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Priyanka Rishi
Assistant Professor,
Faculty of Physiotherapy,
SGT University, Gurugram,
Haryana, India

Saurabh Kumar
Assistant Professor,
Faculty of Physiotherapy,
SGT University, Gurugram,
Haryana, India

Bharti Arora
Assistant Professor,
Faculty of Physiotherapy,
SGT University, Gurugram,
Haryana, India

Ankush Sharma
Assistant Professor,
Department of Physiotherapy,
BUEST, Baddi, Himachal
Pradesh, India

Corresponding Author:
Priyanka Rishi
Assistant Professor,
Faculty of Physiotherapy,
SGT University, Gurugram,
Haryana, India

Prevalence of musculoskeletal symptoms related with body mass index (BMI) in undergraduate university students

Priyanka Rishi, Saurabh Kumar, Bharti Arora and Ankush Sharma

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Abstract
Aim: To estimate the prevalence of Musculoskeletal Symptoms Related with Body Mass Index (BMI) and Contributing Factors in Undergraduate Students of SGT University, Chandu-Budhera, Gurugram, Haryana.
Materials & Methods: Self-administered questionnaire was distributed to 500 undergraduate students age ranging from17- 24 years old and were enrolled in four various programs in SGT University and met the inclusion criteria. The students responded to the Nordic musculoskeletal questionnaire regarding musculoskeletal symptoms. Height and weight measurements were also obtained to determine body mass index.
Results: The results revealed that majority of our participants have low back pain during the last 12 months (81%) and last 7 days (57%). BMI scores had a negative correlation with shoulder, wrist/hands and knees. All other body parts had positive correlation with their respective BMI scores.
Conclusion: The prevalence of musculoskeletal symptoms among undergraduate students was found to be high in all the categories of BMI. However there was no significant relationship between BMI and specific body parts MSDs.

Keywords: Body mass index, musculoskeletal symptoms, students, nordic questionnaire

Introduction
An alteration in body mass index (BMI) is rapidly becoming the norm of our modern society and is observed across all age groups [1]. Many studies highlighted that the prevalence of underweight and overweight among adults had escalated rapidly in many developing countries where double problems of under nutrition and overweight become a critical public concern. The underweight and overweight epidemics are one of the non-communicable diseases (NCDs) that are leading cause of mortality and morbidity worldwide [2-4]. Weight disorders have been a subject of concern to most health practitioners over the years as this can affects the overall wellbeing of a person. It is responsible for a number of health problems [5]. *BMI* is a non-invasive, simple and inexpensive representative *measure* of body fat. It is widely used as a general indicator of whether a person has a healthy body weight for their height or not. World Health Organization categorized BMI into four categories: underweight, normal, overweight and obese. An individual would be considered to be underweight if BMI is in the range of 15- 19.9kg/m^2, normal weight if the BMI is 20-24.9, overweight if the BMI is 25-29.9, and obese if it is 30 or greater [6]. The rate of overweight and obesity has tripled in developing countries over the past 20 years as they rapidly become more urbanized, with increased consumption of high calorie foods and adoption of a more sedentary lifestyle [7]. And it is estimated that 27.8% of all Indians would be overweight and 5.0% obese, by 2030 [8]. As the prevalence of obesity and overweight among adults has drastically increased during the past decade; BMI has been shown to be an independent risk factor for the development of Musculoskeletal disorders (MSDs). "Musculoskeletal disorders manifesting as pain in soft tissues and joints, are a leading cause of disability. These symptoms can be expressed in various areas of the body and affect the quality of life by causing difficulties in performing occupational tasks and activities of daily living." It is well known that people with an elevated BMI tend to have more musculoskeletal pain than the people with a lower body weight [9-10].

Musculoskeletal disorders are extremely common and affect people of all ages, gender and socio-demographic background in society. In recent years, MSDs have emerged as a public health problem among college students also [11]. College or university time students experience autonomy and freedom from direct supervision. These time marked changes in lifestyle can be detrimental to the students' well-being [12]. In their daily routine they struggle to achieve healthy lifestyles, reporting high rates of physical inactivity, breakfast skipping, fast food intake, alcohol consumption, sleep inadequacies and in their academic routine students remain seated for long periods, erratic schedules, greater academic and social pressures [13-14]. Although till now MSDs represent an important health issue for college students. In Africa there is a scarcity of epidemiological studies on the prevalence of MSDs among this population. Estimations made on the basis of data from developed countries may not accurately reflect the reality in developing countries [11]. As we know that BMI has independent risk factor for the development of Musculoskeletal disorders (MSDs). In developing countries like India studies on musculoskeletal disorder among students are much negligible. In the world of technology where the students are adopting sedentary life style and engrossed themselves in keeping busy with mobile activities, online games, laptops, the stress on the joints and muscles are increasing because of the various bad postures attained during these activities which leads to Musculoskeletal disorders. Therefore the need for the study is to identify the impact of BMI on musculoskeletal system and to assess their health-related quality of life in collage going students. This information will be useful for the development of preventive and therapeutic measures to improve the musculoskeletal symptoms and quality of life of students.

Materials and Methods

This cross-sectional survey-based study was designed to find the impact of body mass index (BMI) on musculoskeletal system in undergraduate students; a questionnaire based observational descriptive study was conducted among the undergraduate students of four different departments studying in University.

Sample Size and Sampling

From a university 500 students from departments of Physiotherapy, Nursing, Ayurveda and Pharmacy**.**192 students from Nursing department, 127 students from Physiotherapy department, 126 students from BAMS and 55 students from Pharmacy department were included. The method of sampling was Convenient Sampling. A sample size of 500 was calculated by G power. Bachelor students (n=500) between ages 17-24 year were screened on the basis of following.

Inclusion Criteria

(1) Subject being an undergraduate student; (2) Students within age group of 17-24yearsofage; (3) both males and females were included; (4) studying in a professional course, (5) Possessing basic knowledge of computer or online technology.

Exclusion Criteria

Student having history of any (1) any injury to body part due to any trauma, (2) presence of Congenital Deformities, (3) undergoes any surgery, (4) Physical Disability causing pain (5) Diagnosed with any psychiatric illness, were excluded from the study.

Outcome Measures

Nordic Musculoskeletal Questionnaire [15].

Description of Tool

Nordic musculoskeletal questionnaire: This questionnaire included nine body areas including neck, shoulders, upper back, lower back, elbows, wrist/hands, thighs, knees, and ankles that are usually affected by MSDs. It is a binary response questionnaire, with ‘yes’ and ‘no’ indicating the presence and absence of MSDs, respectively.

Procedure

The purpose and the procedure of the study were explained to each subject and informed consent was obtained from them. The data was collected by using a Questionnaire. After generating the QRL link of the Questionnaireit was then sent to the students either through an e-mail or a WhatsApp message. The demographic data such as profession, Age, Gender, Height, Weight was also taken for each subject. The participants were assessed by the following:

1) Nordic musculoskeletal questionnaire: Participants were asked to indicate whether they had an episode of pain/discomfort in any of the body parts mentioned in the questionnaire (neck, shoulder, elbows, wrists and hands, upper back, lower back, hip, knee, ankle and feet) in the past 12 months (period prevalence), and past 7 days (point prevalence); information on the severity of MSDs in the past 12 months (if MSDs affected their normal daily activities) was also obtained [1, 9].

2) Measurement of BMI: BMI measurements were obtained for each subject in this study. Self-reported body weight in kilogrammes (kg) and body height in meter (m) were used to determine BMI. BMI was computed as weight (kg)/height (m^2). Subsequently, BMI was classified into 4 categories; underweight (BMI less than 18.5), normal weight (BMI 18.5-24.9 kg/m^2), overweight (BMI 25.0- 29.9 kg/m^2) and Obesity (BMI >30kg/m^2) which is in accordance with the International Classification system of the WHO [6].

Statistical Analysis

Data was analysed by using SPSS version 20. Descriptive statistical analyses were preliminarily performed to determine percentages and means of Age, Gender, Height and Weight. Pearson correlation was used to determine the relationship between BMI and MSDs. The p- value are significant at $p < 0.05$

Results

The total sample Was 500 and the Average age was 20.17± 1.61 years, Female counted for 67.4 % and Male 32.6%

Table 1: shows the mean and standard deviation of age and BMI of the subjects

Parameters	Mean	Standard Deviation
Age	20.17	1.619
Bmi	21.88	4.570

[Table 2] Depicts the frequency and percentage of frequency of Age, Gender, Program and Body Mass Index. The data shows that out of 100% in age (1%) student was of 17 years old, (12.4%) 18 years, (24.2%) 19 years, (26.6%) 20 years, (18%) 21 years, (7.6%) 22 years, (4.2%) 23 years and (6%) was 24 years old respectively. In Gender out of 100%, male were 32.6% and female were 67.4%. In Program out of 100%, nursing students were 38.4%, Physiotherapy 25.4%, BAMS, 25.2% and Pharmacy students were 11% respectively.

Out of 100% in underweight BMI category male was 4% female 21%, normal BMI male 19.2% female 29%, overweight male 7.4% female 13.6% and in obesity category male was 2% and female 3.8% respectively. Data of gender and BMI is graphically presented in figure 1 and 2 respectively.

Table 2: Shows the detailed demographic characteristics of the subjects

Parameters			N	Frequency %
Age	17 Years		5	1%
	18 Years		62	12.4%
	19 Years		121	24.2%
	20 Years		133	26.6%
	21 Years		90	18%
	22 Years		38	7.6%
	23 Years		21	4.2%
	24 Years		30	6%
Gender	Male		163	32.6%
	Female		337	67.4%
Program	Nursing		192	38.4%
	Physiotherapy		127	25.4%
	Bams		126	25.2%
	Pharmacy		55	11%
Body Mass Index (Bmi)	Under Weight	Male	20	4%
		Female	105	21%
	Normal	Male	96	19.2%
		Female	145	29%
	Overweight	Male	37	7.4%
		Female	68	13.6%
	Obesity	Male	10	2%
		Female	19	3.8%

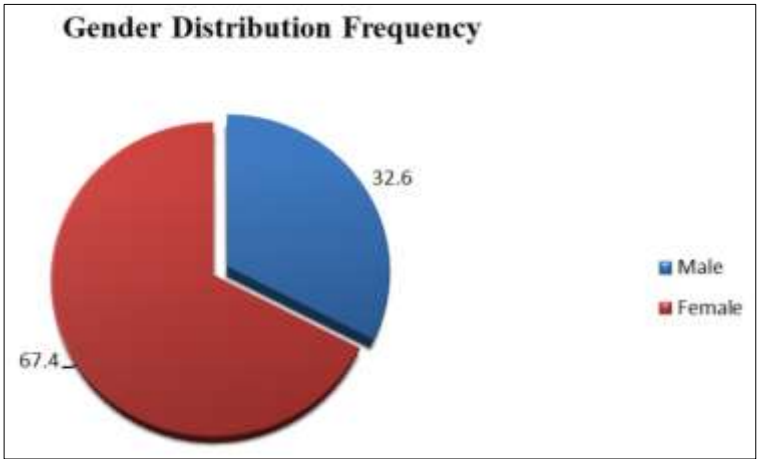

Fig 1: Gender frequency percentage distribution of total sample

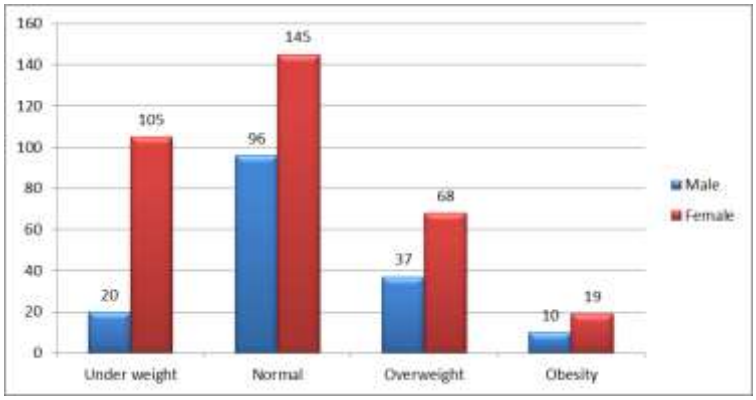

Fig 2: Frequency number of underweight, normal, overweight and obese students based on BMI classification.

[Table 3] shows that in Underweight students the anatomical regions most affected by pain in the previous 12 months were the lower back (30%), neck region (28 %), upper back (22%) and wrist/hands (19%). In the preceding 7 days, 21% had pain in the neck, 19% in the lower back and 15% in the upper back region. The regions that were most frequently associated with activity limitations due to pain were the lower back (23%), neck (20%) and upper back (14%). In previous last 12 months respondents consult the physician for pain were 11% for neck or back region and 7% for shoulder, wrist and hand. The data graphically represented in figure 3.

Table 3: Prevalence of musculoskeletal symptoms by anatomic region according to the NMQ in underweight BMI category.

Anatomical regions	Pain (last 12 months)	Pain (last 7 days)	Limitation of activities (last 12 months)	Physician consultation for pain (last 12 months)
	Frequency %	Frequency %	Frequency %	Frequency %
Neck	28	21	20	11
Shoulder	20	14	7	7
Elbow	3	6	5	3
Wrist/Hand	19	11	8	7
Upper Back	22	15	14	11
Lower Back	30	19	23	11
Hip/Thigh	7	6	4	3
Knee	19	10	7	3
Ankle/Feet	21	8	6	8

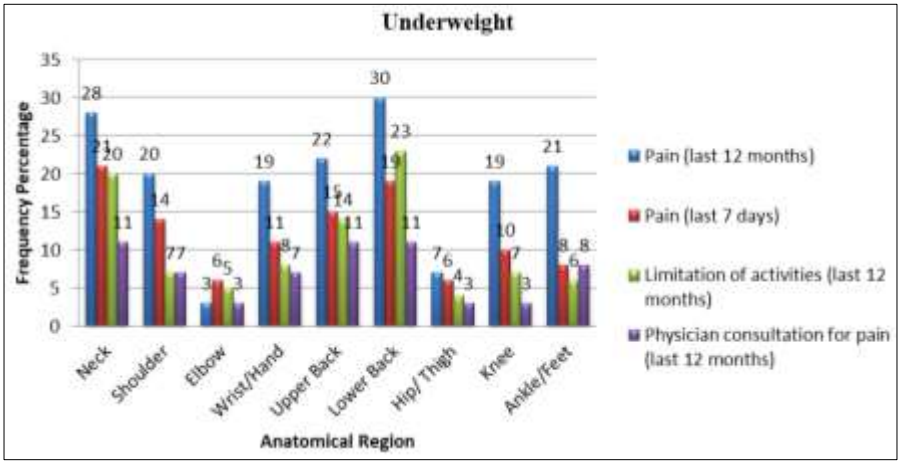

Fig 3: shows frequency percentage distribution of musculoskeletal symptoms of underweight category BMI students

[Table 4]: that in healthy or normal BMI students the anatomical regions most affected by pain in the previous 12 months were the lower back (20 %), neck region (17 %), shoulder (15%) and shoulder, wrist/hands (11%). In the preceding 7 days, 16% had pain in the lower back and 12% in the neck region. The regions that were most frequently associated with activity limitations due to pain were the shoulder (7%), elbow (6%) and neck or upper back (5%). In previous last 12 months respondents consult the physician for pain were 5% for back region and 4% for neck. The data graphically represented in figure 4.

Table 4: Prevalence of musculoskeletal symptoms by anatomic region according to the NMQ in normal/healthy BMI category

Anatomical regions	Pain (last 12 months)	Pain (last 7 days)	Limitation of activities (last 12 months)	Physician consultation for pain (last 12 months)
	Frequency %	Frequency %	Frequency %	Frequency %
Neck	17	12	5	4
Shoulder	15	9	7	3
Elbow	4	1	6	0
Wrist/Hand	11	6	3	1
Upper Back	11	8	5	3
Lower Back	20	16	4	5
Hip/Thigh	8	5	3	2
Knee	8	4	4	1
Ankle/Feet	7	5	3	2

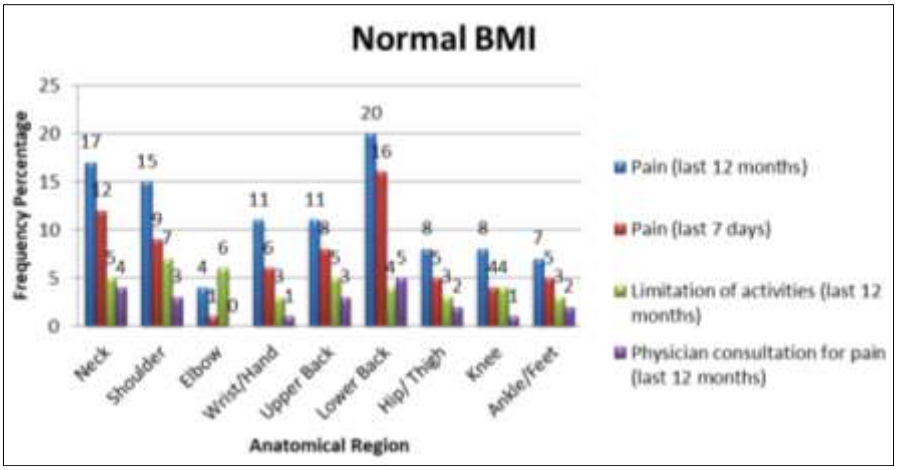

Fig 4: Shows frequency percentage distribution of musculoskeletal symptoms of normal/healthy category BMI students

[Table 5] shows that in Underweight students the anatomical regions most affected by pain in the previous 12 months were the neck (32%), lower back region (31 %), shoulder (27%) and upper back (23%). In the preceding 7 days, 22% had pain in the neck and lower back, 15% in the upper back and 13% in the shoulder region. The regions that were most frequently associated with activity limitations due to pain were the shoulder, hip/thigh (15%), upper back (12 %) and elbow (11%). In previous last 12 months respondents consult the physician for pain were 10% for neck and 7% for lumbar region. The data graphically represented in figure 5.

Table 5: Prevalence of musculoskeletal symptoms by anatomic region according to the NMQ in overweight and obesity BMI category

Anatomical Regions	Pain (last 12 months)	Pain (last 7 days)	Limitation of activities (last 12 months)	Physician consultation for pain (last 12 months)
	Frequency %	Frequency %	Frequency %	Frequency %
Neck	32	22	9	10
Shoulder	27	13	15	6
Elbow	9	3	11	3
Wrist/Hand	22	12	4	3
Upper Back	23	15	12	6
Lower Back	31	22	8	7
Hip/Thigh	14	11	15	2
Knee	18	8	5	3
Ankle/Feet	16	9	6	5

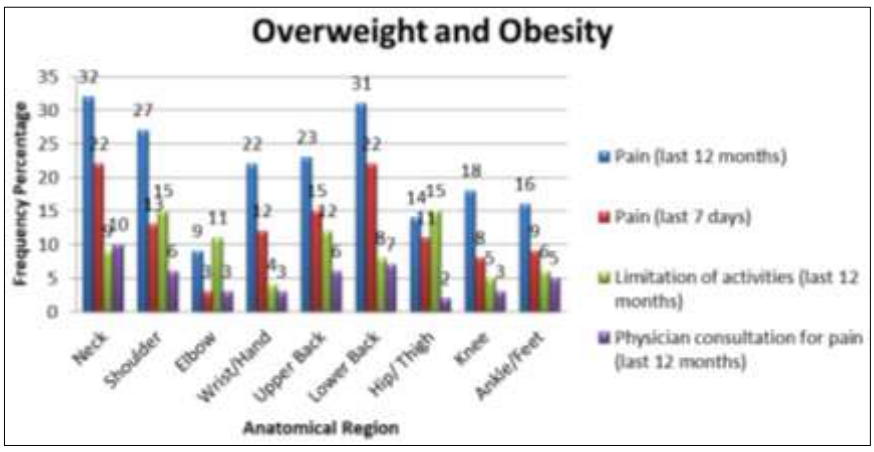

Fig 5: Shows frequency percentage distribution of musculoskeletal symptoms of overweight/obesity category BMI students

[Table 6] shows the summarized results of the correlation analysis between BMI with symptoms during the last twelve months. Overall, the correlations between BMI with symptoms felt by the respondents in all of the body parts covered by the survey were insignificant ($p > 0.05$). Despite BMI scores had a negative correlation with shoulder, wrist /hand (p=.83, r=-0.010; p=0.97, r=-0.001) and positive correlation with the other body parts. When BMI scores were correlated with variables of symptoms felt during the past 7 days, results were significant with negative correlation for shoulder pain (p=.04, r=-0.091) and insignificant ($p > 0.05$) with other symptoms. The results of the correlation analysis between BMI and MSDs with symptoms encountered during the past twelve months with avoidance of work in body parts were insignificant ($p > 0.05$).

Table 6: The relationship between BMI and Musculoskeletal Disorders

Body Parts	12 months period prevalence		Pain (last 7 days)		Limitation of activities (last 12 months)	
	r	P	r	P	r	P
Neck	.007	.86	.006	.89	-0.038	.39
Shoulder	-0.010	.83	-0.091	.04*	-0.037	.41
Elbow	.068	.12	.074	.098	0.66	.14
Wrist/Hand	-0.001	.97	.024	.58	-0.008	.85
Upper Back	.028	.53	.018	.68	.054	.22
Lower Back	.003	.95	-0.003	.94	-0.013	.76
Hip/Thigh	.025	.57	.005	.91	.023	.60
Knee	.021	.64	-0.004	.93	.025	.57
Ankle/Feet	.033	.46	.013	.77	-0.023	.61

*P< 0.05= Significant

Discussion

The present study was investigating the prevalence incidence of MSDs with relation to body mass index among the undergraduate students studying in a University. In total respondents 25% underweight, 48.2% normal or healthy and 26.8% were overweight or obese. The current study revealed no significant correlation between the BMI and MSDs development among students. These results contradict with many studies who stated the positive association between BMI and MSDs [16-19]. Furthermore, a study by Tantawy *et al*. showed a consistent result of non-significant correlation between MSDs and BMI among a University students in different disciplines [9]. The current study findings can be attributed to the majority of participant (48.2%) had normal BMI and developed MSDs so, a high or low BMI not necessary to be an indicator that this person may develop MSDs. There is no much difference among the participants with MSDs with underweight, normal BMI versus overweight. With regard to the 12-month period prevalence, the most commonly reported body part was the lower back with a prevalence of (81 %) followed by the neck pain (77%), shoulders (62%), upper back (56%), wrists and hands (52%), and knees (45%). Further, 45% of the participants reported that the pain was severe enough to interfere with their activities of daily living, and low back pain and neck pain was found to be the most common cause. The current results were somewhat consistent with the findings of Hayes and Smith, who reported a prevalence of 64.3% for neck pain, followed by pain in the lower back (57.9%), shoulders (48.4%), wrists and hands (42%), upper back (41.2%), and knees (26.2%) among dental hygiene students in an Australian university [20]. In another study conducted by Abledu and Offei among undergraduate nursing students in Ghana reported a similar 12-month period prevalence with neck pain being the most common (28%) followed by pain in the upper back (27.4%), lower back (23.6%), wrists and hands (22.9%), and hips and thighs (21%); in addition, 56.1% reported functional impairment due to pain [11].

In the current study, in 7-day point prevalence the most common sites being the upper and lower back (57%) followed by the neck (55%), upper back (38%) and shoulders (29%). Smith *et al*., reported a very similar 7-day prevalence of 67.6% among Chinese medical students, with low back pain being the most common (20.8%) followed by the knees and neck (12.1%). They concluded that musculoskeletal symptoms present in the students may be due to great academic stress, excessive use of mobile phones, sedentary life style, faulty posture etc. Smith *et al*. showed that Chinese medical students who reported higher levels of mental pressure were 2.9 times more likely to develop low back pain over 12 months, thus indicating that high mental pressure is a risk factor for low back pain [21].

Conclusion

The current study concluded that the prevalence of musculoskeletal symptoms was high among the study participants. However, there were no significant relationship between MSDs and BMI. So, it is concluded that BMI was not a risk factor for developing MSDs among undergraduate university going students. More subjects were needed to test this relationship further and contributing factors.

Limitations

The results of this study are limited because of the use of a self-reported questionnaire which is affected by the subject status of the students and a recall bias. There was an unequal ratio of male and female. Most of the respondents had a normal BMI and Physical activity level was also not included. Further studies can take with a large sample size, equal gender distribution, participants with equal BMI category and their physical activity level.

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Conflict of Interest

The authors declare that they have no Conflict of Interests.

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