents consisted of 77.6% (n = 198) female respondents and 22.4% (n = 57) male respondents (Table 1).

About 30.2% (n = 77) of the total number of respondents reported having NP, while 69.8% (n = 178) reported not having NP (Table 2).

The mean age of the total sample was 21.47 ± 1.41 years, with the youngest subject being 19-years-old and the oldest 28-years-old, the median being 22 years and the interquartile range being 20–22 years.

Subjects in the group with NP were slightly older, with a mean age of 21.61 ± 1.76 years, than subjects in the

TABLE 1. The gender structure of the respondents

	Total
Sex	
Male	
n	57
%	22.4
Female	
n	198
%	77.6
Total	
n	255
%	100.0

group without NP, with a mean age of 21.39 ± 1.19 years. Statistical analysis shows that there is no significant difference in mean age between the observed groups ($p > 0.05$) and the sample can be considered homogeneous in terms of age (Table 3).

Respondents who reported not having NP engaged in recreational activities 50.6% ($n = 90$) of the time, compared to respondents who did not engage in recreational activities 49.4% ($n = 88$) of the time. Respondents with NP engaged in leisure activities 46.8% ($n = 36$) of the time, compared to respondents who did not engage in leisure activities 53.2% ($n = 41$) of the time. This observed difference is not statistically significant ($p > 0.05$) (Table 4).

Regarding the course of study that the respondents studied, there was a statistically significant difference ($p < 0.05$) in the sense that the largest number of respondents with NP studied physical therapy 39.0% ($n = 30$), then laboratory technologies 29. 9% ($n = 23$), radiological technologies 16.9% ($n = 13$), sanitary engineering 10.4% ($n = 8$), and healthcare 3.9% ($n = 3$) (Table 5).

In terms of year of study, most respondents at NP were 2nd year students (37.7%, $n = 103$), followed by 3rd year (24.7%, $n = 19$), 4th year (23.4%, $n = 8$), and 1st year with 14.3%, ($n = 11$) of respondents. Statistical analysis does not indicate a statistically significant difference between groups ($p > 0.05$) (Table 6).

Analysis of the Neck Outcome Score (NOOS) questionnaire results

The average mobility score of respondents with NP was 70.55%, minimum 39.29%, and maximum 96.43%. For respondents with NP, the median of respondents' mobility was M = 71.43% (60.71–82.14). Respondents with NP had a problem with mobility 71.43% of the time (Table 7).

The overall median sleep disturbance score for respondents is 86.90%, while the median sleep disturbance score for respondents with NP is 70.62% and for respondents without NP is 93.61%. The median value for sleep disturbance of respondents with NP was M = 75.00% (56.25–87.50), while it was M = 100.00% (93.75–100.00) for respondents without NP. In 75.00% of cases, the respondents with NP have sleep disorders (Table 8).

The average daily activities (due to pain) for respondents with the presence of NP are 70.45%. The minimum value of daily activities (due to pain) for the respondents with NP is 21.88% and the maximum value is 100.00%. The median for daily activities (due to pain) of respondents with the presence of NP is M = 71.88% (59.38–84.38). Respondents with NP have problems in performing daily activities in which they are disturbed by pain 71.88% of the time (Table 9).

The average participation in daily life for respondents with the presence of NP is 77.18%. The minimum value of participation in daily life for respondents with NP is 25.00% and the maximum value is 100.00%. Respondents with NP have problems in participating in daily life 77.50% of the time (Table 10).

TABLE 2. Presence of neck pain

Presence of neck pain		
	n	%
Yes	77	30.2
No	178	69.8
Total	255	100.0

TABLE 3. The age in relation to the presence of neck pain

	Presence of neck pain		Total
	Yes	No	
Age			
X	21.61	21.39	21.47
SD	1.76	1.19	1.41
Min.	19.00	19.00	19.00
Max.	28.00	25.00	28.00
Median	22.00	21.50	22.00
Q1	20.00	20.00	20.00
Q3	22.00	22.00	22.00

Mann–Whitney test; Z statistic value=−0.406, p=0.685

TABLE 4. The existence of recreational activities in relation to the presence of neck pain

Recreational activities of the respondents * Presence of neck pain			
	Presence of neck pain		Total
	Yes	No	
Recreational activities of the respondents			
Yes			
n	36	90	126
%	46.8	50.6	49.4
No			
n	41	88	129
%	53.2	49.4	50.6
Total			
n	77	178	255
%	100.0	100.0	100.0

Chi-square test; χ^2=0.312, p=0.337

TABLE 5. The study program that the respondent studies in relation to the presence of neck pain

Study program that the respondent studies * Presence of neck pain			
	Presence of neck pain		Total
	Yes	No	
Study program that the respondent studies			
Healthcare			
n	3	25	28
%	3.9	14.0	11.0
Radiological technologies			
n	13	19	32
%	16.9	10.7	12.5
Sanitary engineering			
n	8	37	45
%	10.4	20.8	17.7
Physiotherapy			
n	30	57	87
%	39.0	32.0	34.1
Laboratory technologies			
n	23	40	63
%	29.9	22.5	24.7
Total			
n	77	178	255
%	100.0	100.0	100.0

Chi-square test; χ^2=12.088, p=0.034

TABLE 6. Undergraduate study year in relation to the presence of neck pain

Undergraduate study year * Presence of neck pain			
	Presence of neck pain		Total
	Yes	No	
Undergraduate study year			
I			
n	11	22	33
%	14.3	12.4	12.9
II			
n	29	74	103
%	37.7	41.6	40.4
III			
n	19	41	60
%	24.7	23.0	23.5
IV			
n	18	41	59
%	23.4	23.0	23.1
Total			
N	77	178	255
%	100.0	100.0	100.0

Chi-square test; χ^2=0.422, *p*=0.936

TABLE 7. The mobility of the respondents in relation to the presence of neck pain

	Presence of neck pain		Total
	Yes	No	
NOSS – Mobility of the respondents			
X	70.55	92.74	86.43
SD	14.37	13.34	16.80
Min.	39.29	50.00	39.29
Max.	96.43	100.00	100.00
Median	71.43	100.00	96.43
Q1	60.71	92.86	75.00
Q3	82.14	100.00	100.00

Mann–Whitney test, Z statistic value=−10.219, *p*=0.0001

TABLE 8. Sleep disturbances of the respondents in relation to the presence of neck pain

	Presence of the neck pain		Total
	Yes	No	
NOSS – Sleep disturbances of the respondents			
X	70.62	93.61	86.90
SD	19.77	10.92	17.85
Min.	18.75	50.00	18.75
Max.	100.00	100.00	100.00
Median	75.00	100.00	93.75
Q1	56.25	93.75	81.25
Q3	87.50	100.00	100.00

Mann–Whitney test, Z statistic value=−9.470, *p*=0.0001

DISCUSSION

Analysis of gender structure showed that 77.6% (*n* = 198) of female respondents and 22.4% (*n* = 57) of male respondents participated in the study. The analysis of the age structure of the respondents showed that the average age in the total sample was 21.47 ± 1.41 years, with the youngest respondent being 19 years old and the oldest being 28 years old.

TABLE 9. Everyday activities (due to pain) in relation to the presence of neck pain

	Presence of neck pain		Total
	Yes	No	
NOSS – Ability to perform daily activities			
X	70.45	92.92	86.33
SD	17.85	11.36	17.19
Min.	21.88	34.38	21.88
Max.	100.00	100.00	100.00
Median	71.88	100.00	93.75
Q1	59.38	90.63	78.13
Q3	84.38	100.00	100.00

Mann–Whitney test, Z statistic value=−9.776, *p*=0.0001

TABLE 10. Participation in everyday life in relation to the presence of neck pain

	Presence of neck pain		Total
	Yes	No	
NOSS – Participation in everyday life			
X	77.18	95.07	89.88
SD	16.47	9.93	14.70
Min.	25.00	37.50	25.00
Max.	100.00	100.00	100.00
Median	77.50	100.00	97.50
Q1	67.50	95.00	85.00
Q3	92.50	100.00	100.00

Mann–Whitney test, Z statistic value=−9.649, *p*=0.0001

Of the total number of respondents, 77 (30.2%) indicated that they felt NP while 178 (69.8%) indicated that they did not feel NP. Statistical analysis revealed that there was no statistically significant difference between the age groups of respondents with NP and the group of respondents without NP.

The study found that the percentage of respondents with NP who do not participate in leisure activities is 53.2%, but no statistically significant difference was found with respondents with NP who do participate in leisure activities.

In 2010, Lorusso et al. conducted the study on musculoskeletal problems in radiologic technology students at the University of Apulia in Southern Italy. The questionnaire collected data on personal characteristics, physical activity, and the presence of musculoskeletal symptoms in the neck, shoulders, wrist, lower back, and legs. A total of 109 individuals participated in the study, 37% of whom reported pain. Most respondents had pain in the lower back (27%), then in the neck (16%), shoulders (11%), legs (8%), and wrist (5%). The results showed that the low physical activity was associated with the presence of pain. The results of the study conducted do not agree with the results of our study, in which the results showed that engaging in recreational activities had no effect on the occurrence of NP in the student population (23).

A study conducted by Karingada and Sony in 2021 suggests an association between musculoskeletal disorders and online classes during the pandemic COVID-19. In this study, 80% of students reported symptoms of headache and NP; 58% of students reported the presence of

musculoskeletal disorder symptoms in the right shoulder and 56% in the fingers of the right hand; more than 40% of students have experienced some musculoskeletal disorder symptoms since taking online courses (24).

Most respondents with NP were studying in the physical therapy program, followed by laboratory technologies, radiologic technologies, and sanitary engineering, while the fewest students with NP were studying in the health care program.

In 2018, Crawford et al. conducted a study of the prevalence of lumbalgia and NP among final-year Swiss health professions students and concluded that the overall annual prevalence of NP among health professions students was 75.0% (72.8–77.1). The prevalence was highest among midwifery students (82.3% [76.1–88.1]). All students in other professions had a very similar adjusted annual prevalence of NP of approximately 75% (25).

Subjects with NP were most prevalent in the 2nd year of study, followed by the 3rd and 4th years of study, and the lowest number of subjects with NP was in the 1st year of study.

Behera et al. conducted a study on NP among medical students at a large institute in central India and found that 3rd and 4th year students were 2.9 times more likely to have NP currently compared to 1st year students and this was statistically significant. The results of this study were consistent with our study (26).

Analysis of the NOOS questionnaire results was used to analyze the ability to perform activities of daily living based on NP. It was found that respondents with NP due to NP had poorer ability to perform activities of daily living mobility, sleep disturbance, and ability to perform activities of daily living.

Alian et al. conducted a cross-sectional study of the prevalence and risk factors of neck and back pain and its impact on the degree of disability in daily living and quality of life of 382 students at Zagazig University School of Medicine. The study showed that subjects with mild NP had a minimal degree of disability in daily activities and a good quality of life, whereas subjects with moderate and severe NP had a more severe form of disability in daily activities and a very poor quality of life (27).

CONCLUSION

Based on the study conducted, a significant percentage of NP was found in the student population. Considering the characteristics of the sample, whose main feature is younger age, such a percentage of occurrences of NP is worrisome. This is supported by the data that respondents with NP had a weaker ability to perform activities of daily living. Considering the above facts and the current change in the educational model, in which static postures dominate, it is necessary to design and implement programs for targeted physical activity and prevention of long-term inactivity that leads to painful musculoskeletal syndromes.

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DECLARATION OF INTERESTS

The authors declare no conflict of interest.

REFERENCES

1. Carroll LJ, Cassidy JD, Peloso PM, Giles-Smith L, Cheng CS, Greenhalgh SW, et al. Methods for the best evidence synthesis on neck pain and its associated disorders: The bone and joint decade 2000-2010 task force on neck pain and its associated disorders. J Manipulative Physiol Ther 2009;32(2):S39-45.
   https://doi.org/10.1016/j.jmpt.2008.11.009
2. Cohen SP. Epidemiology, diagnosis, and treatment of neck pain. Mayo Clin Proc 2015;90(2):284-99.
   https://doi.org/10.1016/j.mayocp.2014.09.008
3. Haldeman S, Carroll L, Cassidy JD. Findings from the bone and joint decade 2000 to 2010 task force on neck pain and its associated disorders. J Occup Environ Med 2010;52(4):424-7.
   https://doi.org/10.1097/JOM.0b013e3181d44f3b
4. Hoy DG, March L, Woolf A, Blyth F, Brooks P, Smith E, et al. The global burden of neck pain: Estimates from the global burden of disease 2010 study. Ann Rheum Dis 2014;73(7):1309-15.
   https://doi.org/10.1136/annrheumdis-2013-204431
5. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: A systematic analysis for the global burden of disease study 2010. Lancet 2012;380(9859):2163-96.
   https://doi.org/10.1016/S0140-6736(12)61729-2
6. Hoy DG, Protani M, De R, Buchbinder R. The epidemiology of neck pain. Best Pract Res Clin Rheumatol 2010;24(6):783-92.
   https://doi.org/10.1016/j.berh.2011.01.019
7. Blanpied PR, Gross AR, Elliott JM, Devaney LL, Clewley D, Walton DM, et al. Neck pain: Revision 2017: Clinical practice guidelines linked to the international classification of functioning, disability and health from the orthopaedic section of the American physical therapy association. J Orthop Sports Phy Ther 2017;47(7):A1-83.
8. Kim R, Wiest C, Clark K, Cook C, Horn M. Identifying risk factors for first-episode neck pain: A systematic review. Musculoskelet Sci Pract 2018;33:77-83.
   https://doi.org/10.1016/j.msksp.2017.11.007
9. Demyttenaere K, Bruffaerts R, Lee S, Posada-Villa J, Kovess V, Angermeyer MC, et al. Mental disorders among persons with chronic back or neck pain: Results from the world mental health surveys. Pain 2007;129(3):332–42.
   https://doi.org/10.1016/j.pain.2007.01.022
10. Hogg-Johnson S, van der Velde G, Carroll LJ, Holm LW, Cassidy JD, Guzman J, et al. The burden and determinants of neck pain in the general population: Results of the bone and joint decade 2000-2010 task force on neck pain and its associated disorders. Spine (Phila Pa 1976) 2008;33(Suppl 4):S39-51.
    https://doi.org/10.1097/BRS.0b013e31816454c8
11. Karić-Škrijelj M, Mašić I, Pašalić A, Vavra-Hadžiahmetović N. Efikasnost aktivnih vježbi kod pacijenata sa sindromom bolnog vrata. Mat Soc Med 2007;19(4):219-6.
12. Jackson R. The classic: The cervical syndrome. 1949. Clin Orthop Relat Res 2010;468(7):1739-45.
    https://doi.org/10.1007/s11999-010-1278-8
13. Vlak T, Vlak I. Odnos snage mišića vratne kralježnice u bolesnika s cervikalnim sindromom i zdravih osoba. Fizikalna Rehabil Med 1992;9(1-2):3-7.
14. Bernetti A, Agostini F, de Sire A, Mangone M, Tognolo L, Di Cesare A, et al. Neuropathic pain and rehabilitation: A systematic review of international guidelines. Diagnostics (Basel) 2021;11(1):74.
    https://doi.org/10.3390/diagnostics11010074
15. Skirven TM, Osterman AL, Fedorczyk J, Amadio PC. Rehabilitation of the Hand and Upper Extremity. Amsterdam, Netherlands: Elsevier Health Sciences; 2011; 713-22.
16. Abbed KM, Coumans JV. Cervical radiculopathy: Pathophysiology, presentation, and clinical evaluation. Neurosurgery 2007;60(Suppl 1):S28-34.
    https://doi.org/10.1227/01.NEU.0000249223.51871.C2
17. Côté P, Alleyne J, McIntosh GA. Pain in the neck. J Curr Clin Care 2015;5(1):25-33.
18. Steven P, Cohen M. Epidemiology, diagnosis, and treatment of neck pain. Mayo Found Med Educ Res 2015;90(2):284-99.
19. Malanga A, Tran J, Maharjan S. Neck pain: Diagnosis and management. Pract Pain Menag 2012;12(9). Available from: https://www.practicalpainmanagement.com/pain/spine/neck-pain-diagnosis-management (Last accessed on 2022 Feb 18)
20. Mangone M, Paoloni M, Procopio S, Venditto T, Zucchi B, Santilli V, et al. Sagittal spinal alignment in patients with ankylosing spondylitis by rasterstereographic back shape analysis: An observational retrospective study. Eur J Phys Rehabil Med 2020;56(2):191-6.
    https://doi.org/10.23736/S1973-9087.20.05993-6
21. Juul T, Søgaard K, Roos ME, Davis AM. Development of a patient-reported outcome: The neck outcome score (NOOS) content and construct validity. J Rehabil Med 2015;47(9):844-53.

https://doi.org/10.2340/16501977-2013

22. Juul T, Søgaard K, Davis AM, Roos ME. Psychometric properties of the neck outcome score (NOOS), neck disability index (NDI) and short form-36 (SF-36) were evaluated in patients with neck pain. J Clin Epidemiol 2016;79:31-40.

    https://doi.org/10.1016/j.jclinepi.2016.03.015

23. Lorusso A, Bruno S, L'abbate N. Musculoskeletal complaints among Italian X-ray technologists. Ind Health 2007;45(5):705-8.

    https://doi.org/10.2486/indhealth.45.705

24. Karingada KT, Sony M. Demonstration of the relationship between MSD and online learning during the COVID-19 pandemic. J Appl Res High Educ 2021;14(1):200-22.

25. Crawford RJ, Volken T, Schaffert R, Bucher T. Higher low back and neck pain in final year Swiss health professions' students: Worrying susceptibilities identified in a multi-centre comparison to the national population. BMC Public Health 2018;18(1):1188.

    https://doi.org/10.1186/s12889-018-6105-2

26. Behera P, Majumdar A, Revadi G, Santoshi JA, Nagar V, Mishra N. Bol u vratu među studentima dodiplomskog studija medicine u glavnom institutu središnje Indije: Studija presjeka prevalencije i pridruženih čimbenika. J Family Med Prim Care 2020;9(7):3574-81.

    https://doi.org/10.4103/jfmpc.jfmpc_206_20

27. Alian SM, El-Shahawy ED, Yousof MA, Ragab HM. Prevalence and associated risk factors of neck and low back pains among students at faculty of medicine, Zagazig University. Eur J Mol Clin Med 2021;8(2):2476-88.