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To Compare the Effect of Musculoskeletal Discomfort in Undergraduate Students Using Hard Benches and Cushioned-Based Benches

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ABSTRACT:

Background: Prolonged static and sitting in poorly designed furniture may increase Musculoskeletal Disorders. Therefore, the research purposes were to examine the prevalence and severity of musculoskeletal problems among the undergraduates in different parts of body using hard or cushioned benches. A total of 300 university students voluntarily participated in this survey. A Questionnaire was used to find out which type of bench caused the most musculoskeletal discomfort. Different kinds of pain, strain and postural defect were noticed. Moreover, female participants were more affected than male participant in musculoskeletal problems. This study will not only help the students to identify the problem but will create an awareness among the individuals about the correct posture while sitting. They can also help the college or institutions to understand the student's perspective about bringing a change in the infrastructure of the benches.
Methodology: A survey was conducted by circulating google forms to determine the posture related musculoskeletal discomfort in undergraduate students using hard and cushioned-based bench, ranging in age 18-24 years with a sample size 300 participants. Participants from first to final year of the institute are included in the survey.
Result: From 300 participants 241 participants responded through google form While others did not respond due to various reasons. Out of the 20 questions, 32.4% (78 participants) showed severe discomfort, 48.1% (116 participants) showed moderate discomfort whereas 19.5% (47 participants) showed mild discomfort.
Conclusion: According to the data analysis, majority students using hard bench and soft cushioned-based benches have showed posture related musculoskeletal discomfort.

Keywords: *Posture, Musculoskeletal discomfort, type of bench*

1. Introduction

Body posture refers to the position of a person's body in space, the alignment of body parts in relationship to one another and to the environment at one point in time, and is influenced by each of the body's joints [1]. Postural control refers to building up posture against gravity and ensuring that balance is maintained. It enables postural stabilization during voluntary movements and recovery of balance after disturbance [1]. Postural control also constructs a reference frame for proprioception, i.e. the perception of joint angles and muscle tensions, of movement, balance and posture [1]. Postural awareness, as we define it here, is the subjective conscious awareness of body posture that is mainly based on proprioceptive feedback from the body periphery to the central nervous system.

Children spend one-quarter of a day in school and colleges. Of this, 60–80% of time is spent in the classroom. Classroom features, such as workspace and personal space play an important role in children's growth and performance as this age marks the period of anatomical, physiological and psychological developments. [3]

Most of interventions aims to improve posture and postural control in patients with chronic musculoskeletal pain [1] based on the long-held notion that 'bad' posture and 'poor' postural control are major contributors to pain conditions, particularly to back and neck pain [1]. Previous research has indeed shown associations between spinal pain and posture, especially around chronic low back pain. Studies found that patients with chronic low back pain show altered muscle activation patterns of trunk muscles [1], leading to decreased trunk movement [1], trunk stiffening [1], and postural instability [1], with those changes being overall 0indi11.cative of dysfunctional postural control strategies [1]. Studies also showed decreased proprioceptive acuity, i.e. patients with low back and neck pain have less accurate and precise positions sense [1], which indicates lower postural awareness in these patients. On the other hand, epidemiological studies not always support the notion that musculoskeletal pain is associated with body posture [1].

Efficiency of a person depends strongly on the fact that how comfortable a person is with the work environment and also the suitability of workstation with the user. Colleges are the places from where we get qualified and talented graduates which then help in building the nations. Therefore, it is very important to make the classrooms in colleges comfortable and suitable for students, so that they can concentrate and evolve as talented individuals. A comfortable classroom environment improves the efficiency of students by encouraging and motivating them to perform better. Students spend a major time on the chair and desk during college hours, hence it is necessary that the college furniture should fit the requirements of the students[5].

While the links between posture and pain are highly complex and controversially discussed, studies have shown that improving habitual postural patterns might lead to improvements in musculoskeletal pain conditions and prevent further deterioration [1]. Although numerous objective instrument-based measures of posture exist [1], these can hardly be utilized outside of a laboratory setting and mostly measure posture under artificial conditions. To assess variations in everyday postural awareness without technical devices, self-report measures may be feasible, predictive of clinical changes and helpful as additional clinical and research tools. As, to our knowledge, no questionnaire currently exists to measure subjective postural awareness, this study aimed to develop and evaluate the musculoskeletal discomfort by a questionnaire. A second aim was to assess associations of pain intensity and pain-related variables with postural awareness. Finally, the study aimed to assess associations of postural awareness with theoretically related instruments for measures of body awareness, body image and mindfulness.

Using furniture that promotes proper posture is more important to children than adults because it is at this young age that sitting habits are formed. Bad sitting habits acquired

in childhood are very difficult to change later in adolescence or adulthood [2].
Education is a process intended to improve human capacity and potential. Comfortable facilities are an urgent need in classrooms because discomfort may disrupt educational activities and negatively affect students' health conditions. Given this requirement, classroom spaces and the physical elements that constitute a learning environment (e.g., furniture, equipment) have become a crucial concern for designers. Two of the classroom facilities that require improvement are seats and desks. The purpose of the classroom furniture is to facilitate students learning activities. Thus, ergonomically designed classroom furniture makes study comfortable through eliminating physical impediments, more or less, in some extents, to leverage the students to concentrate on the day's lesson. On an average, student spends a quarter of the day at school and 80% of the school time is mostly in the sitting position. So, ergonomically precise sitting posture is important factor for the students.[4] Correct standing and sitting posture is an important factor for the prevention of musculoskeletal symptoms [2]. Static posture and prolonged sitting in a forward bending position, as students often acquire, puts an extreme physiological strain on the muscles, the ligaments and in particular on the discs [2]. Correct standing and sitting posture is an important factor for the prevention of musculoskeletal symptoms [2]. Symptoms resulting from continual inconvenient sitting on non-standard furniture in the classroom had been previously reported kidney and alimentary problems [2], lumbar pains [2]. Changes in the passive flexion stiffness of the lumbar spine may increase the risk of low back injury after prolonged sitting and may contribute to low back pain in sitting [2]. The data indicate a mismatch between the students' bodily dimensions and the classroom furniture available to them. The chairs are too high and too deep and desks are also too high for the pupils. This situation has negative effects on the sitting posture of the children especially when reading and writing [2].

2. Need For The Study

Scholars have reported FHP (Force Health Protection) the prevalence of musculoskeletal defect ranging from 52% to 68% among adolescents. It was observed that there were very few studies related to posture related musculoskeletal defects related to different types of benches. In the recent years, it is seen that the prevalence of posture related musculoskeletal discomfort is increasing gradually in the undergraduate students due to the structure of the benches. It has been observed that students spend sitting on the benches for the majority of time during their college hours which plays a major role in affecting their posture. Also, incorrect posture can lead to various postural defects in the body. This study will focus on which type of bench leads to more postural defects. This study will not only help the students to identify the problem but will create an awareness among the individuals about the correct posture while sitting. They can also help the college or institutions to understand the student's perspective about bringing a change in the infrastructure of the benches and this might serve as a way to improve overall student-teacher relationship.

3. Aims and Objectives of the Study

➢ Aim

- To assess the prevalence of posture related Musculoskeletal discomfort in university students sitting on hard benches and soft cushioned benches.

➢ Objective of the Study

- To survey the posture related musculoskeletal discomfort in undergraduate students sitting on a hard benches and soft cushioned-based benches.

4. Methodology

1. **Source of Data –** The sample will be collected from various undergraduate students from various institutions.
2. **Study setting –** The survey will be recorded based on e-surveys through online via a questionnaire
3. **Duration of study –** Study duration was 6 months
4. **Method of Data Collection –** Data was primarily collected by principal investigator.
5. **Study Design –** Cross-sectional
6. **Study Type –** Descriptive
7. **Sample size** – Sample size for this study was 300 participants.
8. **Target Population –** 18 to 24 years
9. **Sampling method –** convenient sampling
10. **Tools:** Laptop, Mobile phone
11. **Equipment's to be used:** self-formed online questionnaire with open ended questions.
12. **Selection criteria:**

➢ **Inclusion criteria:**

- Medical students from first to final year
- Age in between 18 to 24 years
- Both gender male and female included

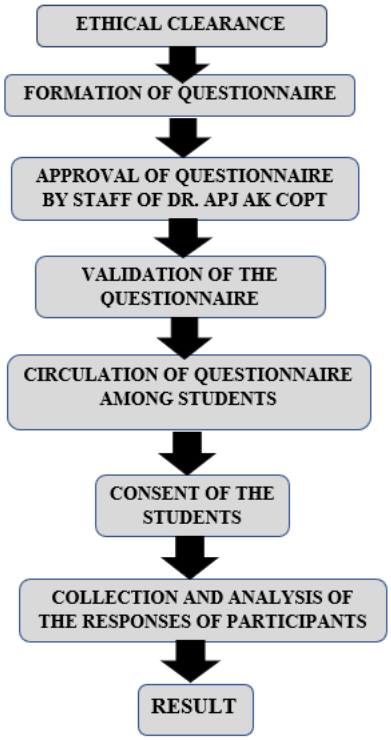
➢ **Exclusion criteria:**

- People who are not ready to provide informed consent.
- Those who are not comfortable in English language.
- Those who did not responded within study period.

13. **Outcome measures**: Posture Related Musculoskeletal Discomfort Questionnaire (PRMD)

5. Procedure

For this study a sample size of 300 undergraduate students was chosen. After the ethical approval (Registration number – Dr. APJAKCOPT/BPT/UG/2023/41), a google form was formed and Students were asked to participate in the survey. Out of 300, 241 subjects responded within the stimulated time frame. Data was collected in a period of 3 months using an e-survey (https://forms.gle/anWg2sjgpY95rMSj7) distributed using social networking platform (whatsapp, Instagram). This survey consisted of 20 questions framed by the investigator. The questionnaire used was first validated by the researchers at Pravara Institute of Medical Sciences. A consent was taken during the questionnaire about agreement for participation prior to the main 20 questionnaire. The data collected was arranged in pie chart format. The schematic design of the questionnaire has been mentioned in figures below. The data collected was arranged in tabular format. The musculoskeletal discomfort between hard benches and soft cushioned-based benches was compared. Also, information was requested regarding which type of bench was used by 241 participants which affects most frequently in different parts of body. The entire data was configured via percentage and pictorial presentation. The data was summarized augmenting the formation of conclusion.



6. Data Analysis and Results

Demographic details

1] Count of Gender

The total number of participants were 300, out of which 241 responses were received and others did not respond within the stimulated time due to various reasons. 42.7% were males and 56.8% were female.

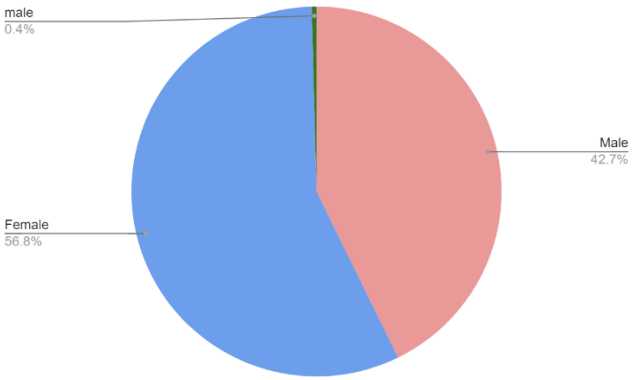


Figure 1: Count of Gender

2] Age group

Similarly the mean value for the age group is 21.

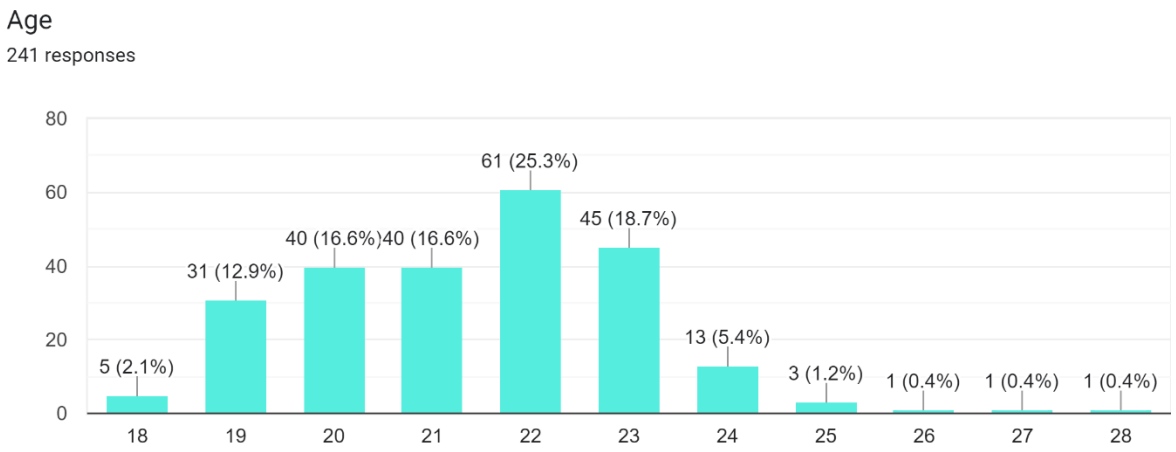


Figure 2: Mean of age group

3] Distribution of students the type of bench they use

The total number of participants were 241, out of which 61.8% (149 individuals) use hard benches and 38.2% (92 participants) use soft cushioned-based bench.

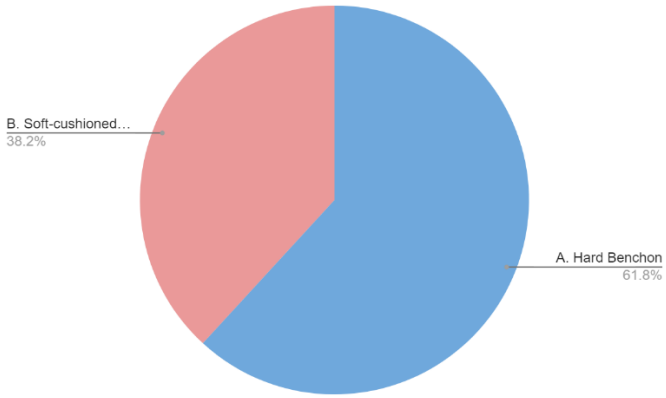


Figure 1: Distribution of participants on the type of bench they use

4] Severity of Musculoskeletal discomfort using the different type of benches

A total of 300 individuals were invited to participate in the survey, 241 individuals(n=241) responded within the stipulated time while others did not wish to participate. Out of which, 34.2% (78 participants) showed severe discomfort, 48.1% (116 participants) showed moderate discomfort and 19.5% (78 participants) showed mild discomfort using both hard and cushioned-based benches.

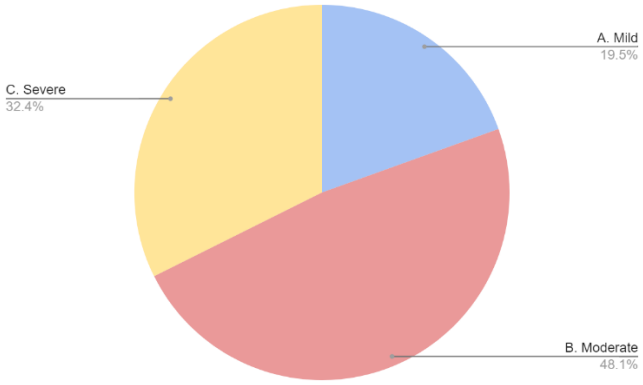


Figure 2: Severity of Musculoskeletal Discomfort

5] Discomfort due to the structure of bench

Similarly, the discomfort caused due to the structure of the bench are 4.6% always, 26.1% often and 41.1% sometimes.

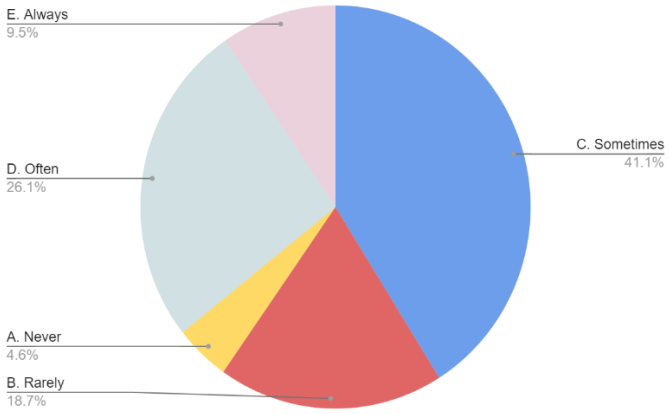


Figure 3: Discomfort due the structure of the bench

7. Results

6] Stiffness while sitting due to the bench surface

When comparing both type of benches, 241 participants who participated, reported more stiffness while sitting due to the respective bench they use. Out of 241, 13.3% (32 participants) showed discomfort always and 27% (65 participants) showed discomfort often and 38.2% (92 participants) showed discomfort sometimes using both hard and cushioned-based benches.

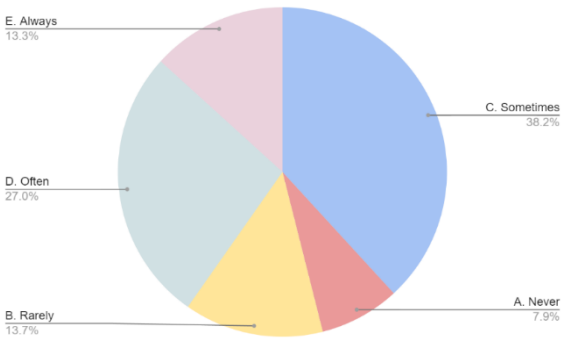


Figure 5: stiffness while sitting due to the bench surface

7] Feeling of numbness / tingling sensation in ower limbs or buttcoks

Other factor after stiffnes which reported the maximum percentage was feeling of numbness or tingling sensation in lower limbs or buttocks dueto the type of bench they use. 36.5% (88 participants) 17% (41particpants) often have this feeling compared to 17% (18 participants) who always face this dicomfort.

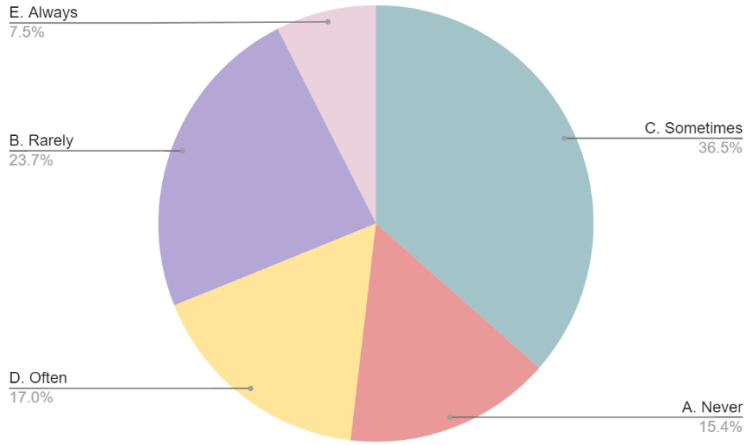


Figure 6: Feeling of numbness/ tingling sensation in lower limbs or buttocks

8] Coccydynia pain

Another factor, coccydynia reported major discofort factor. 5.8% (14 participants) showed discomfort always and 19.9% (48 participants) showed discomfort often and 30.7% (74 participants) showed discomfort sometimes using both hard and cushioned-based benches.

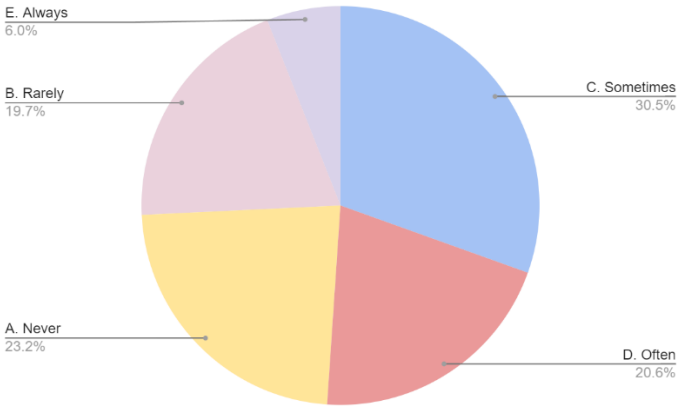


Figure 7: Coccydynia pain

9] Neck pain

Neck pain reported similar discomfort in individuals using hard and cushioned-based benches. 10.4% (25 participants) showed discomfort always and 31.1% (75 participants) showed discomfort often and 36.1% (87 participants) showed discomfort sometimes using both hard and cushioned-based benches.

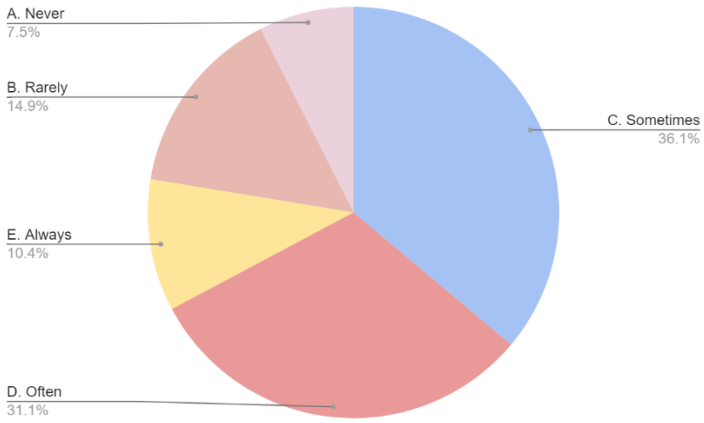


Figure 8: Neck pain due to bench height

10] Strain in lower back

Lower back is mostly involved while side bending or twisting movements. 13.7% (33 participants) showed discomfort always and 27.8% (67 participants) showed discomfort often and 32.4% (78 participants) showed discomfort sometimes using both hard and cushioned-based benches.

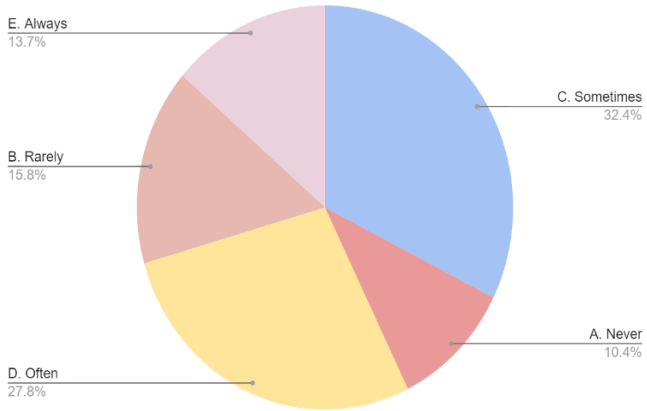


Figure 9: Strain in lower Back while side bending or twisting actions

11] Support to upper back

As per reports of undergraduates 32.4% (78 participants) have back support sometimes, 26.6% (64 participants) often have a back support.

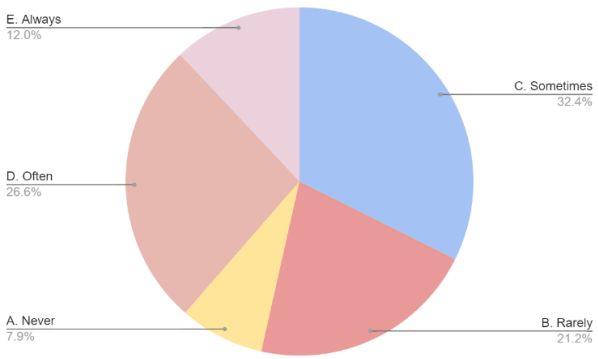


Figure 10: Support to Upper back

12] Comfort while reading or writing

According to the undergraduates 27.8% (67 participants) often feel comfortable while reading or writing.

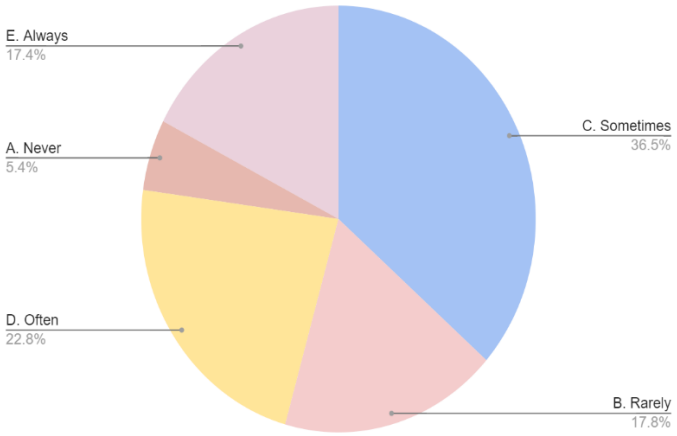


Figure 11: Comfort while writing or reading using their type of bench

13] Distance between the desk and the bench comfortable

According to the survey 19.9% (48 participants) always feel comfortable with the distance between the desk and bench comfortable.

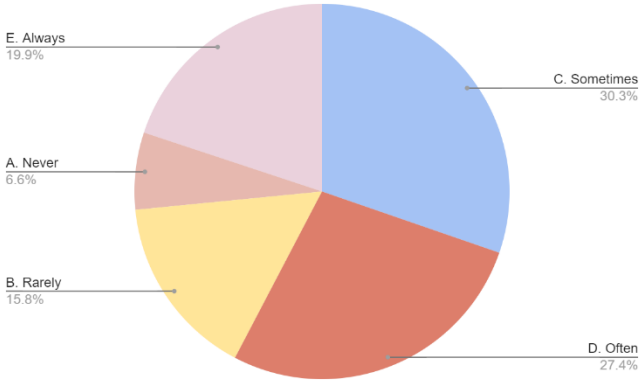


Figure 12: Distance between the desk and the bench comfortable

14] Effort required while getting up from the bench

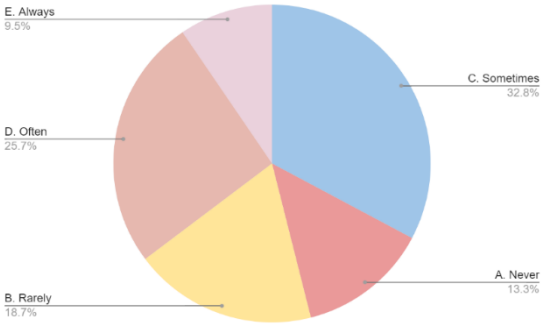


Figure 13: Effort required while getting up from bench

25.7% (62 participants) often need effort while getting up from the bench, whereas 9.5% (23 participants) always need efforts.

15] Discomfort while resting hands on table

30.7% sometimes feel discomfort while resting hand on table, 22% often have this feeling, while 18.7% always have this feeling.

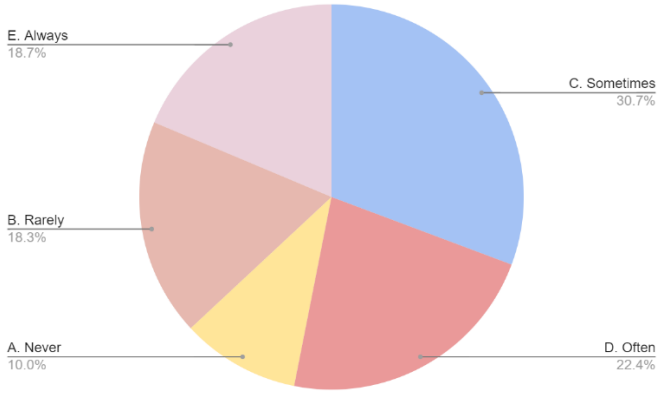


Figure 14: Discomfort while resting hand on table

16] Shoulders get elevated while writing on the desk

Students survey also reported that while writing on the desk shoulder gets elevated. 10.4% (25 participants) showed discomfort always and 24.5% (59 participants) showed discomfort often and 38.2% (92 participants) showed discomfort sometimes using both hard and cushioned-based benches.

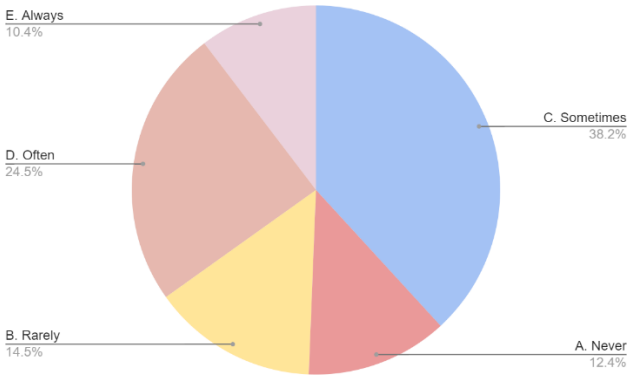


Figure 15: shoulders get elevated while writing on the desk

8. Discussion

The current study was conducted on the musculoskeletal discomfort in undergraduate students using hard benches and cushioned-based benches. Undergraduate students often sit on the benches due to which they are at a risk of musculoskeletal discomfort which leads to neck pain, lower back pain, stiffness in the body, tingling or numbness in lower limbs or buttocks. This affects the strength, mobility and flexibility of human body. This finding underscores the importance of addressing ergonomic factors in educational settings to promote student comfort and well-being.

One notable result is that a considerable percentage of participants reported discomfort always or often while using both hard and cushioned-based benches. This suggests that the type of bench alone may not be sufficient in alleviating musculoskeletal discomfort among students. Other factors, such as bench design, individual posture habits, and duration of sitting, may also play a significant role in contributing to discomfort.
According to the inclusion criteria participants from age 18 to 23 were included and were categorized according to which type of bench they use. The use of hard benches was observed to be greater than that of soft cushioned-based benches in undergraduate students as reported by 241 participants of this study while others did not wish to participate out of 300, which included 56.8% female and 42.7% male. The average age in this survey was 21. The current study's results reinforce the fact that poor body posture can contribute towards the development of postural discomfort as indicated by existing evidence. As per the survey reports, 78 participants showed severe discomfort and 116 participants showed moderate discomfort. Gender related difference was observed like the existing evidence showing female gender to be a risk.

While these findings provide valuable insights into the prevalence of musculoskeletal discomfort among undergraduate students, several limitations should be considered. Firstly, the study relied on self-reported data, which may be subject to recall bias and subjective interpretation. Additionally, the study sample consisted of undergraduate students from a specific demographic, limiting the generalizability of the findings to other populations.
Jolyn Ee, Sharon Parry, the study provides valuable insights into the effects of standing desk interventions on children's behaviour and musculoskeletal health in the classroom. While standing desks effectively increase standing time and reduce sitting time during school hours, their overall impact on daily physical activity levels outside of school remains limited. However, standing desks offer potential benefits in terms of reducing musculoskeletal discomfort among students. Schools should consider incorporating standing desks into classroom design to promote a more active and ergonomic learning environment, potentially improving the long-term health outcomes of children.[15]

In a study by Bruna Xavier Morais, the study aimed to investigate the prevalence and factors associated with musculoskeletal pain among undergraduate health students in a university in southern Brazil. The findings revealed a significant prevalence of musculoskeletal pain among the participants, with the region of the vertebral column showing the highest prevalence at 74.9%. The urgent need for preventive strategies to address the high prevalence of musculoskeletal pain among undergraduate health students within the academic setting.
Indri Hapsari Susilowati conducted a study at Universitas Indonesia during the COVID-19 pandemic, aimed to assess the extent of gadget use and associated musculoskeletal complaints among the university community during the work-from-home (WFH) period. A cross-sectional survey was conducted using an online-based questionnaire, with a total of 1083 respondents including lecturers, students, and managerial staff from various faculties and administrative centres. The study identified common postures adopted during gadget use, such as reclining on a sofa or mattress for 1-3 hours, and sitting at a table for less than 30 minutes among tablet users. These findings underscore the importance of ergonomic practices, such as stretching, limiting usage time, taking regular breaks, and maintaining proper posture, to mitigate musculoskeletal discomfort associated with prolonged gadget use. [11]
Michael O. Ogunlana and others conducted a study. The findings reveal that a significant portion of the student population experiences MSP, with females comprising the majority. The study also highlights the association between poor ergonomic conditions and MSP. By utilizing descriptive statistics, chi-square, and logistic regression, the research sheds light on the impact

of ergonomic hazards on students' musculoskeletal health. These findings underscore the importance of addressing ergonomic factors in educational environments to mitigate MSP among students pursuing healthcare-related professions. (6)
Forouzan Rezapur-Shahkolai and others conducted a study. This study investigates factors related to musculoskeletal behaviours, specifically sitting postures and backpack carrying, among Iranian schoolchildren, using Health Promotion Models. Through a cross-sectional survey involving 673 students from elementary schools in Hamadan, Iran, the study identifies significant associations between various factors and these behaviours. The findings indicate that predisposing factors such as perceived susceptibility, perceived severity, perceived barriers, and perceived self-efficacy, as well as enabling and reinforcing factors, play crucial roles in shaping sitting postures and backpack carrying behaviours among students. The study underscores the importance of considering musculoskeletal health factors in designing future preventive programs for children and adolescents. By addressing these factors, such programs can effectively promote healthier behaviours and reduce the risk of musculoskeletal pain among young individuals.

In another study, Philippe Gorce, Julien Jacquier-Bret, this study sheds light on the prevalence of musculoskeletal disorders (MSDs) among university students due to smartphone use, emphasizing the importance of understanding usage patterns and associated postures. The findings indicate that prolonged smartphone use, especially during the evening, is common among students, with texting and video watching being the primary activities. Different postures, including sitting, standing, and lying, are adopted throughout the day, with reclining postures during evening smartphone use posing a significant risk of MSDs. These results underscore the urgent need for interventions aimed at promoting musculoskeletal health among smartphone users, particularly students. Education on proper ergonomic practices and encouraging breaks from prolonged smartphone use, especially in reclined positions, are essential for mitigating the risk of MSDs. By addressing usage patterns and promoting healthier habits, such interventions can contribute to the overall well-being of young smartphone users and reduce the incidence of MSDs in this population.

9. Conclusion

The present survey demonstrated the musculoskeletal discomfort in undergraduate students using hard benches and soft cushioned-based benches. 241 participants enrolled in this study. They filled out a 20-question questionnaire and the results were analysed. Results revealed that 32.4% (78 participants) showed severe discomfort, 48.1% (116 participants) showed moderate discomfort whereas 19.5% (47 participants) showed mild discomfort. Majority participants demonstrated the use of hard benches by undergraduates more than that of soft cushioned-based benches. The results showed maximum musculoskeletal discomfort in neck, stiffness in the body and lower limb. Study indicates that hard benches caused more musculoskeletal discomfort. To prevent posture related any discomfort students avoiding prolonged static position, one should perform stretching exercises frequently.

Strengths
- This was first kind of a kind of study in this specific geographical area.
- Responses was taken in form of questionnaire which authenticates the response.

Limitations
- The participants were not distributed equally according to gender.
- Participants were only from one institution.

- The sample size was limited.

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