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ORIGINAL SCIENTIFIC PAPER

The Association between Screen Time and Low Back Pain among Male College Students

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Abstract

Low back pain (LBP) is the most common musculoskeletal complaint. LBP affects all age groups, including college students. In the digital and communication era, computers and gadgets are ordinary. Excessive computer/gadget use can produce musculoskeletal work imbalance leading to LBP. Several risk factors are also linked to LBP, such as flexibility, strength muscle, body mass index (BMI), and standing posture. Thus, our study aims to investigate the association between LBP, screen time, and risk factors in male college students. This study was cross-sectional, involving 132 students. Height and weight were measured, and BMI was obtained. LBP was assessed using the Nordic Musculoskeletal Questionnaire (NMQ), and the duration of computer use was obtained using a questionnaire. Back muscle flexibility was measured using a modified sit and reach test; back muscle strength was measured using Back-Leg Dynamometer. Posture was assessed using the New York Posture Rating Chart (NYPRC). All variables were categorized into two groups. Fifty participants (37.9%) had LBP. Forty-six participants (34.8%) use computer/gadget excessively. The screen time was associated with LBP (p=0.04, OR 2.19, 95%CI 1.05-4.56). No relationship was found between flexibility, back muscle strength, BMI, and posture. Screen time is associated with LBP in male colleges. Excessive screen time had a 2.19 times greater risk of having LBP. This study conclude that excessive screen time is associated with LBP in male college students.

Keywords: *flexibility, back muscle strength, body mass index, standing posture, prolonged sitting*

Introduction

Low back pain (LBP) is pain that lies between the lower border of the ribs and the gluteal folds due to known or unknown causes. LBP is rare in children ten years or younger. However, as in adults, the prevalence of LBP in childhood increases with age and is more prevalent in girls than in boys (Brattberg & Wickman, 1992; Troussier, Davoine, de Gaudemaris, Fauconnier, & Philip, 1994; Burton, Clarke, McClune, & Tillotson, 1996; Grimmer & Williams, 2000). Lifetime prevalence of LBP was reported as much as 56.6%, 12-month prevalence 48.8%, and point prevalence of 21.2% in health science college students (Al Shayhan & Saadeddin, 2018). Whereas the year-prevalence of LBP among physiotherapy students in Brazil was about 5.3% (Morais, Silva, & da Silva, 2018), a higher prevalence of LBP was reported among college students in Indonesia, as many as 74.6% (Anggiat, Hon, & Baait, 2018).

LBP is associated with several risk factors. Intrinsic factors have been identified as contributing factors to low back pain. The smaller size (measured by cross-sectional area/CSA) of the lumbar multifidus (MF) and erector spinae were considered more prone to pain in the lumbar area (Goubert et al., 2018). The smaller lumbar muscle CSA was related to LBP's chronicity (Lee, Song, Lee, Kang, Kim, & Ryu, 2011). LBP was also linked with muscle weakness in older women (Kato et al., 2021). Besides, low flexibility was identified as the cause, influencing factor, and consequence of LBP (Ruas & Vieira, 2017).

In addition to intrinsic factors, several external factors are identified as influencing factors of LBP. Impaired neuromuscular control, for example, has been suggested to increase the likelihood of LBP (Cholewicki et al., 2005; Catalá, Schroll, Laube, & Arampatzis, 2018). It has been reported that decreased mobility function (locomotive syndrome) contributed to LBP (Kato et al.,

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2021). Physical activity appears to have an association with LBP. A meta-analysis study indicated that participants with higher physical activity had a low prevalence of LBP (Alzahrani, Mackey, Stamatakis, Zadro, & Shirley, 2019).

Recent studies exhibit that LBP is associated with inappropriate body positions while working for long periods. Sitting had been suspected to increase the likelihood of having occupational LBP (Lis, Black, Korn, & Nordin, 2007). Furthermore, static sitting behavior increases the risk of LBP (Bontrup et al., 2019). Sitting duration has also been acknowledged as a risk factor for LBP (Keskin, Ürkmez, Öztürk, Kepekçi, & Aydın, 2021). A study reported that most adolescents with excessive computer use and video game experienced LBP (Silva, Pitangui, Xavier, Correia-Júnior, & De Araújo, 2016). Therefore, our study purpose to investigate the association between excessive screen time and low back pain among male college students and the role of risk factors.

Material and Methods

Study design and subjects

This study was cross-sectional with a qualitative analytic design, followed by 132 male participants (20.5±1.2 years). The sample selection was performed using a purposive sampling method. The inclusion criteria were male students of the School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia. Exclusion criteria were female, history of back trauma, low back pain due to evident causes, history of back surgery, ongoing LBP therapy, and back muscle training. The study was approved by the Ethics Committee of Atma Jaya Catholic University of Indonesia (40/11/KEP-FKUAJ/2019).

Questionnaire Data

Screen time (duration of gadget/computer use) was asked of participants using an open question. The duration of computer use during weekdays and weekend were recorded. The results were averaged in hours per day. Based on the results, screen time was classified into 'normal' use if <7 hours/day and 'excessive' if ≥7 hours/day (Trinh, Wong, & Faulkner, 2015).

Low back pain was assessed using the Nordic Musculoskeletal Questionnaire (NMQ), developed from a project funded by the Nordic Council of Ministers (Kuorinka et al., 1987). NMQ consists of two sections. Section 1 is a general questionnaire with forty items to identify body area-producing musculoskeletal problems. This section was equipped with a body map to locate nine symptoms: neck, shoulders, upper back, elbows, low back, wrist/hands, hips/thighs, knees, and ankles/feet, and a pain scale from 1 to 10. Participants were asked about any musculoskeletal complaints in the last 12 months and seven days that interfered with their regular activity (Kuorinka et al., 1987).

Section 2 is additional questions for further detailed information about the body area. This section consists of twenty-five items that elicit accidents affecting each area, activity disturbances at home and work (change of job or duties), duration of the problem, seeking treatment from a health professional, and musculoskeletal problems in the last seven days (Kuorinka et al., 1987).

The Indonesian version of NMQ had been validated and produced a satisfactory result. The validity items obtained range from 0.501 (min.) to 0.823 (max.), with Cronbach's alpha reliability being 0.726 (Ramdan, Duma, & Setyowati, 2019).

Measurements

Body height and weight were measured using standard procedures. Height was measured using a microtoise in the Frankfort position, without wearing shoes or shocks. Weight was measured using digital scales. A standard formula obtained the body mass index (BMI) value, weight (kg) divided by the square of height in meters (m). BMI was classified as 'obese' if BMI≥25 kg/m2 and 'normal' if it <25 kg/m2, according to the standard for Asian people (Pan & Yeh, 2008).

Back muscle flexibility was examined by the modified sit and reach test method using a Takei digital anteflexion meter (TKK 5403, Takei Scientific Instruments Co.Ltd, Niigata, Japan). Subjects were encouraged to warm up, stretch before the examination, and remove their shoes and socks. Back flexibility was measured in a sitting position. Both legs extended forward and feet flat against the standard box. The Toe line (zero point) is at the 15 cm mark (Eurofit, 1993). Both palms face down while the fingertips of both hands touch and slide the display forward with one smooth movement as far as possible. The subject held the position for two seconds. The participants complete the test twice. The best of the two scores was recorded. The results were classified as 'good' if ≥14 cm and 'poor' if <14. This classification was modified based on normative results for males aged 20-29 from the American College of Sports Medicine (ACSM) (ACSM, 2018).

Back muscle strength was assessed using a digital back muscle dynamometer (Takei T.K.K. 5402, Takei Scientific Instruments Co., Ltd, Niigata, Japan). The subject stood upright on the base of the dynamometer with feet shoulder-width apart. Arms straight down to hold the bar, connected to the dynamometer with chain, with both hands. The chain length was adjusted so that the subject's trunks were flexed while the knees were extended. The subject pulls the bar as hard as possible with arms kept straight for 3-5 seconds. Subjects performed the test twice with a 60-second rest between trials. The highest score was recorded. Back muscle strength was classified into two groups based on average value (61.77 kg). 'Good' strength if ≥ 62 kg (rounded from average value), and 'poor' if <62 kg.

Posture was assessed using the New York Posture Rating Chart (NYPRC) by Howley, and Franks was applied (Howley & Franks, 1992). Ten body segments were observed and checked, five segments from behind (posterior) and five segments from the side (lateral). Three scale was applied to scoring each segment; '10' for 'normal', '5' for 'mild deviation', and '0' for 'marked deviation'. The maximal score indicating normal posture of all segments from both views was 100. Posture was classified into 'normal' if there were no zero scores at one or more body segments and 'poor' if there was a score of zero at least in one segment.

Statistical analysis

Numeric data were presented in the form of mean and standard deviation. Categorical data was displayed in terms of frequency and percentage. Numerical comparisons between LBP and non-LBP were tested by unpaired T-test. The association between risk factors and LBP was tested with Chi-Square. The level of significance was determined when p<0.05. Data processing and statistical tests were performed using SPSS 19 (Chicago, Illinois).

Results

Table 1. demonstrates the characteristics of the participants. Numeric and categorical data were presented. Obesity was found in sixty-two participants (47%). There were nineteen (14.4%) had 'poor' flexibility, seventy-four (56.1%) had 'poor' strength, and forty-five (34.1%) had 'poor' posture. Excessive use of computers was found in forty-six participants (34.8%), while fifty (37.9%) reported having LBP.

Table 1. Characteristics of participants

Variables	Mean±SD or number (%)
Age (years)	20.5±1.2
Height (kg)	171.4±5.3
Weight (cm)	72.8±12.3
BMI (kg/m2)	24.7±3.7
Normoweight	70 (53.0%
Obesity	62 (47.0%)
Back Flexibility (cm)	22.5±8.2
Good	113 (85.6%)
Poor	19 (14.4%)
Back Strength (kg)	61.6±9.0
Good	58 (43.9%)
Poor	74 (56.1%)
Screen Time (hours/day)	5.0±2.3
Normal (<7 hours/day)	86 (65.2%)
Excessive (≥7 hours/day)	46 (34.8%)
Total Score of NYPR score (lateral view)	46.4±5.4
Total Score of NYPR score (posterior view)	41.3±8.6
Overall score of NYPR	87.7±13.9
Normal posture	87 (65.9%)
Poor posture	45 (34.1%)
Low back pain	
No	82 (62.1%)
Yes	50 (37.9%)

Abbreviation: BMI, body mass index; NYPR, New York Posture Rating

The comparison of the variables between participants with and without LBP in numeric data is described in table 2. None of the variables were comparable (all p was >0.05).

The association between LBP and the variables is shown in table 3. LBP was related with posture (p=0.03, OR 0.32, 95%CI 0.15-0.68), and screen time (p=0.04, OR 2.19, 95%CI 1.05-4.56). Good posture was less likely to have LBP (0.32 times than poor posture), while excessive screen time was more likely to have LBP (2.19 times than normal screen time).

Table 2. The comparison of the variables between LBP vs non-LBP

Variables	No LBP	LBP	p
Height (cm	171.5±5.7	171.1±4.6	0.07
Weight (kg)	72.8±12.0	72.8±11.1	0.35
BMI (kg/m2)	24.7±3.9	24.8±3.4	0.31
Flexibility (cm)	22.9±8.8	21.7±7.0	0.07
Back Strength (kg)	62.3±18.9	60.4±17.9	0.39
Screen time (hr/day)	4.7±2.3	5.6±2.3	0.56
NYPR score	87.9±11.2	87.3±10.3	0.20

Abbreviation: BMI, body mass index; NYPR, New York Posture Rating

Table 3. The association between LBP and risk factors

	BMI	Flexibility	Strength	Screen time	NYPR score
Low back pain					
p	0.86	0.54	0.15	0.04	0.07
OR	0.94	1.38	0.59	2.19	0.32
95% CI	0.46-1.90	0.49-3.90	0.29-1.21	1.05-4.56	0.15-1.07

Abbreviation: BMI, body mass index; NYPR, New York Posture Rating

Discussion

Low back pain is one of the most complaints and disorders affecting many people worldwide and all age groups (Wu et al., 2020). LBP has many causes, from muscle origin to more severe diseases such as malignancy (Downie et al., 2013; Kato et al., 2021). The recent study attempted to identify LBP originating from the muscular system and link it with possible risk factors. This study found that LBP was associated with poor posture and excessive screen time. Flexibility, muscle back strength, and BMI were not related to LBP.

Computer use and its association with muscle pain have been investigated. Several previous studies supported our findings. A study on Lithuanian adolescents reported that back pain was more pronounced as the duration of computer use increased (Skemiene, Ustinaviciene, Luksiene, Radisauskas, & Kaliniene, 2012). Moderate to severe musculoskeletal symptoms (of the head, neck, shoulder, low back, eyes, fingers, and wrist) were also linked with computer use among Finnish adolescents (Hakala et al., 2012). Computer use-related pain might be related more to sitting. Previous studies reported the association between sitting and the presence of LBP. A systematic review concluded that sitting was related to LBP. However, they found that sitting in combination with other factors, such as awkward posture, increased the risk of LBP (Lis et al., 2007). Besides the duration, the sitting position also determined the occurrence of LBP (Casas, Patiño, & Camargo, 2016; Zywie´n, Barczyk-Pawelec, & Sipko, 2022).

The mechanism of LBP due to sitting had been proposed. A sitting position increases the load borne by the spine, which creates pressure on the intervertebral discs greater than standing or lying down (Lis et al., 2007). Further, when sitting, there is a decrease in the degree of lumbar lordosis and sacral slope compared to standing. Lumbar lordosis and sacral slope changes can cause spinopelvic imbalance and lead to chronic low back pain (Casas et al., 2016).

The information about static standing posture and its linkage to LBP is limited due to a lack of investigations. Our findings showed no association between posture and LBP. A review study stated that the evidence for the relationship between posture and LBP was miserable (Kripa & Kaur, 2021). Putri et al. reported that the association between posture and LBP was not evident (Putri, Citrawati, & Astari, 2021). However, when including working or habitual posture and duration of the posture, the linkage with LBP was noticeable. A study reported that standing time was positively associated with LBP. Longer standing time increased the possibility of LBP (de Souza et al., 2022). Longer standing time was hypothesized to increase intervertebral disc compressive force that could promote the occurrence of LBP (Hasegawa, Katsuhira, Oka, Fujii, & Matsudaira, 2018).

Our study did not confirm the association between back muscle strength. However, some previous studies established the association. Cho et al. reported that trunk muscle weakness was a risk factor for LBP (Choet al., 2014). The linkage between trunk muscle and LBP was also confirmed in older women (Kato et al., 2021). Besides trunks muscle, limb muscle may have an association with LBP. A study in Brazil found that lower limb muscle strength was weaker than healthy controls (de Sousa et al., 2019). We supposed that our study's cut-off value for strength classification might affect the association with LBP.

The association between flexibility and LBP is still inconclusive. Our recent study did not find a relationship between flexibility and LBP. Some studies supported this finding. The direct association between LBP and low flexibility was unclear (Ruas & Vieira, 2017). In their study, Sweeney et al., which involved female gymnasts, found that limited joint flexibility might not be associated with LBP (Sweeney, Daoud, Potter, Ritchie, & Howell, 2019). Even stretching, an exercise to improve flexibility, was linked to an increased risk of LBP (Sandler et al., 2014). However, a study examining straight leg raise and popliteal angle reported that dysfunction of LBP was related to posterior chain flexibility (da Silva, Ferraz, Ferretti, & Sfredo, 2017). The discrepancy between studies' findings could be caused by many determinants, such as flexibility measurement methods, examination of muscle flexibility, subject characteristics, sample size, etc.

The association between BMI and LBP was established by earlier studies (Keskin et al., 2021; Zywie'n et al., 2022). However, our findings failed to justify. The distinction could be due to different ages. As in our study, high BMI at a younger age might express high muscle rather than high fat. LBP in older age is linked to lumbar fat infiltration (Goubert et al., 2018). LBP is also connected to increased load in the lumbar in obesity (O'Sullivan, Mitchell, Bulich, Waller, & Holte, 2006).

Several shortcomings of our study existed. First, school bag weight and how to carry it was not recorded. These variables might increase the development of LBP. Second, sitting posture was not included, whereas it considerably impacts LBP. Third, no reference value to determine the cut-off of poor and good posture based on an overall score of the NYPRS. This reference value could help us to distinguish poor posture from good posture. Fourth, the sample size might not be large enough to produce a significant result. Despite these limitations, our study is valuable because it provides further information about the association between excessive screen time and LBP.

Conclusion

The association between screen time and LBP in male college students was confirmed. Excessive screen time (7 hours/day or more) had a 2.19 times greater risk of LBP. However, LBP was not related to back muscle flexibility and strength, static standing posture, and BMI. Further, we suggest that these findings be interpreted cautiously due to several limitations.

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Conflicts of interest
None to declare.

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