J. Phys. Ther. Sci. 36: 151–154, 2024

The Journal of Physical Therapy Science

Original Article

Effects of remote classes on the physical health of university students during the COVID-19 pandemic

Masaru Kanda, MPT, RPT, PhD[1)*], Hironori Suda, CPO, PhD[1)], Yu Maeda, CPO, PhD[1)], Miki Sato, CPO, PhD[1)], Naritoshi Sato, RPT, PhD[1)]

[1)] *Department of Prosthetics, Orthotics and Assistive Technology, Niigata University of Health and Welfare: 1398 Shimami-cho, Kita-ku, Niigata 950-3198, Japan*

Abstract. [Purpose] The purpose of this study is to determine how the study environment during remote classes affected the physical health of university students during the coronavirus disease 2019 pandemic. [Participants and Methods] A total of 3,359 students currently enrolled at our university participated anonymously. The survey was conducted using Google Forms, with items including "gender", "study environment during remote classes", "presence or absence of symptom", "symptoms that existed before starting remote classes", and "changes in symptoms after starting remote classes". [Results] The overall valid response rate was 49%, with a total of 688 males and 983 females providing responses. In the grouping by gender, the number of students with symptoms was significantly higher in females than in males. Similarly, the number of students with existing symptoms that were exacerbated was significantly higher in females than in males. With regards to study environment, a significantly higher proportion of students who sat on the floor during remote classes complained about exacerbated existing symptoms than those who sat on chairs. [Conclusion] The results demonstrate that remote classes during the coronavirus disease 2019 pandemic led to a higher prevalence of new physical symptoms and exacerbation of existing symptoms in females than in males, and when students sat on floors rather than on chairs.

Key words: Remote classes, Coronavirus disease 2019 (COVID-19) pandemic, Physical symptoms

(This article was submitted Nov. 15, 2023, and was accepted Dec. 10, 2023)

INTRODUCTION

In 2019, due to the spread of Coronavirus disease 2019 (COVID-19), the Ministry of Education, Culture, Sports, Science and Technology in Japan issued a notice informing the Japanese people that learning opportunities should be secured through remote classes and that due consideration would be given to development of the communication environment for such classes[1)]. Over 90% of universities in a survey conducted in May 2020 reported that classes were proceeding entirely remotely[2)]. Further, Moriyama et al. reported that the amount of time university students spent on physical activity decreased and the amount of time they spent sitting increased[3)]. Likewise, it has been reported overseas that college students' physical activity and walking time decreased while their sitting time increased due to COVID-19[4, 5)]. The "Guidelines for Working with Information Equipment"[6)], which was revised in 2019, recommends that appropriate posture and working hours for workers using a computer be considered and that necessary measures to ensure their physical health be taken. However, these guidelines are based on the workplace environment not to the remote study environment. Although technical and educational preparations for conducting remote classes are mentioned as above, the effects of the increase in remote class hours and the study environment on the physical health of students have not been reported, and no specific details have been provided.

*Corresponding author. Masaru Kanda (E-mail: kanda@nuhw.ac.jp)

In order to fulfill such lack of information, in this study, we conducted a questionnaire survey to current students at our university, aiming to determine how their study environment during remote classes affected their physical health involving neck and low back pain.

PARTICIPANTS AND METHODS

This study was conducted with 3,359 students currently enrolled at our university. The content of the study was first explained to all potential participants, and only students who agreed to participate anonymously were included. Question items were created using Google Forms, and the URL for the questionnaire was shared with the student mailing list for each department. The multiple-choice question items pertained to the following: "gender", "study environment during remote classes (sitting on a chair, hereafter Chair Sitting, or on a floor, hereafter Floor Sitting)", "presence or absence of neck pain/back pain", "timing of appearance of symptoms (before and after starting remote classes)", "symptoms that existed before starting remote classes", and "changes in symptoms after starting remote classes". The questionnaire was distributed on June 4, 2021, and the deadline was one month later. When a respondent answered all questions properly, their questionnaire response was considered valid, and the valid responses for each question were counted in the analysis. In the statistical analysis, we grouped participants by gender or by study environment during remote classes (Chair Sitting or Floor Sitting) and tested for significant differences using the χ^2 test. SPSS version 27.0 (IBM Japan, Tokyo, Japan) was used for statistical processing, and the significance level in all tests was set at 0.05. The study received the approval by the Ethics Committee of Niigata University of Health and Welfare (Approval number: 18629-210528).

RESULTS

The overall valid response rate was 49% (1,671/3,359). A total of 688 males (41%) and 983 females (59%) provided valid responses. A total of 952 students (57%) reported the presence of physical symptoms (e.g., neck pain/back pain), and 429 (45%) had developed new physical symptoms and 228 (44%) had exacerbated their existing symptoms since the start of remote classes (Table 1). The number of females with Floor sitting were significantly higher than that of males ($p<0.01$) (Table 2). When grouped by gender, the number of females with symptoms were significantly higher than that of males ($p<0.01$). In addition, the number of females with existing symptoms that had exacerbated was significantly higher than the number of males ($p<0.01$). However, no significant differences were found between males and females in terms of the ratio of existing symptoms to symptoms at the onset of remote classes (Table 3).

In grouped by their study environment (Chair Sitting or Floor Sitting) during remote classes, it was revealed that 951 (57%) were Chair Sitting and 720 (43%) were Floor Sitting. A total of 537 (59%) of those with Chair Sitting and 415 (60%) of those with Floor Sitting reported symptoms. The number of students with existing symptoms that had exacerbated was significantly higher than the number of students with Chair Sitting ($p<0.05$). However, no significant differences were found between the number of Chair Sitting students with symptom and those of Floor Sitting students. In addition, no significant differences were found between Chair Sitting students and Floor Sitting Students in terms of the ratio of existing symptoms to symptoms at the onset of remote classes (Table 4).

Table 1. Symptoms of the participants

1,671/3,406 (49%)				N
Non-symptom	719 (43%)			1,671 (total)
Symptom	952 (57%)			
New symptom		429 (45%)		952 (Symptom)
Existing symptom		523 (55%)		
No change			295 (56%)	523 (Existing symptom)
Exacerbation			228 (44%)	

Table 2. χ^2 test statistics of the data of study environment for males and females

	N	Chair sitting	Floor sitting	
Male	688 (41%)	448 (65%)	240 (35%)	**
Female	983 (59%)	503 (51%)	480 (49%)	

**$p<0.01$.

Table 3. χ^2 test statistics of the data of symptoms for males and females

	M: 688 (41%)	F: 983 (59%)	M: 311 (33%)	F: 641 (67%)	M: 165 (32%)	F: 358 (68%)	
Non-symptom	377 (55%)	342 (35%)					**
Symptom	311 (45%)	641 (65%)					
New symptom			146 (47%)	283 (44%)			
Existing symptom			165 (53%)	358 (56%)			
No change					117 (71%)	178 (50%)	**
Exacerbation					48 (29%)	180 (50%)	

**p<0.01.
M: Male; F: Female.

Table 4. χ^2 test statistics of the data of symptoms for study environment

	CS: 951 (57%)	FS: 720 (43%)	CS: 537 (56%)	FS: 415 (44%)	CS: 280 (54%)	FS: 236 (46%)	
Non-symptom	414 (41%)	305 (40%)					
Symptom	537 (59%)	415 (60%)					
New symptom			257 (48%)	179 (43%)			
Existing symptom			280 (52%)	236 (57%)			
No change					167 (60%)	118 (50%)	*
Exacerbation					113 (40%)	118 (50%)	

*p<0.05.
CS: chair sitting; FS: floor sitting.

DISCUSSION

In this study, we determined how the university students' environment during remote classes affected their physical health during the COVID-19 pandemic. The results demonstrate that remote classes during the COVID-19 pandemic can lead to a higher prevalence of physical symptoms and aggravation of existing symptoms in females than in males with Floor Sitting study environment.

Regarding the presence or absence of physical symptoms in both males and females, 952 (57%) reported symptoms, and of those who reported symptoms, 429 (45%) had developed new physical symptoms since starting remote classes. As mentioned above, over 90% of classes were being conducted entirely remotely due to the COVID-19 pandemic[2], and physical activity decreased and time spent sitting increased among college students[3]. It was furthermore reported in 2020 that the same situation would continue in the future. In accordance with this prediction, the remote setting contributed to the development of new physical symptoms in students participating the remote classes. A comparison of physical symptoms by gender indicates that the percentage of females with symptoms (65%) was significantly higher than the percentage of males (45%) ($p<0.01$). That is, showing a possible relationship between gender and induction of physical symptoms. In addition, a significantly higher percentage of females (50%) than males (29%) ($p<0.01$) reported the exacerbation of existing symptoms. This indicates a relationship between gender and changes in existing symptoms. In addition, the ratio of females with Floor sitting was significantly higher than those of males ($p<0.01$). A previous study reported that joint laxity is greater in females than in males[7]. Another study reported that whole lumbar lordosis is 50° when standing, 30.2° when sitting in a chair, and 13.9° when sitting on the floor. In particular, the curve of the 1st sacral space of the 5th lumbar vertebra is 20.2° when standing, 10.3° when sitting in a chair, and 7.4° when sitting on the floor[8]. That is, a decrease in muscle strength due to a decrease in physical activity from participating in remote classes and an increase in the load on joints due to increased sitting time on the floor may have led to the increase or worsening of physical symptoms to a higher degree in the females in our study, who have greater joint laxity. It has also been reported that females are more sensitive and less tolerant of pain than males[9]. Hence, the female participants may have been more aware of the physical changes due to increased remote classes.

In terms of the study environment (Chair Sitting or Floor Sitting) during remote classes, 951 (57%) of students were Chair Sitting and 720 (43%) were Floor Sitting. The percentage of students who reported exacerbation of existing symptoms was significantly higher among those with Floor Sitting (50%) compared to those with Chair Sitting (40%) ($p=0.03$). This demonstrates a relationship between sitting posture and changes in existing symptoms. As mentioned earlier, whole lumbar lordosis is 50° when standing, 30.2° when sitting in a chair, and 13.9° when sitting on the floor. In particular, the curve of the 1st sacral space of the 5th lumbar vertebra is 20.2° when standing, 10.3° when sitting in a chair, and 7.4° when sitting on the floor[8]. Thus, it is presumed that whole lumbar lordosis and lower lumbar lordosis are reduced in the sitting position compared to the standing position and are reduced to an even greater degree when sitting on a bed compared to sitting on a

chair. Another study reported that a decrease in lumbar lordosis increases internal pressure on the lumbar back muscle groups and decreases blood flow to the muscles[10]. An increase in time spent sitting due to participating in remote classes may lead to continuous muscle ischemia, and as a result, lead to the occurrence and exacerbation of pre-existing physical symptoms. The results suggest that sitting on a floor during remote classes during the COVID-19 pandemic can lead to a higher prevalence of physical symptoms and aggravation of existing physical symptoms.

As the limitation of this study, although the participants of this study were students currently enrolled in our university, we were unable to verify their ages, physical characteristics, medical history, and degree of symptoms. In addition, although we describe students' study environment during remote classes, we did not examine sitting posture, spine alignment, time spent sitting, choice of sitting posture, and so on. In the future, these points, which likely have a strong impact, must be investigated. Furthermore, in this study, all symptoms were described as "physical symptoms", and no distinctions were made between low back pain and neck pain. In the future, it is necessary to determine the effects based on the characteristics of each relevant symptom.

In conclusion, the results demonstrate that remote classes during the COVID-19 pandemic led to a higher prevalence of new physical symptoms and exacerbation of existing symptoms in females than in males and Floor Sitting than Chair Sitting.

Funding

This study was supported by the Niigata University of Health and Welfare Research Grant.

Conflict of interest

There are no conflicts of interest to disclose in relation to this study.

REFERENCES

1) Ministry of Education, Culture, Sports, Science and Technology: Guidelines for starting the semester of university, college, and vocational school under the COVID-19. https://www.mext.go.jp/content/20200525-mxt_kouhou01-000004520_2.pdf (Accessed Nov. 10, 2022)
2) Ministry of Education, Culture, Sports, Science and Technology: The current situation, issues, and future direction of educational system with Japanese University under the COVID-19. 5th Research collaborators meeting. https://www.mext.go.jp/content/20200924-mxt_keikaku-000010097_3.pdf (Accessed Nov. 10, 2022)
3) Moriyama M, Yuki A: Changes in physical activity among university students after the lifting of the COVID-19 emergency declaration issued in April 2020. Jpn J Phys Fit Sports Med, 2021, 70: 257–268.
4) Srivastav AK, Sharma N, Samuel AJ: Impact of Coronavirus disease-19 (COVID-19) lockdown on physical activity and energy expenditure among physiotherapy professionals and students using web-based open E-survey sent through WhatsApp, Facebook and Instagram messengers. Clin Epidemiol Glob Health, 2021, 9: 78–84. [Medline] [CrossRef]
5) Medrano M, Cadenas-Sanchez C, Oses M, et al.: Changes in lifestyle behaviours during the COVID-19 confinement in Spanish children: a longitudinal analysis from the MUGI project. Pediatr Obes, 2021, 16: e12731. [Medline] [CrossRef]
6) Ministry of Health, Labour and Welfare: Guidelines for occupational health management in information equipment work. https://www.mhlw.go.jp/content/000539604.pdf (Accessed Nov. 10, 2022)
7) Kogo H, Murata J, Higashi T: The sexual differences and relationship between body flexibility and joint laxity. Jpn J Health Promot Phys Ther, 2015, 4: 189–193.
8) Bae JS, Jang JS, Lee SH, et al.: A comparison study on the change in lumbar lordosis when standing, sitting on a chair, and sitting on the floor in normal individuals. J Korean Neurosurg Soc, 2012, 51: 20–23. [Medline] [CrossRef]
9) Mogil JS: Sex-based divergence of mechanisms underlying pain and pain inhibition. Curr Opin Behav Sci, 2018, 23: 113–117. [CrossRef]
10) Konno S: The intracompartmental pressure of the lumbar back muscles and lower back pain. Clin Orthop Surg, 1993, 28: 2897–2898.