



Assessment of Musculoskeletal Disorders in College Students Using Backpacks

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Abstract:

Background -

Backpack use has been found to be a common cause of musculoskeletal disorders (MSDs) in college students, cited as the main factor for prolonged static postures and ineffective carriage of loads. These conditions result in pain and impairment in function, highlighting the necessity of exploring the relationship between backpack usage practices and MSDs in this group.

Method -

The study was a cross-sectional one with 100 college students (50 men and 50 women) aged 18–30 years, sampled using convenience sampling. Data collection used the Modified Nordic Musculoskeletal Questionnaire, as well as structured demographic and backpack usage questionnaires, to ascertain the prevalence, body regions affected, and patterns of musculoskeletal symptoms.

Result -

The investigation showed a high incidence of MSDs, where 64% of the students reported musculoskeletal pain in the previous year. The most frequently affected areas were the neck (67.2%), shoulders (62.5%), and lower back (45.3%). Despite 65.6% of the students wearing backpacks on both shoulders, a significant number weighed more than recommended and viewed their backpacks as heavy. Symptom duration was generally short (1–7 days), but in some instances, symptoms caused disturbance during daily activities and needed medical consultation.

Conclusion -

The results indicate the high prevalence of musculoskeletal complaints related to backpack use among college students. There is a definite need for ergonomic education and following guidelines for backpack weight and carrying behavior. Preventive interventions and awareness in academic and rehabilitation environments are necessary to reduce the risk of MSDs associated with student backpack use.

Index terms: Musculoskeletal Disorders, College Students, Ergonomics

I. Introduction:

Musculoskeletal disorders (MSDs) are a growing issue among college students, and the causes are mainly lifestyle-related, such as sustained static posture, poor ergonomic habits, and daily load carrying. Backpacks are one of the most common causes of musculoskeletal loading in this population. Backpacks are comparatively more ergonomic than shoulder bags or handbags, but are only as good as their wear and load [1][2].

The spine is anatomically constructed to support vertically aligned, midline symmetrical loads. When used properly, high on the back and across both shoulders, they serve to maintain alignment and distribute forces evenly, with little localised loading of the musculoskeletal system [2]. Throwing the backpack over one shoulder or carrying too heavy a pack eliminates these benefits and serves to induce musculoskeletal strain [2].

Biomechanical research has indicated that, in comparison to handbags and shoulder bags, backpacks impose smaller muscle forces of requirement and cause lower intervertebral compressive force (ICF), shear force (ISF), and disc pressure to carry the same load. Furthermore, stress imposed on intervertebral discs by backpacks is linearly dependent on load, while handbag stress is exponentially dependent, making backpacks safer for everyday scholarly usage when used correctly [2].

Despite these ergonomic advantages, it has been proven through research that if the load of the backpack exceeds 15% of the body weight of a student, it enhances musculoskeletal discomfort and spinal alteration to a very large degree. These risks include shoulder elevation, forward head posture, and thoracic kyphosis, particularly when the weight is worn for long periods of time [3][4].

Gender-based differences have also been identified, with a greater number of females reporting both an increase in the incidence and severity of musculoskeletal symptoms. This may be attributable to reduced muscle mass in the lower body, variations in skeletal frames, and sometimes fashion-influenced choice in the selection and use of backpacks [3][5][6].

Thai students in a cross-sectional analysis had backpacks over 15% of body weight, which was found to be significantly associated with neck, shoulder, and lower back pain, with females experiencing more discomfort than men [5]. These findings are supported by similar results in both Western and Eastern populations consistently identifying unbalanced or overweight bags with chronic pain symptoms in the lower back and shoulder areas [1][6].

A number of interrelated factors have been shown to cause musculoskeletal pain in students who use the use of backpacks. A cross-sectional study among schoolchildren in Lalitpur, Nepal, revealed that the majority of students experienced musculoskeletal discomfort, with shoulders, neck, lower back, and upper back being the most affected areas. Relative load magnitude of the pack to body weight, time of carriage, and heaviness perceived of the load were found to be major predictors of discomfort and fatigue. Students wearing packs heavier than the standard weight had greater chances for physical distress, travel fatigue, and adjustments of posture such as forward or lateral bending. Age, sex, and grade level were also found to be contributing factors, with students of older age and girls reporting more frequently. Further, subjective ratings of the pack as being heavy were also a significant contributing factor to the symptom report. The physical strain of heavy packs impacted numerous facets of daily life, including concentration on school work, household tasks, sleep quality, and participation in physical activity. A large proportion of students reported that they stayed away from school or consulted a physician due to pain. These findings highlight the etiologic diversity of backpack musculoskeletal disorders and necessitate increased awareness and prevention, e.g., education in the ergonomic carrying of load and implementation of the schoolbag weight limits [7].

To quantify and assess the prevalence of musculoskeletal disorders among students, the Nordic Musculoskeletal Questionnaire (NMQ) is widely applied. It is a validated and consistent questionnaire that has been linked with great internal consistency (Cronbach's $\alpha > 0.945$) and good sensitivity and specificity (both $> 85\%$) and therefore can be applied in studies in academic and occupational health [8].

II. Methodology:

This cross-sectional study was conducted among college students to assess musculoskeletal disorders associated with backpack use. A total of 100 participants (50 males and 50 females) aged 18–30 years were recruited through convenience sampling. Data collection involved the use of a structured questionnaire comprising demographic details and backpack usage characteristics, along with the Modified Nordic Musculoskeletal Questionnaire (NMQ) to evaluate musculoskeletal symptoms in nine body regions. All the participants gave informed consent. The data were analysed through the use of descriptive statistical techniques to ascertain the prevalence and trends of musculoskeletal conditions associated with backpack use in students. All the necessary measures to ensure confidentiality and ethical standards were maintained during the research process.

III. Results:

Demographics

Age:-

The age of the participants ranged from 18 to 30 years, with the highest concentration of respondents being 22 years of age (23%), followed by those aged 19 (19%) and 24 (17%).

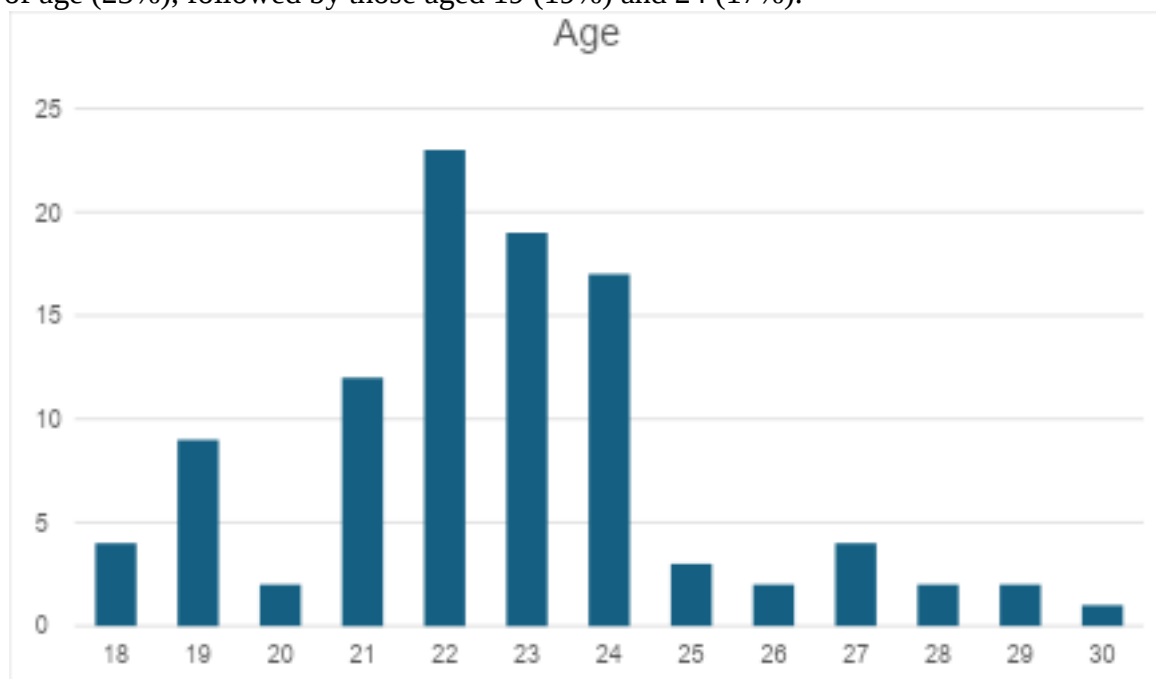


Table 1: Age Distribution of Participants

Age	Frequency
18	4
19	9
20	2
21	12
22	23
23	19
24	17
25	3
26	2
27	4
28	2
29	2
30	1

Gender-:

The study cohort of 100 participants was where 50% were Male and 50% were Female

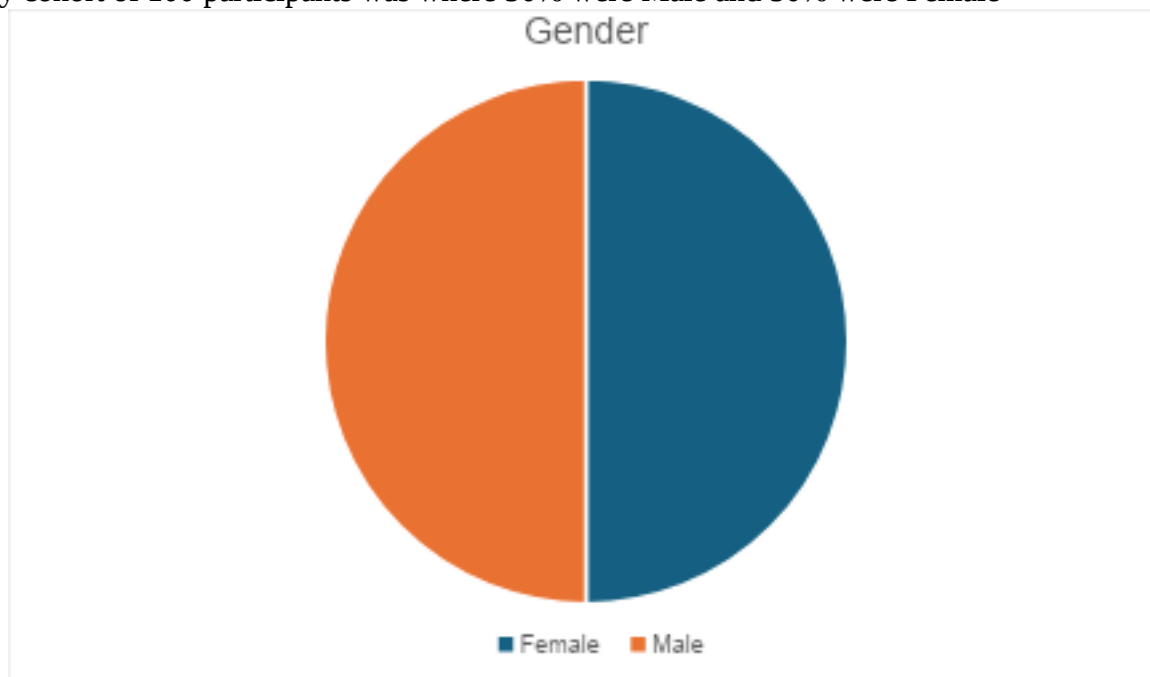


Table 2: Gender Distribution

Gender	Frequency	Percentage
Male	50	50%
Female	50	50%
Total	100	100%

Dominance-:

In terms of physiological characteristics, a significant majority of the participants (91%) reported being right-hand dominant.

4. Dominance

100 responses

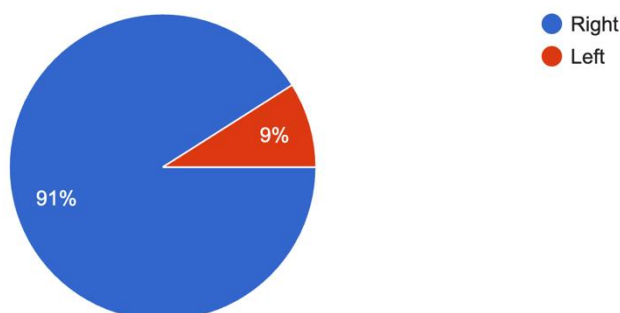


Table 3: Dominant Hand

Dominance	Percentage
Right hand	91%
Left hand	9%

A notable finding from the preliminary screening was that 64% of the 100 respondents affirmed that they experience some form of pain.

5. Do you have pain?

100 responses

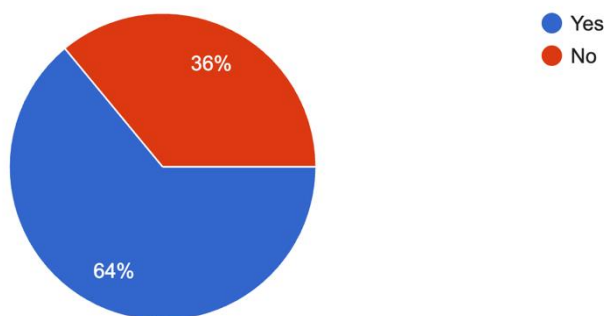


Table 4: Reported Pain

Pain Response	Percentage
Yes	64%
No	36%

Characteristics of backpack use

The predominant mode of transportation to college was public transport, utilised by 73.4% of the students. A smaller proportion of students commuted by walking (15.6%) or private transport (10.9%).

1. Mode of Transport

64 responses

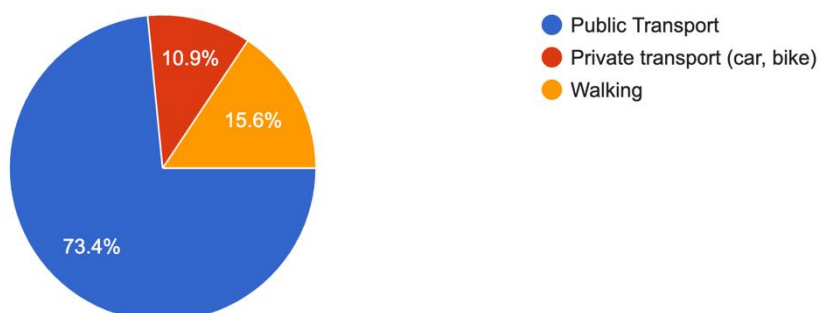


Table 5: Mode of Transport to College

Mode of transport	Percentage
Public Transport	73.4%
Private Transport (car, bike)	10.9%
Walking	15.6%

A substantial majority of the students (67.2%) carried their backpacks for continuous durations exceeding 15 minutes.

2. Duration: for how long do you carry your backpack

64 responses

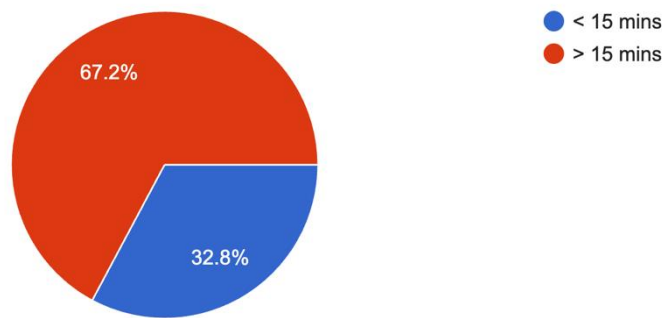


Table 6: Duration of Backpack Use

Backpack Wearing Duration	Percentage
< 15mins	67.2%
> 15mins	32.8%

The most common method of carrying the backpack was on both shoulders, as reported by 65.6% of respondents. A smaller group, 17.2%, reported a preference for carrying their backpack on the right shoulder, while 9.4% reported alternating between shoulders.

3. Which side you carry backpack

64 responses

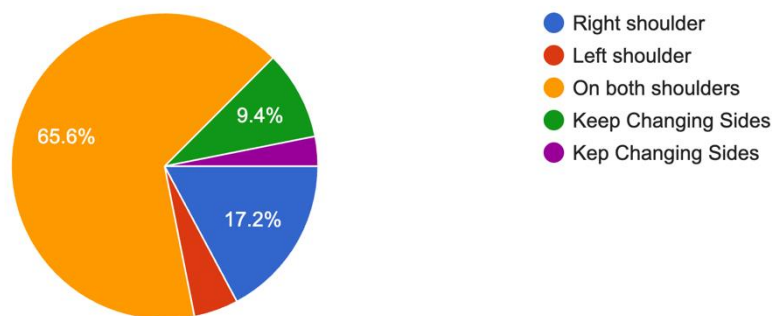


Table 7: Backpack Carrying Style

Method of Carrying Backpack	Percentage
Both Shoulders	65.6%
Only on Right Shoulder	17.2%
Only on Left Shoulder	3.1%
Alternate Shoulder	14.1%

In terms of load, 53.1% of students reported their backpack weight to be in the range of 3 to 5 kg, while 43.8% carried a lighter load of 0 to 2 kg. Despite the measured weight, a significant 68.8% of these students perceived their backpacks to be "heavy".

4. Approximate weight of your bag

64 responses

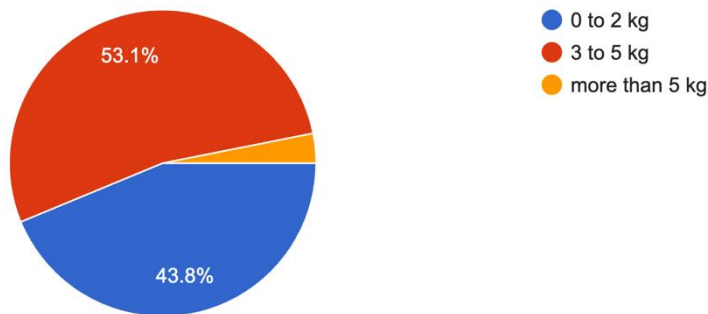


Table 8: Measured Backpack Weight

Weight Range	Percentage
0-2 kg	43.8%
3-5 kg	53.1%
>5kg	3.1%

5. Perceived Weight of Backpack

64 responses

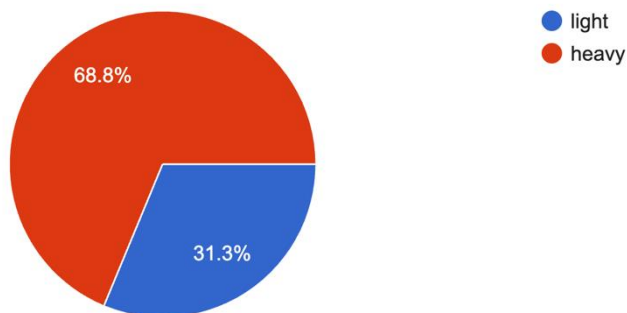


Table 9 -: Perceived Weight of Backpack

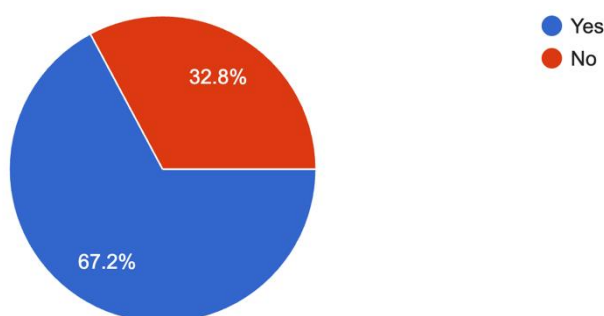
Perceived Weight of Bag	Percentage
Light	31.3%
Heavy	68.8%

MODIFIED NORDIC QUESTIONNAIRE**1. NECK**

The neck was the most frequently reported site of discomfort, with 67.2% of respondents experiencing trouble in the last 12 months. Among those with neck trouble (n=43), a high percentage (86%) stated it had impeded their normal daily activities, and 88.4% had experienced symptoms within the last 7 days. The discomfort was typically transient, lasting 1-7 days for 79.1% of this group. Medical consultation for this issue was uncommon, with only 20.9% seeking a doctor's advice.

1. Have you at any time during the last 12 months had trouble in your neck?

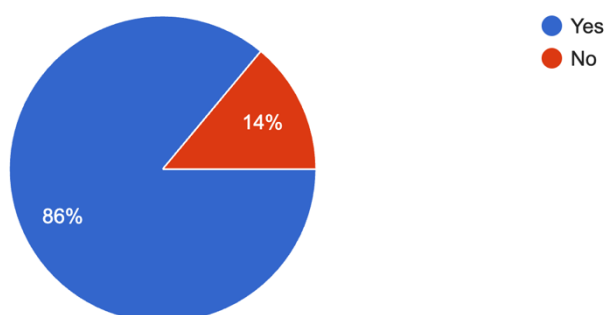
64 responses

**Table 10 -: Prevalence of Neck Pain**

Experience of Neck Trouble in the Last 12 Months	Number of Respondents (out of 64)	Percentage
Yes	43	67.2%
No	21	32.8%
Total	64	100%

2. Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?

43 responses

**Table 11 -: Impact of Neck Trouble on Normal Work in the Last 12 Months**

Prevented from Normal Work due to Trouble	Number of Respondents (out of 43)	Percentage
Yes	37	86%
No	6	14%
Total	43	100%

3. Have you had trouble at any time during the last 7 days?

43 responses

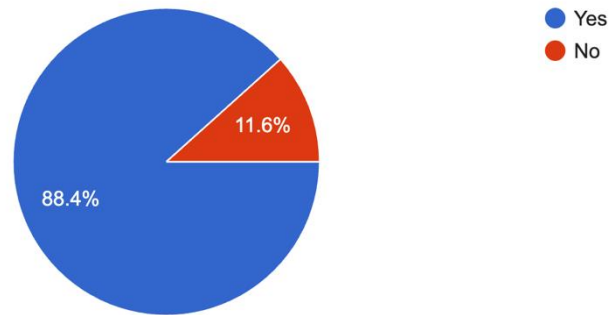


Table 12 : Prevalence of Neck Trouble in the Last 7 Days

Experienced Trouble in the Last 7 Days	Number of Respondents (out of 43)	Percentage
Yes	38	88.4%
No	5	11.6%
Total	43	100%

4. Have you ever hurt your body part in an accident?

43 responses

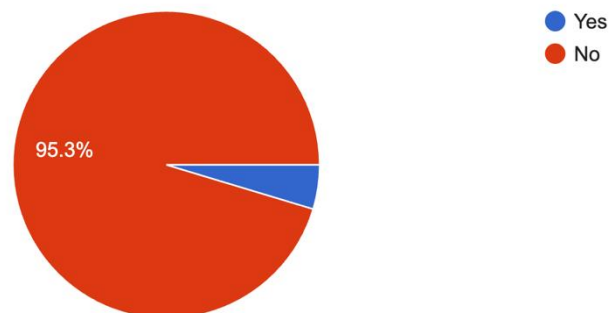


Table 13: Lifetime History of Injury from an Accident (in Neck Region)

Ever Hurt a Body Part in an Accident	Number of Respondents (out of 43)	Percentage
Yes	2	4.7%
No	41	95.3%
Total	43	100%

5. What is the total length of time that you have had trouble during the last 12 months?

43 responses

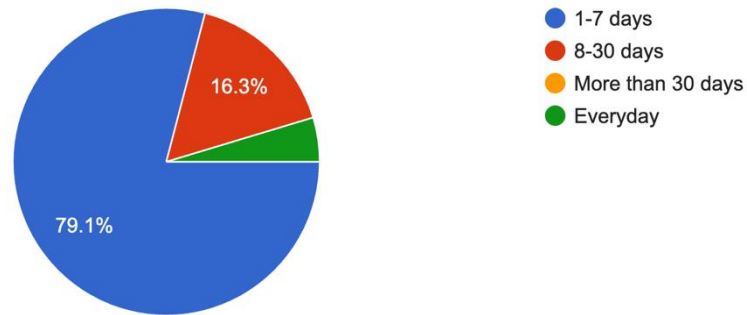


Table 14: Duration of Trouble Experienced in the Last 12 Months (in Neck Region)

Duration of Trouble	Number of Respondents (out of 43)	Percentage
1-7 days	34	79.1%
8-30 days	7	16.3%
Everyday	2	4.6%
More than 30 days	0	0.0%
Total	43	100.0%

6. Have you been seen by a doctor because of trouble during the last 12 months?

43 responses

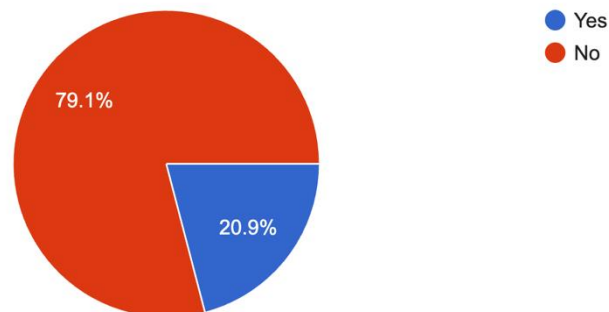


Table 15: Doctor Visits for Trouble in the Last 12 Months (in Neck Region)

Seen by a Doctor for Trouble	Number of Respondents (out of 43)	Percentage
Yes	9	20.9%
No	34	79.1%
Total	43	100.0%

2. SHOULDER

Shoulder trouble was also highly prevalent, affecting 62.5% of the 64 respondents. For those with shoulder issues (n=40), 55% reported an impact on their normal work, and an equal percentage experienced symptoms in the last 7 days. The duration of symptoms was 1-7 days for 80% of this subgroup. The vast majority (97.5%) of neck and shoulder complaints were not attributed to a prior accident.

1. Have you at any time during the last 12 months had trouble in your shoulder ?

64 responses

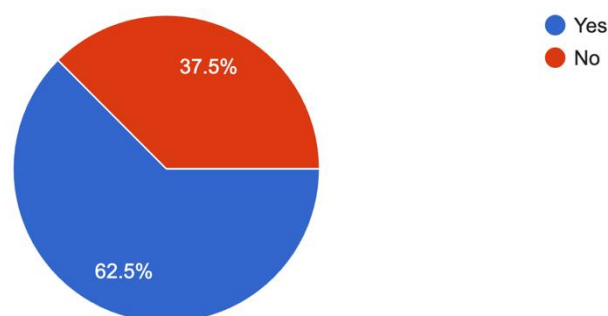


Table 16 -: Prevalence of Shoulder Pain

Experience of Shoulder Trouble in the Last 12 Months	Number of Respondents (out of 64)	Percentage
Yes	40	62.5%
No	24	37.5%
Total	64	100%

2. Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?

40 responses

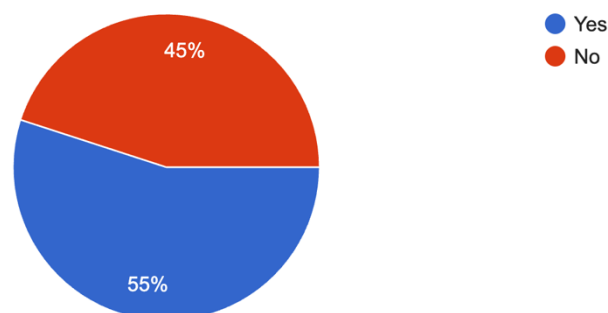


Table 17 -: Impact of Shoulder Trouble on Normal Work in the Last 12 Months

Prevented from Normal Work due to Trouble	Number of respondents (out of 40)	Percentage
Yes	22	55%
No	18	45%
Total	40	100%

3. Have you had trouble at any time during the last 7 days?

40 responses

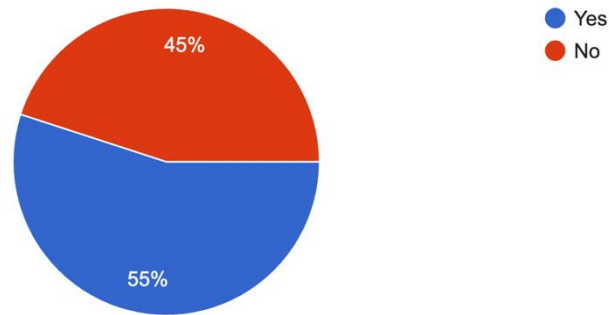


Table 18 : Prevalence of Shoulder Trouble in the Last 7 Days

Experienced Trouble in the Last 7 Days	Number of Respondents (out of 40)	Percentage
Yes	22	55%
No	18	45%
Total	40	100%

4. Have you ever hurt your body part in an accident?

40 responses

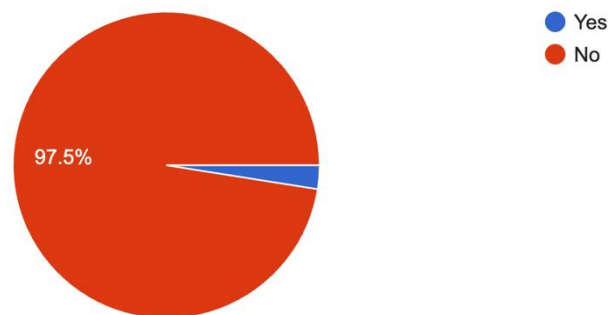


Table 19: Lifetime History of Injury from an Accident (in Shoulder Region)

Ever Hurt a Body Part in an Accident	Number of Respondents (out of 40)	Percentage
Yes	1	2.5%
No	39	97.5%
Total	40	100%

5. What is the total length of time that you have had trouble during the last 12 months?

40 responses

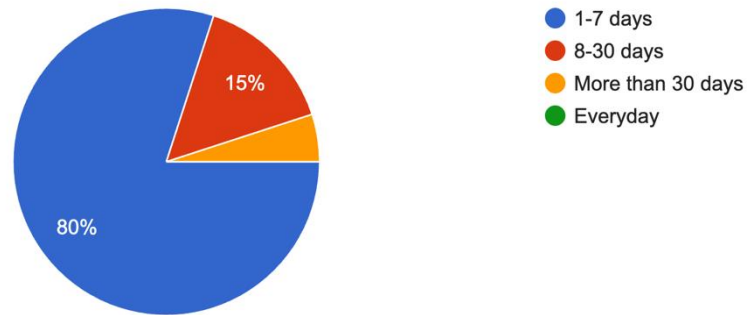


Table 20: Duration of Trouble Experienced in the Last 12 Months (in Shoulder Region)

Duration of Trouble	Number of Respondents (out of 40)	Percentage
1-7 days	32	80%
8-30 days	6	15%
Everyday	0	0%
More than 30 days	2	5%
Total	40	100.0%

6. Have you been seen by a doctor because of trouble during the last 12 months?

40 responses

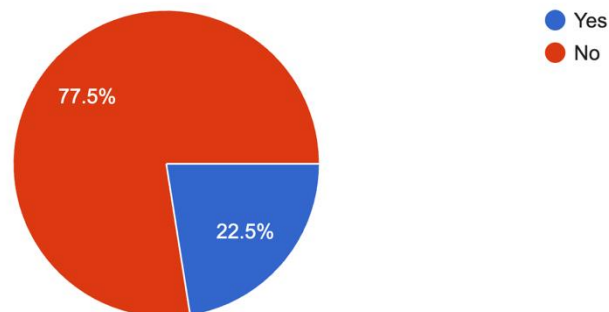


Table 21: Doctor Visits for Trouble in the Last 12 Months (in the Shoulder Region)

Seen by a Doctor for Trouble	Number of Respondents (out of 40)	Percentage
Yes	9	22.5%
No	31	77.5%
Total	40	100.0%

3. Elbow

Elbow was reported by a minority of the 64 participants, with 96.9% reporting no trouble in these areas.

1. Have you at any time during the last 12 months had trouble in your elbow ?

64 responses

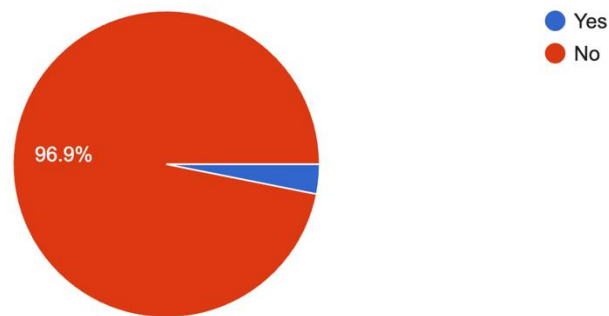


Table 22 -: Prevalence of Elbow Pain

Experience of Elbow Trouble in the Last 12 Months	Number of Respondents (out of 64)	Percentage
Yes	2	3.1%
No	62	96.9%
Total	64	100%

2. Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?

2 responses

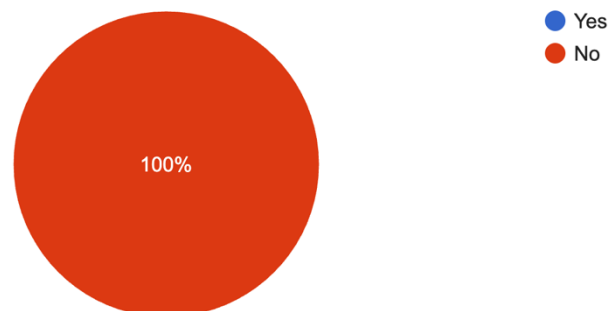


Table 23 -: Impact of Elbow Trouble on Normal Work in the Last 12 Months

Prevented from Normal Work due to Trouble	Number of respondents (out of 2)	Percentage
Yes	0	0%
No	2	100%
Total	2	100%

3. Have you had trouble at any time during the last 7 days?

2 responses

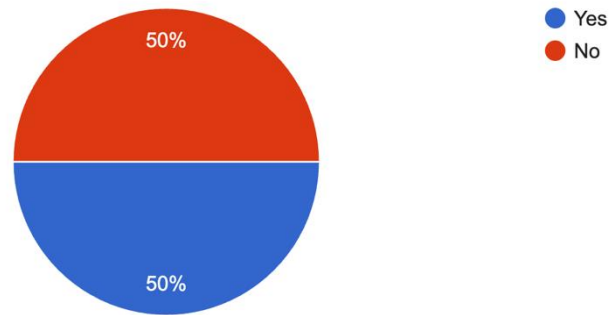


Table 24: Prevalence of Elbow Trouble in the Last 7 Days

Experienced Trouble in the Last 7 Days	Number of Respondents (out of 2)	Percentage
Yes	1	50%
No	1	50%
Total	2	100%

4. Have you ever hurt your body part in an accident?

2 responses

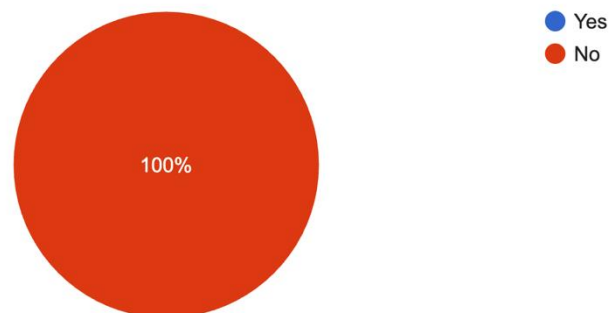


Table 25: Lifetime History of Injury from an Accident (in Elbow Region)

Ever Hurt a Body Part in an Accident	Number of Respondents (out of 2)	Percentage
Yes	0	0%
No	2	100%
Total	2	100%

5. What is the total length of time that you have had trouble during the last 12 months?

2 responses

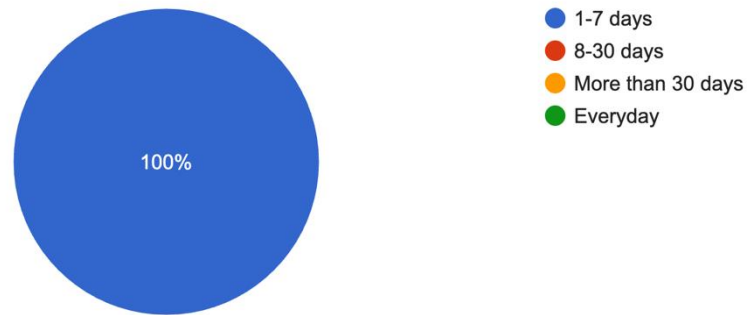


Table 26: Duration of Trouble Experienced in the Last 12 Months (in Elbow Region)

Duration of Trouble	Number of Respondents (out of 2)	Percentage
1-7 days	2	100%
8-30 days	0	0%
Everyday	0	0%
More than 30 days	0	0%
Total	2	100.0%

6. Have you been seen by a doctor because of trouble during the last 12 months?

2 responses

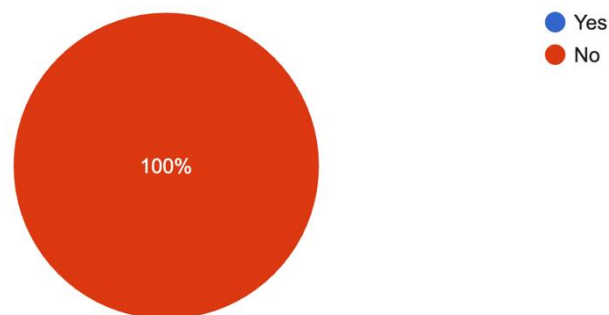


Table 27: Doctor Visits for Trouble in the Last 12 Months (in the Elbow Region)

Seen by a Doctor for Trouble	Number of Respondents (out of 2)	Percentage
Yes	0	0%
No	2	100%
Total	2	100.0%

4. Wrist and Hand

Wrist and Hand issues were reported by a minority of the 64 participants, with 95.3%, reporting no trouble in these areas

1. Have you at any time during the last 12 months had trouble in your wrist/hand ?

64 responses

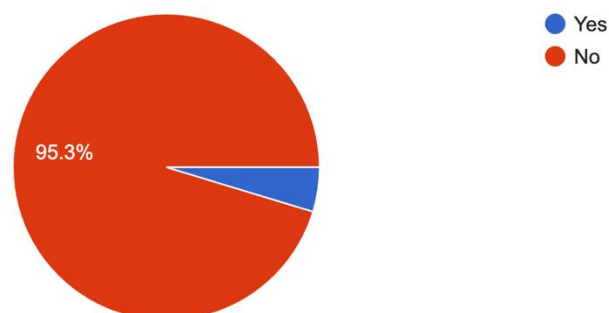


Table 28: Prevalence of Wrist and Hand Pain

Experience of Wrist and Hand Trouble in the Last 12 Months	Number of Respondents (out of 64)	Percentage
Yes	3	4.7%
No	61	95.3%
Total	64	100%

2. Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?

3 responses

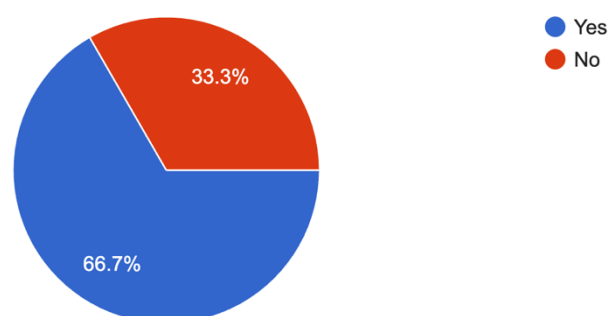


Table 29: Impact of Wrist and Hand Trouble on Normal Work in the Last 12 Months

Prevented from Normal Work due to Trouble	Number of respondents (out of 3)	Percentage
Yes	2	66.7%
No	1	33.3%
Total	3	100%

3. Have you had trouble at any time during the last 7 days?

3 responses

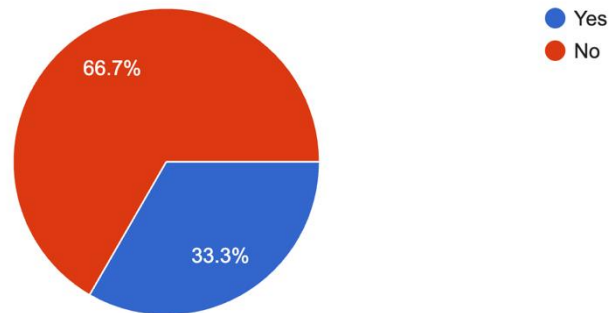


Table 30: Prevalence of Wrist and Hand Trouble in the Last 7 Days

Experienced Trouble in the Last 7 Days	Number of Respondents (out of 3)	Percentage
Yes	1	33.3%
No	2	66.7%
Total	3	100%

4. Have you ever hurt your body part in an accident?

3 responses

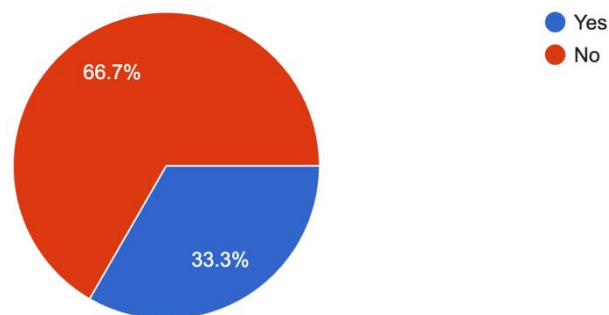


Table 31: Lifetime History of Injury from an Accident (in Wrist and Hand Region)

Ever Hurt a Body Part in an Accident	Number of Respondents (out of 3)	Percentage
Yes	1	33.3%
No	2	66.7%
Total	3	100%

5. What is the total length of time that you have had trouble during the last 12 months?

3 responses

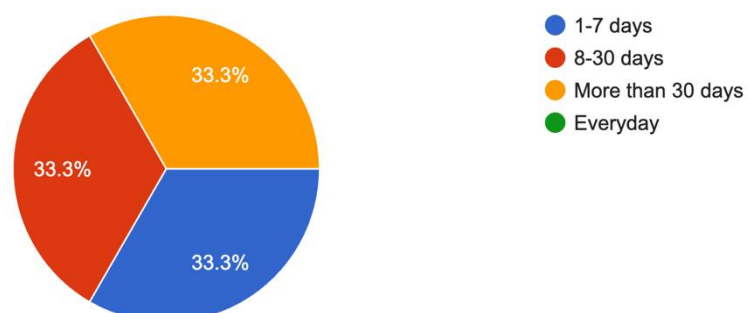


Table 32: Duration of Trouble Experienced in the Last 12 Months (in Wrist and Hand Region)

Duration of Trouble	Number of Respondents (out of 3)	Percentage
1-7 days	1	33.3%
8-30 days	1	33.3%
Everyday	0	0%
More than 30 days	1	33.3%
Total	3	100.0%

6. Have you been seen by a doctor because of trouble during the last 12 months?

3 responses

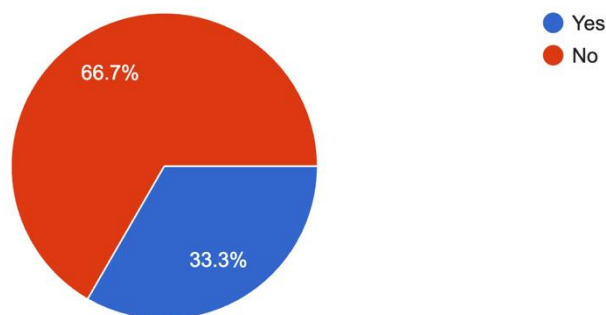


Table 33: Doctor Visits for Trouble in the Last 12 Months (in Wrist and Hand Region)

Seen by a Doctor for Trouble	Number of Respondents (out of 3)	Percentage
Yes	1	33.3%
No	2	66.7%
Total	3	100.0%

5. Upper back

Upper back trouble was reported by 32.8% of the 64 students. Of those affected (n=21), 28.6% experienced functional limitations. This condition had a more significant functional impact, with 79.3% of the affected individuals (n=29) reporting that it prevented them from doing their normal work. Furthermore, 82.8% of this group had experienced symptoms within the last 7 days. The duration of low back trouble was more prolonged, with 62.1% reporting symptoms lasting between 8 and 30 days. Correspondingly, a higher proportion of students with low back trouble (41.4%) had sought medical consultation. In both upper and lower back cases, the symptoms were overwhelmingly reported as non-accidental in origin.

1. Have you at any time during the last 12 months had trouble in your upper back?

64 responses

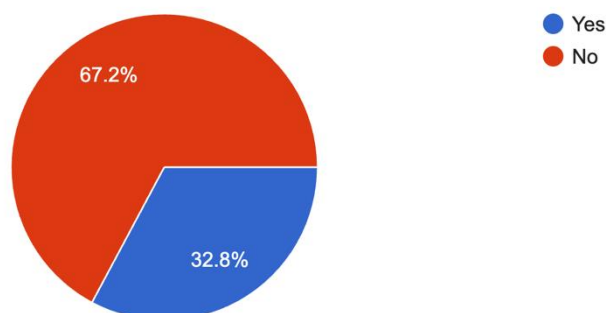


Table 34: Prevalence of Upper Back Pain

Experience of Upper Back Trouble in the Last 12 Months	Number of Respondents (out of 64)	Percentage
Yes	21	32.8%
No	43	67.2%
Total	64	100%

2. Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?

21 responses

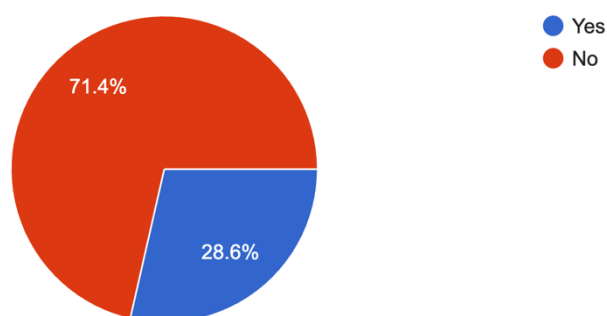


Table 35: Impact of Upper Back Trouble on Normal Work in the Last 12 Months

Prevented from Normal Work due to Trouble	Number of respondents (out of 21)	Percentage
Yes	6	26.6%
No	15	71.4%
Total	21	100%

3. Have you had trouble at any time during the last 7 days?

21 responses

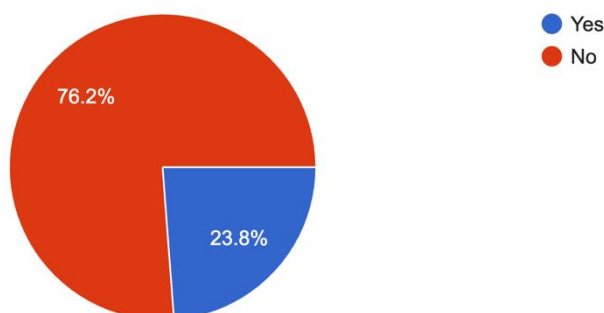


Table 36: Prevalence of Upper Back Trouble in the Last 7 Days

Experienced Trouble in the Last 7 Days	Number of Respondents (out of 21)	Percentage
Yes	5	23.8%
No	16	76.2%
Total	21	100%

4. Have you ever hurt your body part in an accident?

21 responses

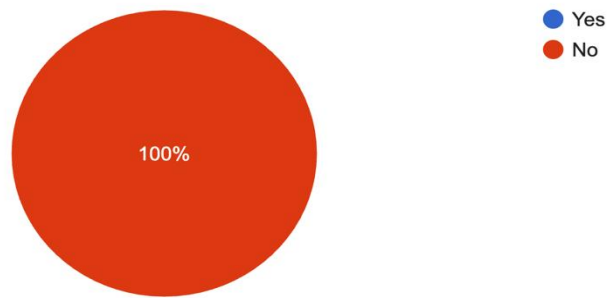


Table 37: Lifetime History of Injury from an Accident (in the upper Back Region)

Ever Hurt a Body Part in an Accident	Number of Respondents (out of 21)	Percentage
Yes	0	0%
No	21	100%
Total	21	100%

5. What is the total length of time that you have had trouble during the last 12 months?

21 responses

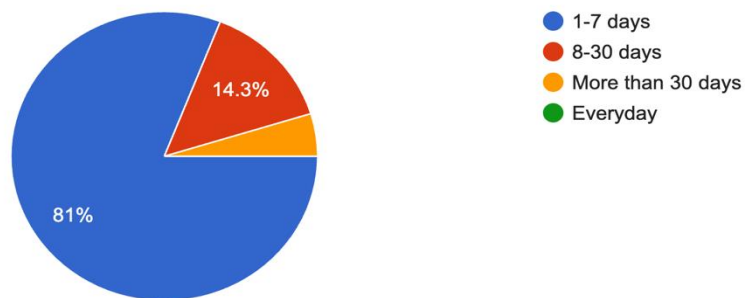


Table 38: Duration of Trouble Experienced in the Last 12 Months (in Upper Back Region)

Duration of Trouble	Number of Respondents (out of 21)	Percentage
1-7 days	17	81%
8-30 days	3	14.3%
Everyday	1	4.7%
More than 30 days	0	0.0%
Total	21	100.0%

6. Have you been seen by a doctor because of trouble during the last 12 months?

21 responses

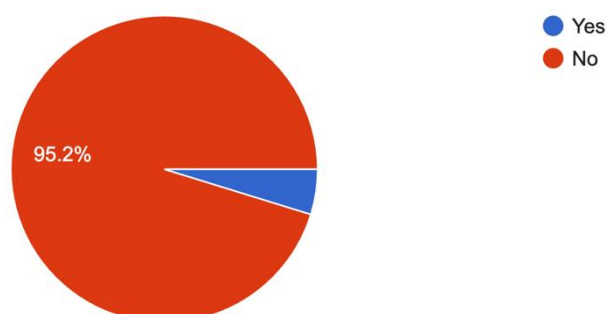


Table 39: Doctor Visits for Trouble in the Last 12 Months (in Upper Back Region)

Seen by a Doctor for Trouble	Number of Respondents (out of 21)	Percentage
Yes	2	4.8%
No	19	95.2%
Total	21	100.0%

6. Lower back

Lower back trouble was more prevalent, with a prevalence of 45.3%, compared to upper back.

1. Have you at any time during the last 12 months had trouble in your low back?

64 responses

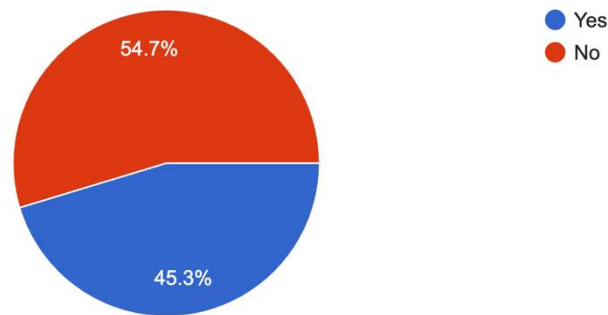


Table 40: Prevalence of Lower Back Pain

Experience of Lower Back Trouble in the Last 12 Months	Number of Respondents (out of 64)	Percentage
Yes	29	45.3%
No	35	54.7%
Total	64	100%

2. Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?

29 responses

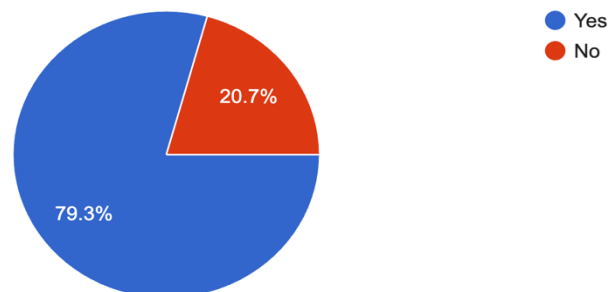


Table 41: Impact of Lower Back Trouble on Normal Work in the Last 12 Months

Prevented from Normal Work due to Trouble	Number of respondents (out of 29)	Percentage
Yes	22	79.3%
No	6	20.7%
Total	29	100%

3. Have you had trouble at any time during the last 7 days?

29 responses

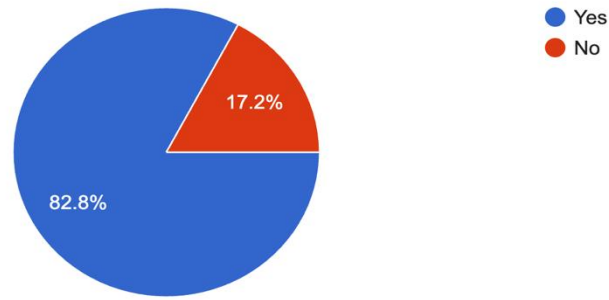


Table 42: Prevalence of Lower Back Trouble in the Last 7 Days

Experienced Trouble in the Last 7 Days	Number of Respondents (out of 29)	Percentage
Yes	24	82.8%
No	5	17.2%
Total	29	100%

4. Have you ever hurt your body part in an accident?

29 responses

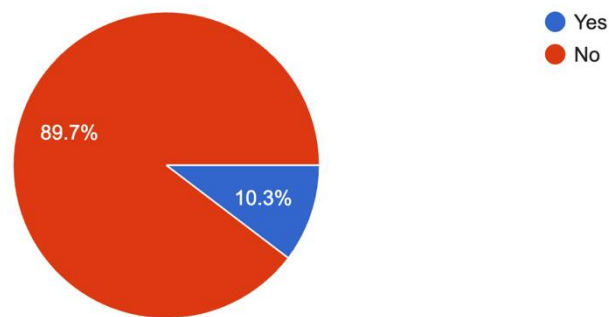


Table 43: Lifetime History of Injury from an Accident (in Lower Back Region)

Ever Hurt a Body Part in an Accident	Number of Respondents (out of 29)	Percentage
Yes	3	10.3%
No	26	89.7%
Total	29	100%

5. What is the total length of time that you have had trouble during the last 12 months?

29 responses

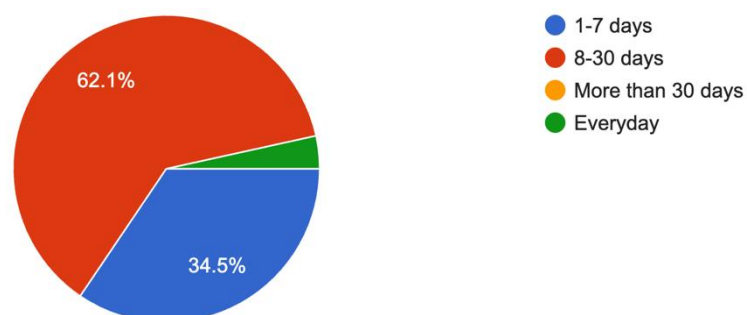


Table 44: Duration of Trouble Experienced in the Last 12 Months (in Lower Back Region)

Duration of Trouble	Number of Respondents (out of 29)	Percentage
1-7 days	7	34.5%
8-30 days	18	62.1%
Everyday	4	3.4%
More than 30 days	0	0.0%
Total	29	100.0%

6. Have you been seen by a doctor because of trouble during the last 12 months?

29 responses

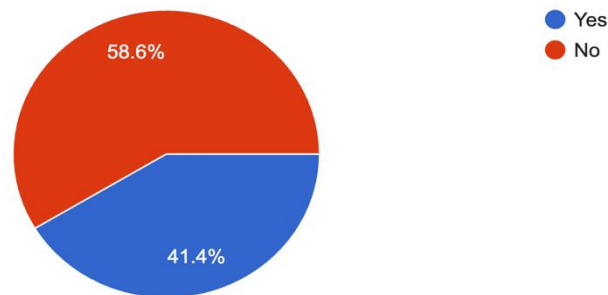


Table 45: Doctor Visits for Trouble in the Last 12 Months (in Lower Back Region)

Seen by a Doctor for Trouble	Number of Respondents (out of 29)	Percentage
Yes	12	41.4%
No	17	58.6%
Total	29	100.0%

7. Hips and Thighs

The hips/thighs and knees were largely unaffected, with 98.4% of respondents reporting no trouble in these regions.

1. Have you at any time during the last 12 months had trouble in your Hips/thighs ?

64 responses

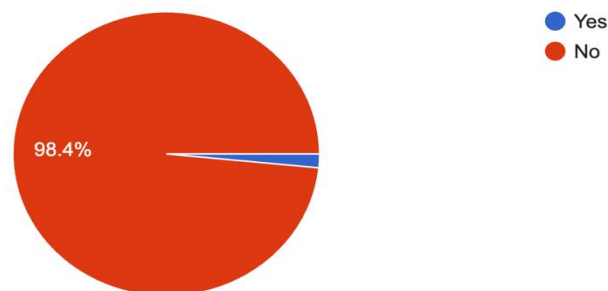


Table 46: Prevalence of Hip and Thighs Pain

Experience of Hips and Thighs Trouble in the Last 12 Months	Number of Respondents (out of 64)	Percentage
Yes	1	1.6%
No	63	98.4%
Total	64	100%

2. Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?

1 response

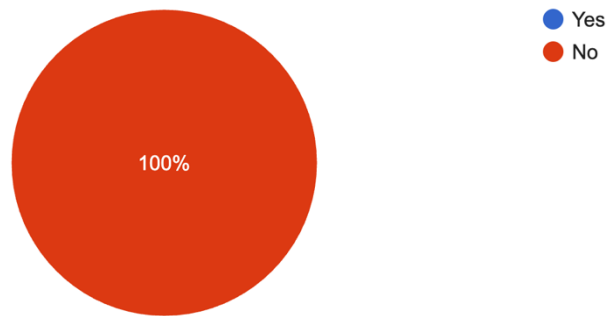


Table 47: Impact of Hips and Thighs Trouble on Normal Work in the Last 12 Months

Prevented from Normal Work due to Trouble	Number of respondents (out of 1)	Percentage
Yes	0	0%
No	1	100%
Total	1	100%

3. Have you had trouble at any time during the last 7 days?

1 response

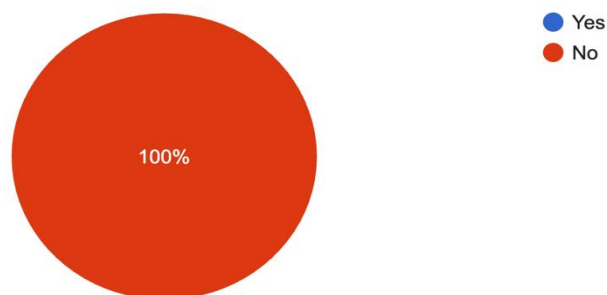


Table 48: Prevalence of Hips and Thigh Trouble in the Last 7 Days

Experienced Trouble in the Last 7 Days	Number of Respondents (out of 1)	Percentage
Yes	0	0%
No	1	100%
Total	1	100%

4. Have you ever hurt your body part in an accident?

1 response

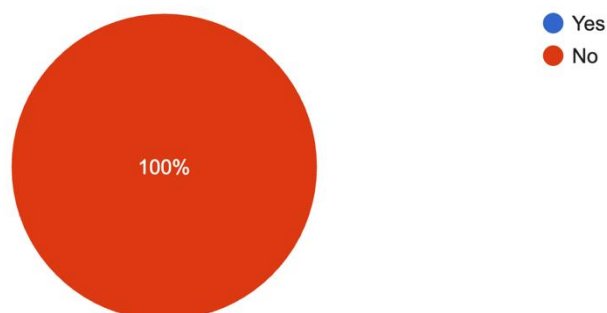


Table 49: Lifetime History of Injury from an Accident (in Hips and Thighs Region)

Ever Hurt a Body Part in an Accident	Number of Respondents (out of 1)	Percentage
Yes	0	0%
No	1	100%
Total	1	100%

5. What is the total length of time that you have had trouble during the last 12 months?

1 response

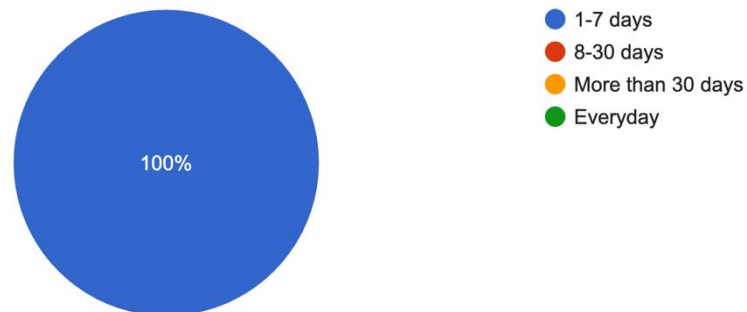


Table 50: Duration of Trouble Experienced in the Last 12 Months (in Hips and Thighs Region)

Duration of Trouble	Number of Respondents (out of 1)	Percentage
1-7 days	1	100%
8-30 days	0	0%
Everyday	0	0%
More than 30 days	0	0%
Total	1	100.0%

6. Have you been seen by a doctor because of trouble during the last 12 months?

1 response

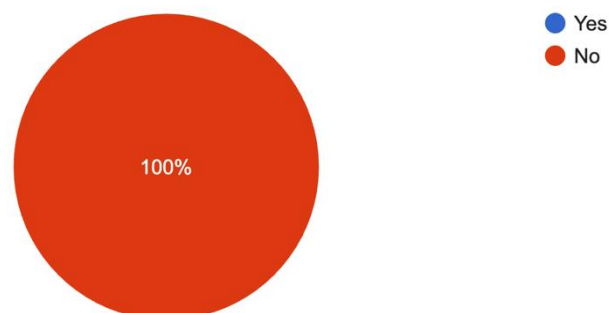


Table 51: Doctor Visits for Trouble in the Last 12 Months (in Hips and Thighs Region)

Seen by a Doctor for Trouble	Number of Respondents (out of 1)	Percentage
Yes	0	0%
No	1	100%
Total	1	100.0%

8. Knees

Knee trouble was equally infrequent, with 98.4% of the 64 participants reporting no issues in the last 12 months. The single respondent who reported knee trouble indicated that it did not prevent normal work, was not experienced in the last 7 days, lasted for a period of 1-7 days, and was not the result of an accident. This individual did not seek medical consultation for the issue.

1. Have you at any time during the last 12 months had trouble in your knees?

64 responses

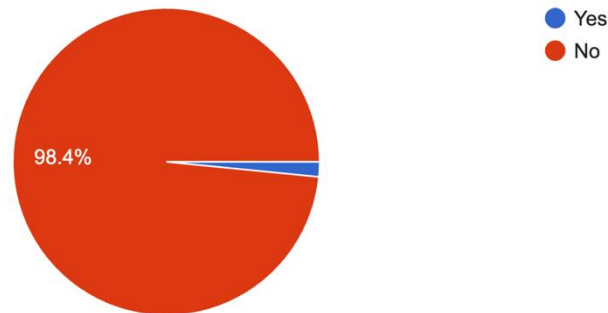


Table 52: Prevalence of Knees Pain

Experience of Knees Trouble in the Last 12 Months	Number of Respondents (out of 64)	Percentage
Yes	1	1.6%
No	63	98.4%
Total	64	100%

2. Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?

1 response

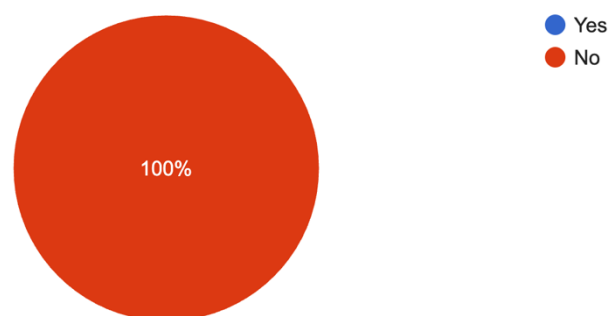


Table 53: Impact of Knees Trouble on Normal Work in the Last 12 Months

Prevented from Normal Work due to Trouble	Number of respondents (out of 1)	Percentage
Yes	0	0%
No	1	100%
Total	1	100%

3. Have you had trouble at any time during the last 7 days?

1 response

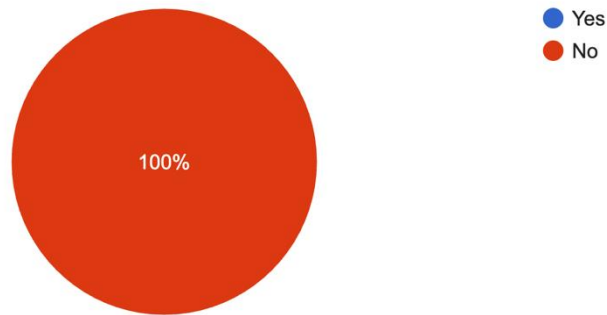


Table 54: Prevalence of Knees Trouble in the Last 7 Days

Experienced Trouble in the Last 7 Days	Number of Respondents (out of 1)	Percentage
Yes	0	0%
No	1	100%
Total	1	100%

4. Have you ever hurt your body part in an accident?

1 response

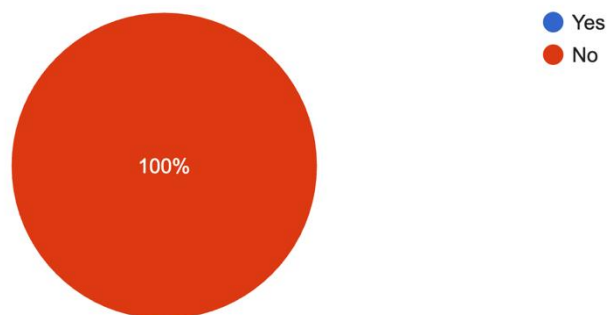


Table 55: Lifetime History of Injury from an Accident (in Knees Region)

Ever Hurt a Body Part in an Accident	Number of Respondents (out of 1)	Percentage
Yes	0	0%
No	1	100%
Total	1	100%

5. What is the total length of time that you have had trouble during the last 12 months?

1 response



Table 50: Duration of Trouble Experienced in the Last 12 Months (in the Knees Region)

Duration of Trouble	Number of Respondents (out of 1)	Percentage
1-7 days	1	100%
8-30 days	0	0%
Everyday	0	0%
More than 30 days	0	0%
Total	1	100%

6. Have you been seen by a doctor because of trouble during the last 12 months?

1 response

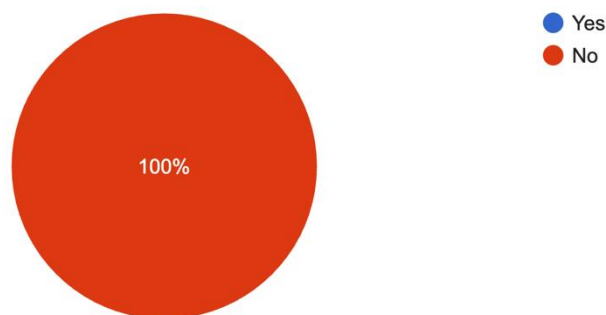


Table 51: Doctor Visits for Trouble in the Last 12 Months (in the Knees Region)

Seen by a Doctor for Trouble	Number of Respondents (out of 1)	Percentage
Yes	0	0%
No	1	100%
Total	1	100.0%

9. Ankles and Feet

Ankle and feet problems were reported by 9.4% of the students.

1. Have you at any time during the last 12 months had trouble in your ankles/feet ?

64 responses

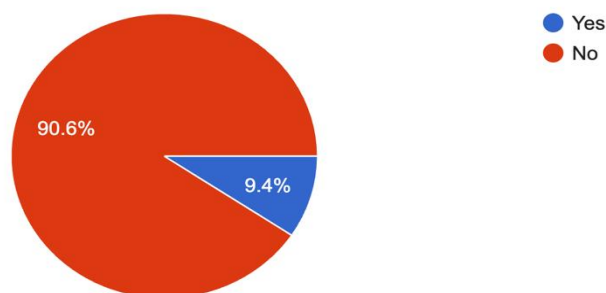


Table 52: Prevalence of Ankle and Feet Pain

Experience of Ankle and Feet Trouble in the Last 12 Months	Number of Respondents (out of 64)	Percentage
Yes	6	9.4%
No	58	90.6%
Total	64	100%

2. Have you at any time during the last 12 months been prevented from doing your normal work because of the trouble?

6 responses

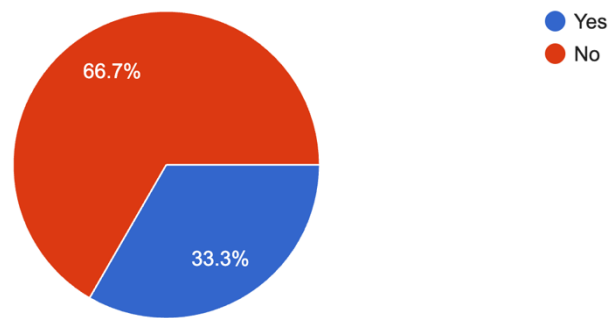


Table 53: Impact of Ankle and Feet Trouble on Normal Work in the Last 12 Months

Prevented from Normal Work due to Trouble	Number of respondents (out of 6)	Percentage
Yes	2	33.3%
No	4	66.7%
Total	6	100%

3. Have you had trouble at any time during the last 7 days?

6 responses

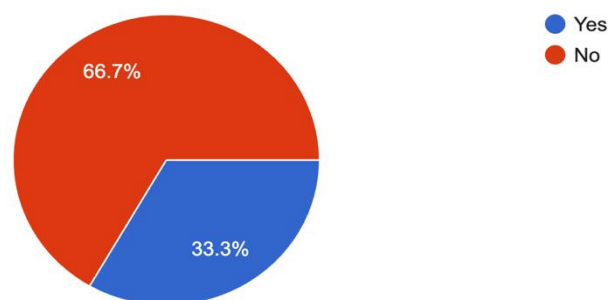


Table 54: Prevalence of Ankle and Feet Trouble in the Last 7 Days

Experienced Trouble in the Last 7 Days	Number of Respondents (out of 6)	Percentage
Yes	2	33.3%
No	4	66.7%
Total	6	100%

4. Have you ever hurt your body part in an accident?

6 responses

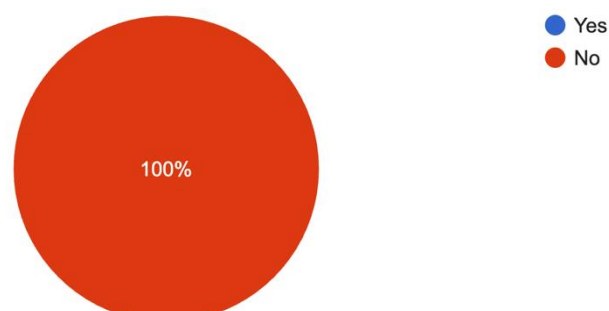


Table 55: Lifetime History of Injury from an Accident (in Ankle and Feet Region)

Ever Hurt a Body Part in an Accident	Number of Respondents (out of 6)	Percentage
Yes	0	0%
No	6	100%
Total	6	100%

5. What is the total length of time that you have had trouble during the last 12 months?

6 responses

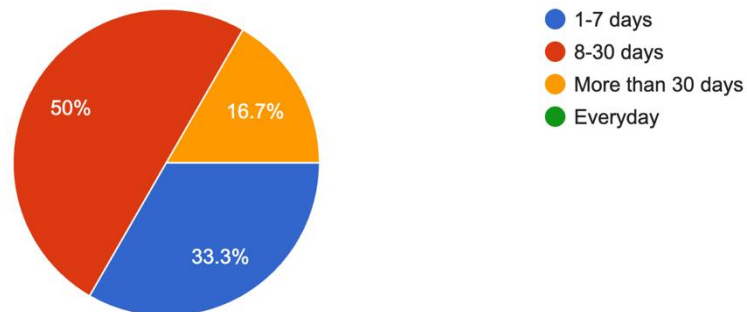


Table 56: Duration of Trouble Experienced in the Last 12 Months (in Ankle and Feet Region)

Duration of Trouble	Number of Respondents (out of 6)	Percentage
1-7 days	2	33.3%
8-30 days	3	50%
Everyday	1	0%
More than 30 days	0	16.7%
Total	6	100.0%

6. Have you been seen by a doctor because of trouble during the last 12 months?

6 responses

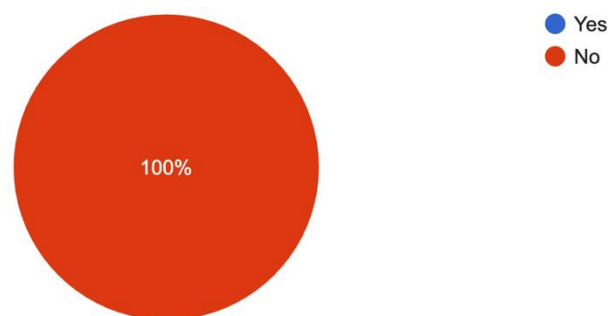


Table 57: Doctor Visits for Trouble in the Last 12 Months (in Ankle and Feet Region)

Seen by a Doctor for Trouble	Number of Respondents (out of 6)	Percentage
Yes	0	0%
No	6	100%
Total	6	100%

IV. DISCUSSION

The findings of this study reveal concerning patterns of musculoskeletal disorders among college students using backpacks, with 64% of participants reporting pain-related symptoms.

The high prevalence of neck pain (67.2%) and shoulder pain (62.5%) observed in this study corresponds with previous research findings. Sankaran et al. found that 18.8% of school-going children experienced musculoskeletal pain in the preceding year, with backpack weights exceeding 10% of body weight being significantly associated with increased pain risk[6]. Similarly, a Nigerian study of 1,785 secondary school students reported shoulder pain as the most prevalent discomfort (63.5%), with significantly higher pain levels in females[1]. The consistency of these findings across different populations and age groups underscores the universal nature of backpack-related musculoskeletal problems.

The lower prevalence of lower back pain (45.3%) compared to neck and shoulder symptoms differs from some studies that identify the lower back as the primary area of concern[9]. However, this finding aligns with research by Choudhary et al., who reported that 55.9% of students experienced musculoskeletal pain in the last 12 months, with varied distribution across different body regions[10]. The predominance of upper-body symptoms in the current study may reflect the specific demographics and backpack usage patterns of the college student population studied.

The study's finding that 53.1% of students carried backpacks weighing 3-5 kg, yet 68.8% perceived their bags as "heavy," highlights the subjective nature of load perception. This perception-reality disconnect is significant, as research demonstrates that perceived backpack weight, rather than actual weight, may be more strongly associated with reported symptoms[11]. Ramadan and Al-Tayyar established that backpack loads should not exceed 10% of the child's body weight, with their ergonomically designed backpack showing superior performance at loads of 15% and 20% of body weight in terms of both subjective comfort and electromyographic responses[12].

The recommendation that backpack weight should not exceed 10-15% of body weight is well-established in ergonomic literature[13]. Studies consistently show that loads exceeding these thresholds result in significant biomechanical alterations and increased musculoskeletal stress[14]. The current study's findings of perceived heaviness despite relatively moderate actual weights suggest that factors beyond absolute weight, such as backpack design, carrying duration, and distribution of load, play crucial roles in symptom development.

The predominant use of both-shoulder carrying (65.6%) observed in this study represents optimal carrying practice according to established ergonomic principles. Research consistently demonstrates that bilateral carrying distributes load more evenly and reduces asymmetrical stress on the musculoskeletal system[1]. Studies comparing unilateral versus bilateral carrying methods show that unilateral carrying results in significantly greater postural adaptations, including lateral flexion and increased muscle activation patterns[15].

The minority of students using unilateral carrying methods (20.3% combined) may represent a higher-risk group for developing asymmetrical musculoskeletal problems. Mandrekar et al. found significant changes in sagittal shoulder posture and craniohorizontal angle with unilateral school bag carriage compared to minimal changes with bilateral carriage[15]. This finding emphasizes the importance of education regarding proper carrying techniques to minimize long-term musculoskeletal consequences.

The prevalence of neck and shoulder symptoms in this study reflects well-documented biomechanical adaptations to backpack carrying. Research using photographic postural analysis demonstrates that backpack use results in significant forward head posture, characterised by decreased craniovertebral angles and increased craniohorizontal angles[14][16]. These postural adaptations represent compensatory mechanisms to maintain balance while carrying external loads but can contribute to muscle strain and pain over time.

Li and Chow identified critical changes in trunk muscle activation and lumbar spine loading at backpack loads of 10% of body weight, suggesting this threshold represents a biomechanical tipping point[17]. The authors found that lightweight backpack carriage at approximately 3% of body weight might actually reduce peak lumbosacral compression force, indicating that minimal loads may provide stabilization benefits[17].

However, loads exceeding optimal thresholds result in disproportionate increases in muscle activation and spinal loading.

While this study maintained equal gender representation (50% male, 50% female), the literature consistently reports higher prevalence and severity of backpack-related symptoms in females. Multiple studies demonstrate that female students experience more severe musculoskeletal symptoms compared to their male counterparts [18][1][5]. Mongkonkansai et al. found that Thai students carrying backpacks over 15% of body weight showed significantly higher associations with neck, shoulder, and lower back pain, with females experiencing more discomfort than males[5].

These gender differences may be attributed to several factors, including differences in muscle mass, pain threshold, hormonal influences during adolescence, and carrying behaviour patterns [5]. Understanding these gender-specific vulnerabilities is crucial for developing targeted prevention strategies and ergonomic recommendations.

The finding that 67.2% of students carried backpacks for more than 15 minutes continuously highlights the chronic nature of exposure in this population. Research demonstrates that both duration and frequency of backpack carriage significantly influence symptom development[11][15]. Studies examining static versus dynamic loading conditions show that prolonged carrying periods result in progressive postural deterioration and increased muscle fatigue[15].

The relationship between carrying duration and symptom severity is well-established in the literature, with longer exposure periods associated with greater biomechanical stress and higher pain prevalence[11][19]. This finding emphasizes the importance of considering temporal factors in addition to load characteristics when assessing backpack-related health risks.

The predominant use of public transportation (73.4%) among study participants provides important context for understanding backpack usage patterns. Students using public transportation may experience additional challenges related to crowded conditions, prolonged standing, and limited ability to adjust or remove backpacks during transit. This environmental factor may contribute to the high prevalence of symptoms observed, as students must maintain loaded postures for extended periods in suboptimal conditions.

Conclusion:

The study confirms that musculoskeletal disorders due to backpack use are a major concern among college students, driven by perceived load, carrying duration, and misuse—highlighting the urgent need for gender-sensitive ergonomic interventions and long-term research.

V. ACKNOWLEDGMENT

We would like to thank all our participants for their contribution to this research

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