International Journal of Industrial Ergonomics xxx (2015) 1–9

Contents lists available at ScienceDirect

International Journal of Industrial Ergonomics

journal homepage: www.elsevier.com/locate/ergon

Musculoskeletal and visual symptoms among undergraduate students: Individual and computer-use-related risk factors and interference with academic performance

Mahmut Ekşioğlu

Ergonomics Laboratory, Department of Industrial Engineering, Boğaziçi University, 34342, İstanbul, Turkey

ARTICLE INFO

Article history:
Received 6 August 2014
Received in revised form
30 May 2015
Accepted 24 November 2015
Available online xxx

Keywords:
Musculoskeletal symptom
Visual discomfort
University student
Computer
Academic performance

ABSTRACT

This study explored the prevalence and academic performance interference (API) of musculoskeletal symptoms (MS) and visual discomfort (VD), and investigated the associations of individual and computer-use-related risk factors with MS and VD among a group of university undergraduate students. The study involved first application of Student-Specific Cornell Musculoskeletal Questionnaire (SS-CMDQ) as a new tool to collect symptom data among student population. MS was found to prevail and interfere with ability to perform academic activities mostly in the neck, upper back and lower back with prevalence rates of 69.8%, 61.8% and 55.1%, respectively; and with API rates of 20.2%, 20.2% and 16.9%, respectively. The prevalence and API rates of VD were 62.9% and 33.7%, respectively. Among the investigated factors, being female, non-engineering academic concentration, years of computer use, daily computer use more than 4 h and experiencing visual discomfort during computer use were the significant risk factors.

Relevance to industry: Students are prospective members of the computer work force. Taking proactive measures against musculoskeletal symptoms and visual discomfort will ensure a healthy and productive workforce in the future.

1. Introduction

It has been well known that musculoskeletal symptoms (MS) form a common problem among computer workforce (e.g., Punnett and Bergqvist, 1997; Mekhora et al., 2000; Johnston et al., 2008; Klussmann et al., 2008; Village et al., 2005; Gerr et al., 2002; Collins and O'Sullivan, 2015). A review of epidemiological studies of computer work by Punnett and Bergqvist (1997) reported that computer work indicated higher risk of neck, shoulder, arm, wrist, and hand musculoskeletal illness compared with non-computer work. The study by Collins and O'Sullivan (2015) indicated that self-reported musculoskeletal symptoms for computer workers were highest in the neck, shoulder and lower back; and were higher for females than males.

A number of studies highlighted that musculoskeletal problems not only prevail among computer workers, but also among university students who are extensive computer users and prospective members of the workforce (e.g., Jacobs et al., 2011; Noack-Cooper et al., 2009; Chang et al., 2007; Menéndez et al., 2007; Moras and Gamarra, 2007; Hamilton et al., 2005; Hupert et al., 2004; MacMahan and Lutz, 2003; Katz et al., 2000). As the use of computers has become more widespread in young generations, occurrence and effects of MS among university students has become more salient. For instance, Hamilton et al. (2005) found prevalence of computer-related MS to be 80.6% among female college students in a university in the USA. Two other studies found prevalence of MS among college students to be 96% (Chang et al., 2007) and 86% (Menéndez et al., 2007). MS among university students were found to prevail mostly in the neck, upper back, lower back and shoulders (Noack-Cooper et al., 2009; Chang et al., 2007; Menéndez et al., 2007; Moras and Gamarra, 2007; MacMahan and Lutz, 2003). According to Schlossberg et al. (2004), prevalence of computer-related persistent or recurrent upper extremity or neck pain was 60% among graduate students. Of these symptomatic students, 41% of them reported to have noticed computer-related pain prior to starting graduate school, which pinpointed that undergraduate students comprise a high risk group. While prevalence and location of MS have been extensively studied, scant research investigated the impact of MS on academic performance of university students

E-mail address: mahmut.eksioglu@boun.edu.tr.

http://dx.doi.org/10.1016/j.ergon.2015.11.011
0169-8141/

(Jenkins et al., 2007; Hupert et al., 2004). Many studies have shown that MS decrease work performance of symptomatic computer workers (Fagarasanu and Kumar, 2006; Hagberg et al., 2007; Van den Heuvel et al., 2007). By the same token, MS could possibly decrease academic performance of symptomatic university students as well. Hupert et al. (2004) reported that the academic activity of the 9% of the students was hindered with the MS they have experienced. This ratio was found even higher (16%) by another study (Jenkins et al., 2007). Substantial prevalence and outcomes of MS has necessitated further studies to create awareness among university managers and authorities about taking necessary measures toward this problem such as healthy computing training for students (Jacobs et al., 2009; Jenkins et al., 2007), and to explore the associated risk factors and consequences of MS among university students (Katz et al., 2000).

A number of studies investigated associations between certain individual and computer-use-related risk factors and MS among university students (e.g., Noack-Cooper et al., 2009; Chang et al., 2007; Hamilton et al., 2005; Schlossberg et al., 2004). A significant individual risk factor has been found being female. Breadth of research showed that MS are more prevalent and pose more severe outcomes (i.e., functional limitation) among females compared to male students (e.g., Noack-Cooper et al., 2009; Chang et al., 2007; Jenkins et al., 2007; Hupert et al., 2004; Katz et al., 2000). Among the widely studied computer-use-related risk factors is the duration of daily computer use (Jacobs et al., 2011; Noack-Cooper et al., 2009; Chang et al., 2007; Hamilton et al., 2005). The findings about the relationship between duration of daily computer use and MS are not conclusive. Some studies did not find a significant association between the reported duration of daily computer use and frequency of MS (Noack-Cooper et al., 2009; Hamilton et al., 2005). On the other hand, Jacobs et al. (2011) reported a daily notebook use of students 4 h as a risk factor; Chang et al. (2007) found that computer use longer than three hours a day was related to 50% significantly higher odds of reporting MS among university students in short term; and Katz et al. (2000) found that computing for more than 20 h per week was significantly associated with prevalence of computer related MS among college students. Other investigated risk factors include age, academic concentration, using desktop vs. notebook computers and duration of computer use without a break (Noack-Cooper et al., 2009; Chang et al., 2007; Hamilton et al., 2005; Schlossberg et al., 2004).

Along with the MS, visual discomfort (VD) has been found another prevalent problem among computer users (e.g., Sjøgren and Elfstrøm, 1989; Bergqvist and Knave, 1994; Marumoto et al., 1999; Aarås et al., 2000; Suparna et al., 2005; Wu et al., 2006; Robertson et al., 2006; Aarås et al., 2007; Sen and Richardson, 2007; Helland et al., 2008; Abdelaziz et al., 2009). According to Bergqvist and Knave (1994) eye discomfort is related to computer work and that symptoms of gritty feeling or redness of the eye as well as sensitivity to light were associated with computer work. Wu et al. (2006) and Sen and Richardson (2007) reported that prevalence of computer-related visual problems among computer users were higher than 74% and 50%, respectively. Abdelaziz et al. (2009) reported that computer users run a higher risk of having visual problems compared to non-computer users. A number of studies indicated the link between VD and duration of daily computer use (Sjøgren and Elfstrøm, 1989; Robertson et al., 2006; Sen and Richardson, 2007; Aarås et al., 2007).

VD has also been found to prevail among university students, who use computers extensively for academic, private, and social purposes (e.g., MacMahan and Lutz, 2003; Moras and Gamarra, 2007; Sen and Richardson, 2007). For instance, Moras and Gamarra (2007) found that prevalence of eye strain was 57% among notebook-user undergraduate students and MacMahan and Lutz (2003) showed that prevalence of eye fatigue/eye strain was 85% among college students.

Furthermore, some studies in the literature indicated an association between VD and MS in computer use. For example, Aarås et al. (1998) reported a relation between visual discomfort and pain in the neck and shoulder for computer operators. Marumoto et al. (1999) studied the association between school myopia and postural parameters of students while studying and concluded that poor posture, particularly decreased neck angle, is significantly related to the degradation of naked vision. Hence, VD should be considered not only as a health problem per se, but also a potential computer-related musculoskeletal risk factor for university students.

As is the case with MS, VD also could possibly pose adverse effects on academic performance among university students. However, no study appears to explore the impact of VD on academic performance among university students.

Among the ways of computer use, playing computer games has become widespread in the young (Hakala et al., 2006; Zapata et al., 2006). Apparently, playing computer games among young users involves prolonged use of computers with repetitive hand motions while assuming static and awkward body postures. Therefore, it is considered that playing computer games could contribute to occurrence of MS and VD among players. Some studies concentrated on the effect of playing computer games on physical discomfort among adolescents. Zapata et al. (2006) investigated playing computer games as a musculoskeletal risk factor among adolescents and they did not find significant association between frequent playing of computer games and musculoskeletal pain. In another study, Hakala et al. (2006) identified playing digital games >5 h/day as a significant risk factor for low back pain. However, no study seems to investigate playing computer games with musculoskeletal health perspective among university students.

Self-report tools are widely used to collect musculoskeletal symptom data and proposed to have high validity (e.g., Hupert et al., 2004; Menéndez et al., 2007; Moras and Gamarra, 2007; Robertson et al., 2006). Researchers used various self-report tools specifically designed to investigate MS among university students (e.g.; Hamilton et al., 2005; Hupert et al., 2004; Jenkins et al., 2007; Menéndez et al., 2007; Moras and Gamarra, 2007).

The examination of existing studies indicated several lacking of used survey tools. Although some existing survey instruments addressed the effects of MS on academic activities such as student functional limitations (Jenkins et al., 2007), none of them considered the assessment of the frequency, severity and the academic performance outcomes of the MS for each body part. Another lacking was not considering the evaluation of lower extremities. Indeed, working with computers may introduce musculoskeletal risks for lower body parts (e.g., knees) as well due to poor desk design and sitting particularly in awkward postures (Janwantanakul et al., 2009).

Most studies have concentrated on computer-related upper extremity and upper body MS among university students (Chang et al., 2007; Katz et al., 2000; MacMahan and Lutz, 2003; Menéndez et al., 2007; Moras and Gamarra, 2007; Noack-Cooper et al., 2009). No study was found to explore MS for all body parts (Hamilton et al., 2005; Jenkins et al., 2007).

In summary, the following research needs can be drawn from the reviewed literature: (i) Further studies are needed to clearly identify the associations between individual and computer-use-related risk factors and MS among university students; (ii) investigating the extent and academic performance outcomes of VD as well as the association between VD and MS among university students can provide valuable knowledge to the existing literature and practical applications; (iii) studies on the effect of playing

Please cite this article in press as: Ekşioğlu, M., Musculoskeletal and visual symptoms among undergraduate students: Individual and computer-use-related risk factors and interference with academic performance, International Journal of Industrial Ergonomics (2015), http://dx.doi.org/10.1016/j.ergon.2015.11.011