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The effect of computer use on the occurrence of migraine

Uticaj upotrebe računara na pojavu migrene

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Abstract

Background/Aim. Risk factors concerning computer use-related migraine onsets are still unknown. The aim of this study was to determine the prevalence of headaches in computer users as well as the effects of computer use and behavior on the prediction of migraine presence. **Methods.** A cross-sectional study included 1,500 subjects from the general population who were given a questionnaire to assess the presence and type of headache and questions regarding computer-assisted behavior. All examinees were divided into two groups: the first group consisted of respondents who had a headache, and the second group consisted of subjects without a headache. **Results.** A total of 67.9% of the subjects had a headache, of which 23.9% had a migraine. Results of multinomial regression analysis showed that significant predictors of the migraine group, compared to the group without headache, were gender (female) and family anamnesis positive for migraine, as well as spending more time on the computer, making shorter and infrequent breaks in which physical activities were less included. Furthermore, members of the migraine group, compared with the group with other types of headaches, were younger and had family anamnesis, rarely made pauses during computer use, and their pauses were shorter. **Conclusion.** Improper and excessive computer use could be considered a risk factor for migraine occurrence, particularly in young people who have positive family anamnesis for migraine.

Key words:
computers; headache; migraine without aura; risk assessment; risk factors; sex factors; work; workplace.

Apstrakt

Uvod/Cilj. Faktori rizika od nastanka migrene usled rada na računaru još uvek su nepoznati. Cilj rada bio je da se utvrdi učestalost glavobolje kod korisnika računara i efekat načina upotrebe i ponašanja pri radu na računaru u predviđanju prisustva migrene. **Metode.** U studiju preseka je bilo uključeno 1 500 ispitanika iz opšte populacije kojima je zadat upitnik za procenu prisustva i tipa glavobolje, kao i pitanja u vezi sa ponašanjem prilikom rada na računaru. Svi ispitanici su bili podeljeni u dve grupe: prvu grupu su činili ispitanici sa glavoboljom, a drugu grupu ispitanici bez glavoblje. **Rezultati.** Glavobolju je imalo 67,9% ispitanika, od kojih je 23,9% imalo migrenu. Rezultati multinomalne regresione analize pokazali su da su pol (ženski), porodična anamneza, kao i više vremena provedenog za računarom, ređe i kraće pauze u toku kojih su često fizički neaktivni, bili značajni prediktori u grupi ispitanika sa migrenom, u odnosu na grupu bez glavobolje. Štaviše, pripadnici grupe sa migrenom u poređenju sa grupom ispitanika koja je patila od drugih vrsta glavobolja, bili su mlađi i imali pozitivnu porodičnu anamnezu za migrenu, ređe pravili pauze u toku rada na računaru, a te pauze su bile kraće. **Zaključak.** Nepravilna i prekomerna upotreba računara može se smatrati faktorom rizika od pojave migrene, posebno kod mladih osoba sa pozitivnom porodičnom anamnezom za migrenu.

Ključne reči:
kompjuteri; glavobolja; migrena bez aure; rizik, procena, faktori rizika; pol, faktor; rad; radno mesto.

Introduction

The number of people suffering from frequent headaches is increasing every day [1]. Headache is the most common neurological symptom today, which can have a significant impact on reducing the quality of life [2, 3]. This also affects work life, as headaches can reduce productivity at work [3], and pupils and students may experience learning disabilities [4].

Nowadays, working on a computer is becoming more and more common within the professional as well as in the private sphere of life [5, 6]. In addition to the many benefits that

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the use of a computer can bring, it can also lead to numerous damages to the health of users, of which, in the past research, besides spinal pain, shoulder pain, visual impairment [7], fatigue, depression, and obesity, headache has become the most mentioned [6, 8–10]. Some studies show that the use of computers can be considered a significant risk factor for migraines [6, 8, 11]. Although the use of computers has recently been increasingly associated with the onset of headache attacks, not all the risk factors for working on a computer, that contribute to its occurrence, are known yet [8].

Consequently, all strategies for preventing computer harm are not yet well known [8, 12], and further research is needed [8]. The aim of the study was to determine the prevalence of headaches in computer users as well as to determine the effect and the pattern of using the computer in a migraine occurrence.

Methods

This cross-sectional study was approved by the Ethics Committee of the Faculty of Medicine in Novi Sad (No 01-39/81/1). The study was conducted over one year in primary and secondary schools, preschools, colleges, and enterprises in the municipalities of Sombor, Apatin, Novi Sad, and Mali Idjos, with prior approval of the management of these institutions.

The minimum number of subjects was calculated based on G-power software, with an a priori set test power of 0.95. The baseline for initial values were the headache prevalence results from a previous study [13], as this is the only study in these areas that presents headache prevalence results. Consistent with the prevalence of headaches in the aforementioned study, it was calculated that the minimum sample size should be 1,040 subjects to control the type II error. A total of 1,506 subjects that use a computer were included in the survey. The respondents in the study were adult pupils, students, teaching and non-teaching staff in schools and colleges, and workers in enterprises. The exclusion criteria were as follows: persons with poor mental development and dementia, severe and life-threatening acute and chronic illnesses, which excluded 6 subjects. Data collection was performed using a set of questions that was modeled after other studies [2, 6, 8, 13–15]. Immediately before the questionnaire was distributed, the study participants were introduced to the method of filling in correctly, the meaning of certain terms, and were informed about the objectives of the test after receiving their written consent for voluntary participation in the study. The survey lasted about 45 min. The questionnaire consisted of a total of three parts. The first part contained questions about general demographic data (gender, age, place of residence, educational level, occupation, and employment), data on the health status of the respondents (about the presence of headaches in the previous year, about the presence of chronic diseases, about the existence of neck pain and so on) and information about the presence of headaches in the family. The second part contained questions about computer use and behavior while working on the computer (time spent on the computer during the day, whether pauses were made while working on the computer, and if so, how long, and of what content, as well as if the subject occupied the correct position while operating the computer). The third part was filled in exclusively by the respondents who answered that they had at least one headache attack in the last year. It contained questions about the characteristics of headaches and was partly taken from previous research [13]. This set of questions follows the criteria of the International Classification of Headaches [16]. All participants initially were divided into two groups: subjects with headaches and subjects without headaches. Furthermore, the first group was divided into two subgroups: the ones with migraine and the ones with other types of headaches.

Data analysis

Multinomial regression analysis was used in order to test the prediction of belonging to the migraine group, compared to the controls and other headache (non-migraine) groups. Category predictors were gender, employment, family anamnesis, and whether participants make a pause during the computer use, and continuous predictors were age, pause frequency (on a scale from 1 = after 30 min to 5 = never), pause duration (on a scale from 1 = never to 5 = 2 hrs and more), correct position during computer use (on a scale from 1 = never to 4 = always), and total hrs of computer use per day. Due to the missing data on some questions, the total number of answers was not the same across variables. Using the χ^2 test, the difference in the prevalence of migraine and other types of headaches between school children and adults was determined. Analysis was performed in SPSS v.23 for Windows.

Results

The total sample was first divided into two groups. The first group consisted of 1,019 (67.9%) respondents who had a headache. The second group consisted of subjects who did not have a headache (control group), which consisted of 481 (32.1%) respondents. The headache group was divided into two subgroups. The first subgroup consisted of 243 (23.9%) subjects with migraine, and the second group consisted of 776 (76.1%) subjects with other types of primary and secondary headaches.

Table 1 shows the demographic characteristics, usage patterns, and behavior of respondents while working on a computer.

Using the χ^2 test, it was determined that there were statistically significant differences in the prevalence of migraine and other types of headaches between school children and adults [χ^2 (4) = 10.55, p = 0.032]. The prevalence of migraine and other types of primary and secondary headaches was significantly higher in school children than in adults. Results of multinomial regression analysis showed that model was significant [χ^2 (20) = 1,044.93, p < 0.001], with R^2 ranging from 0.59 (Cox & Snell) to 0.68 (Nagelkerke) and 77.3% of overall correct classification. Significant prediction of membership to the migraine group

Table 1

Demographic characteristics, usage patterns, and behavior of examinees while working on a computer

Parameter	Migraine n = 243	Other headaches n = 776	Control n = 481
Demographics characteristics			
gender, n (%)			
male	47 (19.3)	228 (29.4)	226 (47.0)
female	196 (80.7)	547 (70.6)	255 (53.0)
employment, n (%)	88 (36.2)	311 (40.1)	234 (48.6)
yes			
no	155 (63.8)	465 (59.9)	247 (51.4)
age (years)			
mean ± SD	26.66 ± 10.82	28.69 ± 12.7	31.38 ± 14.46
school children, n (%)	110 (45.3)	347 (44.7)	184 (38.3)
adults, n (%)	133 (54.7)	429 (55.3)	297 (61.7)
family anamnesis, n (%)			
yes	114 (46.9)	228 (29.4)	48 (10.0)
no	129 (53.1)	548 (70.6)	433 (90.0)
Characteristics of computer use			
total hours per day, mean ± SD	6.85 ± 3.43	6.23 ± 2.88	2.91 ± 2.06
pause (break), n (%)			
yes	185 (76.1)	620 (79.5)	390 (81.1)
no	55 (22.6)	156 (20.5)	49 (10.2)
pause frequency, n (%)			
after 30 min	15 (6.3)	121 (15.9)	261 (59.5)
after 1 h	18 (7.5)	246 (32.3)	94 (21.4)
after 2 hrs	47 (19.7)	181 (23.8)	27 (6.2)
after 3 or more	104 (43.5)	58 (7.6)	8 (1.8)
never	55 (23.0)	156 (20.5)	49 (11.2)
pause duration, n (%)			
up to 10 min	103 (56.3)	252 (41.7)	52 (13.3)
between 15 and 30 min	62 (33.9)	232 (38.3)	147 (37.6)
between 31 min and 1 h	14 (7.7)	85 (14.0)	98 (25.1)
about 2 hrs and more	4 (2.2)	36 (6.0)	94 (24.0)
activity during the pause, n (%)			
mobile/tablet	47 (25.5)	158 (26.1)	72 (18.4)
relaxing	77 (41.8)	262 (43.2)	109 (27.9)
physical activity, other	60 (32.6)	186 (30.7)	210 (53.7)
correct position, n (%)			
never	32 (13.3)	421 (55.1)	62 (14.2)
sometimes	129 (53.8)	277 (36.3)	199 (45.6)
often	68 (28.3)	51 (6.7)	141 (32.3)
always	11 (4.6)	15 (2.0)	34 (7.8)

n – number of subjects; SD – standard deviation.

compared to controls showed gender (with more females in the migraine group) and family anamnesis (with more participants with family anamnesis in the migraine group) from the demographics characteristics (Table 2). Regarding variables about computer use, results showed that the migraine group compared to controls, spent more total hrs per day on the computer, rarely made pauses during computer use (after 3 hrs or never), made shorter pauses (up to 10 min), and were more relaxing in pauses than engaging in physical activity. Compared to participants with other headaches, participants from the migraine group were younger and had family anamnesis more often, while there were no significant gender differences nor differences in employment (Table 2). Furthermore, although there were no differences in total spent hrs per day, participants with migraine rarely made pauses during computer use and made shorter pauses. However, they reported that they sat more correctly during computer use compared to the participants with other headaches. There were no differences in the type of activity during the pause between migraine and other headache groups.

Most subjects with both migraine and other types of headaches reported having a headache after 2 to 6 hrs of computer work (Table 3).

Table 2

Prediction in the migraine group based on demographics characteristics and characteristics of computer use

Parameter	Migraine vs. controls				Migraine vs. other headaches			
	Exp(B)	*p*	CI		Exp(B)	*p*	CI	
			lower	upper			lower	upper
Demographics characteristics								
gender (male)	2.45	0.003	1.35	4.45	1.59	0.075	0.96	2.64
age	1.01	0.537	0.97	1.05	1.05	0.003	1.02	1.09
employment (no)	1.36	0.521	0.53	3.49	0.75	0.492	0.34	1.69
family anamnesis (no)	0.13	0.000	0.07	0.24	0.47	0.000	0.30	0.71
Characteristics of computer use								
total hours per day	0.69	0.000	0.62	0.77	1.06	0.145	0.98	1.13
pause frequency	0.15	0.000	0.11	0.21	0.32	0.000	0.25	0.41
pause duration	3.54	0.000	2.56	4.91	1.77	0.000	1.33	2.36
correct position	0.90	0.544	0.65	1.25	0.29	0.000	0.22	0.38
activity during pause (mobile/tablet)	0.53	0.076	0.26	1.07	0.80	0.454	0.45	1.42
activity during pause (relaxing)	0.38	0.002	0.21	0.70	0.75	0.266	0.46	1.24

CI – confidence interval.

Table 3

Presence of computer use as a headache trigger

Parameter	Migraine	Other primary and secondary headaches
Computer as a headache trigger (yes), n (%)	207 (85.2)	560 (72.2)
Time onset of the headache after the beginning of computer use (hours), n (%)		
1–2	31 (15.1)	81 (14.5)
2–6	116 (56.6)	307 (54.8)
> 6	58 (28.3)	172 (30.7)

n – number of subjects.

Discussion

Due to the increasing number of people suffering from headaches, many studies conducted so far have focused on discovering significant triggers for headache attacks [17–19]. One of the triggers analyzed, which has recently become increasingly significant, is the use of computers [4–6, 8, 11, 14, 15, 17–20]. As in many other studies [6, 9, 11, 21], our study also found a high prevalence of headaches among computer users. In our study, as many as 67.9% of respondents who are computer users experienced a headache in the previous year. A similar prevalence of headaches among computer users (64.5%) was observed in a study conducted in Sweden [11]. Moreover, in a survey conducted in Iceland, 65.2% of computer users had a headache [11]. A slightly higher prevalence of headaches (74.9%) among computer users was observed in a study conducted in Finland [11] and in a study conducted in Brazil, where 80.6% had a headache [6]. A significantly lower prevalence of headache (26%) in computer users has been observed in a study conducted in Australia [8]. In our study, 23.9% of the subjects were affected by migraine. A slightly lower prevalence of migraine (19.3%) is observed in a study on the prevalence of headaches in adolescents and their association with the use of computers and video games [6]. The prevalence of migraine (30.2%) is observed in the study by Saueressig et al. [9]. These differences in the prevalence of headaches among computer users between the different surveys may be primarily due to different demographic characteristics of the respondents (due to differences in gender and age structure) and different methodology since it is observed that the inclusion criteria for determining the presence of headaches differ from study to study (from three months to one year). Given that, headache prevalence is expected to be higher in studies where the inclusion criterion for headache was the presence of headache for at least one year prior to the survey.

This study, in addition to determining the prevalence of migraine among computer users, was also conducted to identify behaviors during computer use to determine risk factors contributing to the onset of migraine attacks.

In addition to the already known fact that migraines are more common in women and those with a positive family history of headaches, the results of our study also indicate the importance of the length of work and certain computer behaviors as risk factors for the presence of migraines. Specifically, the subjects with migraine, in comparison with the control group without headaches, spend significantly more time during the day working on the computer, rarely taking a break, and when they do, they are of shorter duration and more often physically inactive during the break. In comparison with the group of patients with other types of primary and secondary headaches, the subjects with migraine belong to the younger age category and have a positive family history. Although there are no significant differences in daily computer exposure, subjects with migraine compared with subjects with other types of primary and secondary head-

aches are significantly less likely to take a break, and when they do, those breaks have a significantly shorter duration. However, it is noted that migraine sufferers are more likely to occupy a proper position while working on a computer than those suffering from other types of headaches. The length of computer exposure during the day is the most studied factor to date, which has proven to be significant in the onset of migraine attacks [6, 9, 14, 15]. Specifically, Saueressing et al. [9] point out that the chance of a migraine is even 2.54 times higher for computer users who use the computer for more than 3 hrs during the day. In their research, Xavier et al. [6] point out that computer users who used a computer for more than 4 hrs a day were more likely to experience primary headaches, especially migraines. Milde-Busch et al. [15] in their research warn that even shorter exposure times to computers/the Internet (as little as 30 min) may result in an increased risk of migraine attacks. Additionally, confirmation of the importance of the length of work on a computer during the day for the onset of migraine is found in the results of the research conducted by Montagni et al. [14]. They cite two potential "scenarios" that could explain the effects of computer screens on migraine. The first is the brightness and frequency of the screen that can directly trigger the attack, and the second is the screen exposure time, which can reduce the threshold for headache, which is then induced by other factors. In contrast to our and the results of the aforementioned studies, different results, namely that the length of computer exposure does not play a significant role in the onset of headache attacks, were obtained by Smith et al. [8] in the study of the prevalence of neck pain and headache in computer users. However, the results of their study show the importance of the length of work on the computer for the onset of pain in the cervical spine. It is well known that ergonomic recommendations aimed at preventing the harmful effects of a computer on the health of users require the proper positioning of the body while operating the computer [6, 18, 22, 23]. Prolonged irregular position of the body when working on a computer in an environment that is not designed according to ergonomic rules is thought to be stressful for the trapezius muscle, which in addition to pain in the neck and shoulder can lead to headaches [24, 25]. In our study, taking the proper position when working on a computer proved to be a significant predictor between migraines and other types of headaches.

In order to determine how much and whether computer users who were suffering from headaches were aware of the computer as a trigger in our study, the respondents were asked if the occurrence of a headache attack could be affected by computer work. As a result, 85.2% of migraine and 72.2% of other primary and secondary headache sufferers reported that the computer could be a trigger. More than half of migraine and other primary and secondary headache sufferers reported that the headache usually occurs after 2–6 hrs of computer work.

As in other studies [4, 8], the results of our study show that computer users with headaches generally do not adhere to existing ergonomic recommendations to prevent the harmful effects of computers on health. Given that the number of headache sufferers is increasing every day, there is a need to develop and implement measures to prevent the onset of headache attacks, especially migraines. It is recommended that computer users receive adequate ergonomic training to prevent headaches [26].

In addition to confirming the results of previous research that the length of work on the computer is probably a risk factor for the presence of different types of headaches, this study found that the main difference between the types of headaches is the dynamics of work at the computer, i.e., the key is to take a break.

Limitations of the study

This research has several limitations. One of them refers to the way data was collected, which is a survey, and, therefore, not the best way to obtain reliable data. The limited time of 45 min provided for completing the survey questionnaire conditioned the limited number of questions. Therefore, questions about the diagnosis, the use of drugs in case of a headache, whether drugs are used on the recommendation of a doctor or independently, what is the effect of these drugs, and the like, would have given additional weight to the study and indicated the complexity of this problem.

Conclusion

The results of our study indicate a high prevalence of headaches in computer users. In addition to being female and having a positive family history of headaches, length of computer work and individual computer behaviors were significant predictors of belonging to the migraine group compared to the headache-free group. Respondents with migraine compared to the group without headaches significantly spend more time during the day working on the computer, taking a break less often, and when they do, they are more often physically inactive during the break which is most often of shorter duration. Respondents with migraine compared to subjects with other types of headaches are younger and have a positive family history of headaches. Although there are no significant differences in the length of work on the computer during the day, subjects with migraine compared to those with other types of headaches are much less likely to take a break, and when they do, those breaks are of a significantly shorter duration. Therefore, the length of time you work on your computer is probably a risk factor for the presence of different types of headaches, but the main difference between the types of headaches is in the dynamics of working on the computer, that is, taking breaks. Computer users with headaches generally do not adhere to existing ergonomic recommendations for the prevention of the harmful effects of computers on health, and there is a need to develop and implement preventative measures, which can be achieved by training users on ergonomic principles for proper and adequate use of computers.

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