

## Research Article

# Association Between Sitting Position and Lower Extremity Musculoskeletal Disorders in Medical Students During Study from Home

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## Abstract.

During the COVID-19 pandemic, learning at educational institutions continued, even though it is carried out online. Limited learning facilities affect the sitting position of students, increasing the potential for musculoskeletal disorders, especially in the lower extremities. This study aimed to examine the relationship between sitting position and musculoskeletal disorders in some parts of the lower extremities. It was quantitative, analytical observational, with a cross-sectional design study. Respondents are students at one of the medical faculty in West Java and includes 158 people. Data collection was carried out in 2020. The sitting position category was determined based on observation of the results of taking photographs while studying, and musculoskeletal complaints in 12 areas of the lower extremities were determined based on filling out the Nordic Body Map (NBM) questionnaire. The data was analysed by Chi Square using SPSS 20 software. Results showed that most of the respondents sit in a certain position using a special chair and desk for studying. The knee of the respondent is mostly in a flexed position. Most respondents felt lower extremity musculoskeletal complaints in the buttocks and lower buttocks. There is an association between sitting position and musculoskeletal complaints in the knees, calves, and ankles. The ergonomic sitting position helps reduce musculoskeletal complaints in various parts of the body, including the lower extremities.

**Keywords:** lower extremity, medical students, musculoskeletal disorders, sitting position

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Published 8 November 2022

Publishing services provided by Knowledge E

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Selection and Peer-review under the responsibility of the SIRES Conference Committee.

## 1. INTRODUCTION

Many changes have occurred in various aspects of life due to the COVID-19 pandemic. Prevention efforts to reduce the spread of infection with this disease are carried out in various routine activities, including the learning process in early childhood education up to college. Learning activities that were previously carried out in the classroom have turned into a study room at home by learning online.

Factors that affect a person's ability to survive learning for a long duration consist of internal and external factors. One of the external factors that influence is the availability

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of supporting facilities that make the learning position quite comfortable to carried out. The difference in the availability of learning facilities at home certainly affects how each student's learning position is. This is different from the condition of classrooms on campus that have been provided by the faculty so that all students sit in the same position, adjusted to the available facilities.

This difference in learning positions will have an impact on how the body is positioned at a certain time, adjusting to learning facilities such as tables and chairs at home. Just like a position at work, an inappropriate learning position will put a certain pressure on the body part and become stiff, especially if the body part is not in a physiological position for a long time [1]. The result will certainly cause musculoskeletal complaints and affect body strength to

maintain the body position along the duration of learning. Musculoskeletal complaints that are often felt include muscle aches or stiffness [2].

The current learning system in the medical faculty is generally carried out in small groups with one lecturer acting as a discussion guide [3-6]. The discussion takes about 2-3 hours according to the learning method determined by the faculty. The learning position during this learning period also plays a role in the emergence of musculoskeletal complaints in students, especially if the supporting facilities at home do not allow them to sit in ideal conditions [7- 10].

The aim of this study was to determine the association between sitting position and lower extremity musculoskeletal complaints in medical faculty students during the online learning process in the COVID-19 pandemic.

## 2. MATERIAL AND METHODS

This research is quantitative, descriptive observational, with a cross sectional design. Data collection on musculoskeletal complaints used a Nordic body map questionnaire that had been tested for validity and reliability and was filled out independently. Learning position data retrieval using photos of learning positions provided by respondents and assessed according to the recommended position based on references [11-15].

Subjects were 4<sup>th</sup> grade students at preclinical level of the medical faculty who were registered as still active in the 2020-2021 academic year. The research took place at the medical faculty of the Universitas Islam Bandung, carried out from September 2020 to July 2021.

After given appropriate informed consent, the questionnaire was distributed online via social media or email to all 4<sup>th</sup> grade students at preclinical level. The variables to

be collected including sitting position and lower extremity musculoskeletal complaints. The data obtained are presented in the frequency distribution table for each observed variable and Chi square or Fisher Exact analysis to determine the relationship. Data processing using SPSS 20 software.

### 3. RESULTS AND DISCUSSION

The questionnaire has gone through the process of editing, filling out socialization, and distributing to all 4<sup>th</sup> grade students at preclinical level, totaling 180 people. The completeness of the questionnaires filling, and photos entered was checked and there were 22 respondents with incomplete data, so the total number of respondents were 158 students.



Figure 1: Student sitting positions during study.

On Figure 1 above, we can observe that there are many variations in student sitting positions. General sitting position using a chair, some sitting on the floor with legs straightened and bent.

TABLE 1: Characteristics of respondent based on gender, sitting position and knee angle.

Description	n (%)
Gender Female Male	110 (69,6) 48 (30,4)
Using studying chair Yes No (sitting on the floor)	123 (77,8) 35 (22,2)
Knee angle Not bended (>90°) Bended (<90°)	54 (34,2) 104 (65,8)

The ideal position of the feet when studying is between the torso and thighs forming an angle of 90 degrees, as well as between the thighs and lower legs forming the same angle of 90 degrees. Table 1 showed that most of the students have used the proper study chairs and desks, so that the body posture looks more ergonomic, but there are still 22.2% who sit without using a chair/on the floor. This can occur due to the limitations of supporting facilities at home and in student boarding places. In the current online

learning situation, the condition of the signal received by the computer/laptop may also affect the choice of a place to study, thus allowing the use of improvised facilities in the room with a good signal.

TABLE 2: Musculoskeletal disorder on lower extremities.

Muscle Location	Level of Pain			
	No Pain	Slight Painful	Painful	Very Painful
	n (%)	n (%)	n (%)	n (%)
Buttock	67 (42.4)	48 (30.4)	36 (22.8)	7 (4.4)
Lower Buttock	76 (48.1)	55 (34.8)	20 (12.7)	7 (4.4)
Left Thigh	132 (83.5)	18 (11.4)	8 (5.1)	0 (0)
Right Thigh	130 (82.3)	20 (12.7)	8 (5.1)	0 (0)
Left Knee	125 (79.1)	27 (17.1)	5 (3.2)	1 (0.6)
Right Knee	122 (77.2)	32 (20.3)	3 (1.9)	1 (0.6)
Left Calf	136 (86.1)	20 (12.7)	1 (0.6)	1 (0.6)
Right Calf	136 (86.1)	20 (12.7)	1 (0.6)	1 (0.6)
Left Ankle	133 (84.2)	20 (12.7)	5 (3.2)	0 (0)
Right Ankle	137 (86.7)	16 (10.1)	5 (3.2)	0 (0)
Left FOOT	138 (87.3)	17 (10.8)	3 (1.9)	0 (0)
Right foot	138 (87.3)	15 (9.5)	5 (3.2)	0 (0)

Table 2 above showed that pain complaints with various levels were mostly felt by students. The body parts that most students complained about (>50%) were in the waist, back, upper neck, lower neck, buttocks, and lower buttocks area. This is possible because the average online learning time is at least 2 hours, so that the static position for a long duration causes stiffness in the muscles and causes pain complaints. In addition, the absence of stretching time in between online learning can also be one of the factors that causes frequent complaints in the area.

Based on the table above, it can be concluded that there is a significant association between sitting position and musculoskeletal complaints in the knee, calf, and left and right ankle areas. Respondents who sat on the floor complained more about pain in these three areas. This is in accordance with the theory which states that sitting cross-legged on the floor causes pressure in that area, thus affecting blood flow. In learning activities, the duration of the sitting position on the floor can last a long time, more than 30 minutes, so that pain complaints are felt.

TABLE 3: Association between sitting position and complaints in buttock area.

Area	Sitting position Using chair	Sitting on the floor	No Pain	Slight Painful	Painful	Very Painful	p-value
			n (%)	n (%)	n (%)	n (%)	
Buttock	Sitting position Using chair	Sitting on the floor	53 (43.1)	37 (30.1)	29 (23.6)	4 (3.3)	0,622
			14 (40)	11 (31,4)	7 (20)	3 (8,6)	
Lower buttock	Sitting position Using chair	Sitting on the floor	62 (50.4)	42 (34,1)	15 (12,2)	4 (3,3)	0,420
			14 (40)	13 (37,1)	5 (14,3)	3 (8,6)	
Left thigh	Sitting position Using chair	Sitting on the floor	106 (86.2)	13 (10,6)	4 (3,3)	4 (0)	0,093
			26 (74.3)	5 (14,3)	(11,4)	(0)	
Right thigh	Sitting position Using chair	Sitting on the floor	104 (84.6)	15 (12,2)	4 (3,3)	4 (0)	0,142
			26 (74.3)	15 (14,3)	(11,4)	(0)	
Left knee	Sitting position Using chair	Sitting on the floor	106 (86.2)	14 (11,4)	3 (2,4)	2 (0)	<0,001*
			19 (54.3)	13 (37,1)	(5,7)	(2,9)	
Right knee	Sitting position Using chair	Sitting on the floor	103 (83.7)	19 (15,4)	1 (0,8)	2 (0)	<0,001*
			19 (54.3)	13 (37,1)	(5,7)	(2,9)	
Left calf	Sitting position Using chair	Sitting on the floor	111 (90.2)	12 (9,8)	8 (0)	1 (0)	0,005*
			25 (71.4)	(22,9)	(2,9)	(2,9)	
Right calf	Sitting position Using chair	Sitting on the floor	111 (90.2)	12 (9,8)	8 (0)	1 (0)	0,005*
			25 (71.4)	(22,9)	(2,9)	(2,9)	
Left ankle	Sitting position Using chair	Sitting on the floor	112 (91.1)	10 (8,1)	10 (0,8)	4 (0)	<0,001*
			(60)	(28,6)	(11,4)	(0)	
Right ankle	Sitting position Using chair	Sitting on the floor	116 (94.3)	6 (4,9)	10 (0,8)	4 (0)	<0,001*
			21 (60)	(28,6)	(11,4)	(0)	
Left foot	Sitting position Using chair	Sitting on the floor	111 (90.2)	11 (8,9)	16 (0,8)	2 (0)	0,056
			27 (77.1)	(17,1)	(5,7)	(0)	
Right foot	Sitting position Using chair	Sitting on the floor	110 (89.4)	10 (8,1)	5 (3 (2,4)	2 (0)	0,243
			28 (80)	(14,3)	(5,7)	(0)	

## 4. CONCLUSION

There was a significant relationship between sitting position and musculoskeletal disorder in the knee, calf, and left and right ankle areas.

## 5. CONFLICT OF INTEREST

There is no conflict of interest in all the research process.

## ACKNOWLEDGEMENT

We would like to thank the Institute for Research and Community Service (LPPM) of the Universitas Islam Bandung for funding this research. Thank you also to all students who are willing to be respondents.

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