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Association Between Body Mass Index and Low Back Pain: A Retrospective Observational Study

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ABSTRACT

Background: Low back pain (LBP) affects around 80% of adults globally and is a leading cause of healthcare visits. Simultaneously, obesity is a growing concern, with 13% of adults obese and 39% overweight. Rising obesity rates, combined with increased longevity from improved healthcare, have heightened musculoskeletal pain risks, especially LBP. This study explored the LBP-BMI relationship using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI).

Methods: A double-centred, Retrospective observational study of 2508. All patients aged 36 years and above, presenting with lumbago to spine clinics at two tertiary care hospitals between January 2023 to March 2024 were included in the study via convenience sampling technique. The major components for the evaluation of patients in our study were BMI, VAS for pain, Oswestry disability using VAS, and ODI. Mean and a chi-square test were applied with frequencies, and a p-value <0.05 was considered significant using SPSS v 24.

Results: 1468 patients were overweight, with 43.8% (1098) experiencing severe disability according to ODI (p<0.017). Additionally, 34.3% of patients reported severe back pain, predominantly those with a BMI of 25-29.9 (p<0.048). Notably, 58.5% of patients with back pain had a BMI of 25-29.9, Punjabi ethnicity was most affected, with 60.26% having a BMI >25.

Conclusion: The study highlights a significant association between LBP and BMI, emphasizing the need for a holistic, interdisciplinary approach to manage this multifaceted condition effectively. These findings underscore the importance of addressing obesity as a key factor in LBP management and improving patient outcomes.

Keywords: Quality of Life, Low Back Pain, Body Mass Index, Visual Analogue Scale, Risk Reduction Behaviour.

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INTRODUCTION

Low back pain (LBP) is estimated to be experienced by eight out of 10 adults during their lifetimes and it may comprise the main reason for seeking healthcare among individuals across all ages in almost every nation worldwide[1,2]. Of those, between 70-85% suffer from pain classified as low back pain, described to come between the last ribs and lower gluteal folds with or without discomfort in one or both legs[3]. Most of these patients complain of non-specific low back pain which cannot be related to spinal fractures, malignancies, or inflammatory and infectious causes as an underlying cause[2]. About 15 to 45% of people in the world have low back pain. The impact of low back pain is soaring as the global population ages and it is now the number one cause of disability worldwide. One-year prevalence is 47%, meaning that around five in every ten people experience LBP yearly[4,5]. During middle age, LBP is more frequent than among younger people because of diminishing levels of physical activity and changes in the spine that take place with aging. In addition, LBP has a higher prevalence in women compared with men, possibly due to hormonal and anatomical differences[6]. People in low and middle-income countries are likely to be confronted with increasing disability as a result of the epidemic rise in back pain, but are least able to cope due to these regions having fewer social and health resources[4].

Conversely, the obesity rate worldwide is increasing, with 10–15% of people being defined as obese and about 40% overweight in adulthood[7]. Risk factors for LBP considered in this context are obesity, smoking, and physical activity status, amongst others, to assess the weight of these risk factors vs data on chronic pain[5]. Obesity is commonly based on a specific BMI metric, where "(BMI: weight [kg]/ height [m]^2)". Obesity is defined as a BMI of more than 30 kg/m^2 by the WHO[8]. As of 2016, 39% of adults (39% of men and 40% of women) were overweight, in the same year; found that adult obesity globally has nearly tripled since 1975, According to WHO 13% of adults worldwide were obese (11% of men and 15% of women)[9]. According to the Global Burden of Disease Study 2016, rates of obesity and average years lived by those with obesity are increasing. Women tend to live longer but are also at greater risk of developing musculoskeletal pain conditions, such as low back pain[10].

Because of the high incidence rates for both conditions and mounting suggestions that a link between obesity and low back pain has its foundation in common etiological factors, many studies have aimed to explore this relationship further. When a systematic review and meta-analysis of 33 studies were conducted, it was reported that obesity and or overweight not only amplified the risk factor for LBP but also had an evident role in healthcare consultation-seeking behaviour by people suffering from this[11].

This study aimed to determine the relationship between LBP and BMI with Visual analogue score (VAS) & Oswestry Disability Index (ODI). This relationship may help clinicians to recognize and manage lower back pain when it starts in an obese person.

METHODS

A double-centre, retrospective observational study was conducted using the patients' data retrieved from the Doctor's Hospital and Medical Centre, Lahore, and Dr Ziauddin Hospital, Karachi's E-medical records of patients attending the clinic complaining of low back pain between January 2023 and March 2024 (8071123SRORT). Demographic data (age, sex, weight, comorbidities, and BMI) of the participants were documented to assess the risk reduction behaviours of patients with low back pain. Retrospectively, data from 2508 patients were assessed in the clinic, and VAS and ODI were recorded using a convenience sampling technique. Inclusion criteria: All patients > 35 years of age, regardless of sex, with body weight and height measurements obtained upon presentation to the clinic for lower back pain without acute knee joint pain during the visit.

The sample size was calculated with the Epi Ver-24 calculator, and it was based on the authorities of 25 patients with LBP each without LBP to determine an interactional effect between LBP and BMI on the level of disability.

All patients excluded from the study were those who had a history of back surgery, traumatic lower back pain, or spine trauma, any patient with a history of knee or hip surgery, or known cases of Ankylosing Spondylitis, Rheumatoid Arthritis, and spondyloarthropathy.

Spinal radiographs were reviewed with no evidence of traumatic or tumorous pathology. Radiographs of the knee were evaluated in patients, which is a routine procedure in the outpatient department.
To eliminate all other associated parameters, the LBP included was measured using the Oswestry Disability Index (ODI). The severity of pain was recorded using the Visual Analogue Scale (VAS). Age and sex were self-reported by the subjects themselves, and height and weight were measured. The body weights of the participants were measured. Body mass index (BMI) was calculated using the formula weight in kilograms/height in metre^2.

Patients with LBP were evaluated for VAS scores and

ODI scores as independent variables. The covariates are Age, Gender, ethnic group, Body Mass Index (BMI), and Geriatric Dementia Scale (GDS) score. These covariates were pre-chosen based on their relationship with disability and clinical judgment. Mean and a chi-square test were applied with frequencies, and a p-value <0.05 was considered significant. Statistical analyses were performed with SPSS IBM version 24.

RESULTS

Table 1: Demographics

Variable	Frequency (n)	Percentage (%)
Total No. of Patients	2508	100
Male	1126	44.9
Female	1382	55.1
<18.5 (Underweight)	22	0.88
18.5 - 24.9 (Normal)	322	12.84
25 - 29.9 (Overweight)	1468	58.53
30 - 39.9 (Obese)	696	27.75

A total of 2508 patients with low back pain participated in the study. As **Table 1** shows, 1126 (44.9%) of the participants in this study were male, and 1382 (55.1%) were female. Among 2508 patients, there were 22 (0.88%) underweight (BMI < 18.5 kg/m^2), 322 (12.84%) normal weight (BMI 18.5-24.9 kg/m^2), 1468 (58.53%) overweight (BMI 25-29.9 kg/m^2) and 696 (27.75%) became obese (BMI 30-39.9 kg/m^2).

Table 2: Association of BMI with Lower Back Pain via Their Functional Scoring Scales and with Comorbidities and Knee O.A

ODI	BMI				TOTAL	p- Value
	< 18.5	18.5 To 24.9	25 To 29.9	30 To 39.9		
Moderate Disability (21%–40%)	0	10(0.4%)	50(2.0%)	20(0.8%)	80(3.2%)	0.017
Severe Disability (41%–60%)	8(0.3%)	218(8.7%)	1098 (43.8%)	490(19.5%)	1814 (72.3%)	
Crippling Back Pain (61%–80%)	14(0.6%)	92(3.7%)	304(12.1%)	178(7.1%)	588 (23.5%)	
Bed-Bound (81%–100%)	0	2(0.1%)	16(0.6%)	8(0.3%)	26(1%)	
Total	22(0.9%)	322(12.8%)	1468 (58.5%)	696(27.8%)	2508 (100%)	
VAS Pain Score						
Mild (1-2)	0	0	2(0.1%)	2(0.1%)	2(0.1%)	<0.048
Moderate (3-4)	6(0.3%)	26(1%)	92(3.7%)	28(1.1%)	152 (6.1%)	
Severe (5-6)	14(0.6%)	236(9.4%)	886(35.3%)	484(19.3%)	1620 (64.6%)	
Very Severe (7-8)	2(0.1%)	60(2.4%)	480(19.1)	182(7.3%)	724 (28.9%)	
Worst Possible Pain (9-10)	0	0	8(0.3%)	0	8(0.3%)	
Total	22(0.9%)	322(12.8%)	1468 (58.5%)	696(27.8%)	2508 (100%)	
Comorbidities						
Diabetes	12(0.5%)	120(4.8%)	514(20.5%)	374(14.9%)	1020 (40.7%)	<0.001

Hypertension	2(0.1%)	194(7.7%)	328(13.1%)	238(9.5%)	762 (30.4%)	<0.019
Hypothyroid	4(0.2%)	36(1.4%)	70(2.8%)	38(1.5%)	148 (5.9%)	<0.013
Ischemic Heart Disease	0	28(1.1%)	150(6%)	202(8.1%)	380 (15.2%)	<0.028
CVA	0	18(0.7%)	24(0.9%)	16(0.6%)	58 (2.3)	<0.07
More/ Other	4(0.2%)	26(1%)	48(1.9%)	62(2.5%)	140 (5.6%)	<0.063
Kellgren and Lawrence Grading (KNEE O.A)						
Grade - I	2(0.1%)	10(0.4%)	156(6.2%)	78(3.1%)	246 (9.8%)	0.004
Grade - II	6(0.3%)	24(0.9%)	210(8.4%)	114(4.5%)	354 (14.1%)	
Grade - III	4(0.1%)	70(2.8%)	398(15.9%)	206(8.2%)	678(27%)	
Grade - IV	10(0.4%)	218(8.7%)	704(28%)	298(11.9%)	1230 (49%)	
Total	22(0.9%)	322(12.8%)	1468 (58.5%)	696(27.8%)	2508 (100%)	

As can be seen in **Table 2**, the participant's Body Mass Index was compared with parameters such as lower back pain functional scoring scales and co-morbidities. Then when we carried out statistical analysis on the association of Oswestry Disability Index with BMI, ODI revealed that among patients needing help to stand up, 22.9% were underweight, 44.2% normal weight and 32.9% overweight. There were no underweight patients in the worst class for ODI grade 5, however and equally it consisted entirely of overweight or obese (body mass index >30) people. On patients in ODI grade 6, which is classically described as the 'crippled' class, there were no under-sized individuals and 58 (32.5 new low %) who were normal weight. There were no underweight people in the worst cases of weight group. At the bed bound level, 0 were underweight, normal weight00 was of If we give bedridden patients a weight of obese and 71 over their optimal BMI, (up to 29% increase. the p value for this is p = 0.017.

Also, in **Table 2** Visual Analogue scale scores is compared against the BMI of participants. No patients (0%) with a BMI in the underweight and normal weight ranges had mild pain on the scoring scale. Where 2 (50%) patient were in overweight weight category, and 02 (50%) were in obese. For those with moderate pain, 6 (3.9) were underweight, 26 (17.1) normal weight, 92 (60.5) were overweight and obesity had 28 (18.4). Patients with severe pain were 14 (0.9%) underweight, 236 (14.6%) normal weight, 886 (54.7%%) overweight and 484 (29.9%) obese. Among participants, 2 (0.3%) were underweight, 60 (8.3%) were normal weight, 480 (66.3%) were overweight and 182 (25.1%) obese most graded you pain as Very severe due to their condition with regard to your pain Overweight & Obesity & Noobesity & Grading the pain desperate death Finally, assigning the maximum pain category, all patients (8 patients=100%) were overweight. This was associated with a P value of P=0.048.

At study time, most of the participants were diagnosed with multiple co morbidities. Out of total 2508 participants, DM diagnosed in 1020(40.7%) with a p-value of <0.001 and HTN in 762 (30.4%) with a p-value of <0.019, similarly all the p-values were 0.013, 0.028, 0.07, 0.063 for hypothyroidism, IHD, CVA and others respectively, with the last two having insignificant p-values. Based on BMI of participants, DM incidence was as follows, 12 (1.2%) underweight, 120 (11.8%) normal weight, 514 (50.4%), overweight and 374 (36.7%)obese. HTN patients group when compared with BMI among participants were found: 2 (0.3%) underweight, 194(25.6%) normal weight, 328(43.0%) overweight and 238(31.2%) obese. P value was P= 0.09.

We also considered associations of BMI with Kellgren and Lawrence Knee Osteoarthritis grading. For the overweight participants, relative to all patients in grade category, 156 (63.4%) were grade I knee osteoarthritis, 210 (59.3%) were grade II, 398 (58.7%) and 706 (57.4%) respectively with grade III and IV category in the knee osteoarthritis score. In the group of patients with obese, when examining all patients per grade level categories, 78 (29.3%) have grade ≤ 1, 114 (32.2%) have a grade II, while116 (30.4%) with a score III and298 (24.2)% within the I [45%] or IV [55%] category For this, the P value was P=0.004.

Table 3: Association of Patient Ethnicity with Lower Back Pain with Religious Practices, and Smoking

BMI	Ethnicity					TOTAL (N)	P-Value
	Punjabi	Pathan	Baloch	Sindhi	Urdu Speaking		
< 18.5 (Underweight)	6(27.27%)	4(18.18%)	0(0)	4(18.18%)	8(36.31%)	22(0.88%)	<0.017
18.5 - 24.9 (Normal)	90(27.94%)	80(24.85%)	30(9.32%)	64(19.88%)	58(18.01%)	322(12.84%)	
25 - 29.9 (Overweight)	450(30.66%)	366(24.93%)	90(6.13%)	318(21.66%)	244(16.62%)	1468(58.53%)	
30 - 39.9 (Obese)	206(29.60%)	194(27.87%)	76(10.92%)	116(16.67%)	104(14.94%)	696(27.75%)	
Total	752 (30.0%)	644 (25.7%)	196 (7.8%)	502 (20.0%)	414 (16.5%)	2508 (100.0%)	
Gender							
Female	406(29.38%)	308(22.29%)	102(7.38%)	316(22.87%)	250(18.09%)	1382(55.1%)	<0.0018
Male	346(30.73%)	336(29.84%)	94(8.35%)	186(16.52%)	164(14.56%)	1126(44.9%)	
Total	752(29.98%)	644(25.68%)	196(7.81%)	502(20.02%)	414(16.51%)	2508(100%)	
Religious Practice							
Islam	608(30.87%)	644(32.69%)	176(8.93%)	294(14.92%)	248(12.59%)	1970 (78.55%)	<0.16
Hinduism	22(9.1%)	0	0	206(85.12%)	14(5.78%)	242(9.65%)	
Christianity	122(44.2%)	0	0	2(0.73%)	152(55.07%)	276(11.0%)	
Other	0	0	20(100%)	0	0	20(0.8%)	
Total	752(29.98%)	644(25.68%)	196(7.81%)	502(20.02%)	414(16.51%)	2508(100%)	
Tobacco Smoking							
Non-Smoker	338(30.78%)	286(26.05%)	84(7.65%)	226(20.58%)	164(14.94%)	1098 (43.78%)	<0.02
Smoker	354(29.75%)	310(26.05%)	88(7.39%)	222(18.66%)	216(18.15%)	1190 (47.45%)	
Casual/Social Smoker	60(27.27%)	48(21.82%)	24(10.91%)	54(24.55%)	34(15.45%)	220(8.77%)	
Total	752(29.98%)	644(25.68%)	196(7.81%)	502(20.02%)	414(16.51%)	2508(100%)	

In **Table 3**, the study participants are divided by ethnicity and their comparison with BMI. Of 2508 patients, there were 752 (30.0%) Punjabi, 644 (25.7%) Pathan, 196 (7.8%) Baloch, 502 (20.0%) Sindhi and 414 (16.5%) Urdu-speaking patients documented. Among the obese patients, 206 (27.4%) were Punjabi, 194 (30.1%) Pathan, 76 (38.8%) Baloch, 116 (23.0%) Sindhi and 104 (25.1%) Urdu speaking. Ethnicity is also compared with sex, the practice of religion, and smoking tobacco. Ethnicity was also associated with the geriatric depression scale. Among the asymptomatic patients, there were 182 Punjabi, 196 Pathan, 98 Baloch, 214 Sindhi, and 96 Urdu-speaking individuals.

DISCUSSION

It was a retrospective observational study that had as its primary objective to evaluate the association between Lower Back Pain with Body Mass Index by Visual analogue score (VAS) & Oswestry Disability Index (ODI). LBP presents a major health issue in this day and age, affecting much of the population[12]. Those who demonstrate extreme disability secondary to either acute or chronic LBP, limited function, and participation in society, have on average poor quality of life[13]. In our study, we examined functional capacity measurements in people with LBP. Our results showed a statistically significant relationship between LBP and BMI. We hope that these results will provide the impetus for new treatment protocols or strategies, along with devising preventive strategies and above all advancing the quality of life in patients.

We examined patients with proven LBP in the study, having a strong correlation with their BMI. Because LBP is highly prevalent throughout society, the consequential disability burden directly resulting from it contributes significantly to health care utilization, at least in part of the community. It is important to know the causes of such disability. Previous research has been done on this, highlighting the cause of back pain. We aimed to strengthen these conclusions and explore any additional implications of our study. Results of our survey reveal that the female presentation in terms of complaining about LBP was greater than that of males. Although these findings are preliminary, they are interesting and need more study to understand if they have any implications for subtype-specific treatment. Our findings are consistent with those of other studies, generally analysing this association[14]. In a healthy population from Spain, the female gender was a risk factor for chronic low back pain with an OR of 1.706[15].

Other known risk factors for LBP have also been reported, including age, sex, smoking, low income, low education, occupations, sedentary lifestyle,

and depression. This study also compared the co-morbidities of the participants with their BMI[16,17]. It revealed that more participants with Diabetes and Hypertension were diagnosed in the overweight and obese group.

Numerous studies have been conducted throughout the years to research and analyze this relationship between overweight and obesity on one side and LBP on the other side. Individuals in the highest BMI category (BMI > 34.9) are two times as likely to have LBP compared with those at a healthy weight (Normal BMI)[18]. Additionally, analyses from recent US-based cross-sectional national health survey data showed that the odds of reporting incident LBP during the past three months was approximately 1.27(95% CI: 1.16-1.38) higher in overweight, and 1.72 (95% CI: 1.60-1.85) times higher in obese patients. Another research said that high BMI can obtusely correlate with the prevalence of LBP[19]. In our study, we looked at disability according to the ODI and subsequently assessed it concerning BMI, showing a significant influence on BMI. Disability was twice as common in overweight or obese people, and all deficits were more likely to be related to obesity.
Simultaneously, the participants were rated on their Visual Analogue Score and correlated with BMI. This yielded a similar finding as the ODI score, that more participants in higher pain thresholds were overweight and obese. Most studies have concluded active pain correlates with obesity[20]. We also studied patients with Knee O.A using the Kellgren and Lawrence knee osteoarthritis grading system for their plain knee radiographs. The patients all received a grade on the scale, after evaluating their radiographs. The majority of affected patients were either overweight or obese across all grades. Therefore, according to various parameters evaluated by our study, we can conclude that BMI has a direct relationship with LBP. Multiple case-control studies have shown a positive association between increased BMI and disc herniation at the lumbar level. Lumbar disc herniation is a significant source of LBP and lumbosacral radicular pain[21].

In-depth studies have been carried out, and several mechanisms have been suggested to explain the relation of obesity with LBP. A proposed theoretical model is that the mechanical load on our lower back, an inevitable consequence of being overweight and obese, would cause a greater compressive force in the spine during different physical activities[22]. Increased rates of injuries, along with systemic and chronic inflammation in obese individuals, may be the second mechanism. This is why obese patients produce higher amounts of cytokines and pro-inflammatory substances (elevated tumour necrosis factor-alpha, TNF-a, interleukin-6 or blood IL levels), leading to pain[23].

Also, our study was significant in that we included local ethnicities to determine the association between ethnicity and some parameters. This would help the government to frame better and more efficient plans to control LBP, obesity etc. All ethnicities have trended toward a higher percentage of people being overweight or obese. This is consistent with earlier local studies which have revealed a high frequency of overweight and obesity in the adult Pakistani population[24].

It would make sense, logically, to start campaigns to come up against the now widely known terrible source of obesity and what it produces. Among the benefits proven by these researches is weight loss for patients with osteo-muscular problems like a physical exercise program can also be included in the management plan, which has an important role in chronic back pain patients get back to their normal daily activities and work[25].

CONCLUSION

It is established from this research that a significant association between Lower back pain exists with patients having higher BMI. Stating that higher BMI plays an essential role in terms of pain severity and disability. It was also found that patients with a BMI greater than or equal to 25 were more likely (7 times) to have persistent pain, compared with normal-weight individuals. This underscores the growing importance of strategies that may help to decrease low back pain, especially through focusing on obesity as a modifiable risk factor. They are particularly relevant due to the massive global increase in obesity rates and related diseases, especially with respect to low back pain but also general musculoskeletal health.

LIST OF ABBREVIATIONS

BMI Body Mass Index
VAS Visual analogue scale
ODI Oswestry Disabaility Index
LBP Low Back Pain
IRB Institutional Review Board
KOA Knee Osteoarthritis
DM Diabetes Mellitus
HTN Hypertension
IHD Ischemic Heart Disease
CVA Cerebral Vascular Accident

CONFLICT OF INTEREST

None

PATIENT CONSENT

Written informed consent was taken from all participants before their inclusion in the study.

ETHICAL APPROVAL

The ethical approval for the current study was obtained from the Ethical Review Committee at Ziauddin University, Karachi, under reference number (8071123SRORT).

AUTHORS' CONTRIBUTIONS

SRB: contributed substantially to the work's concept and design, analyzed and interpreted the data, performed a final review and approved the final version, and agreed to be accountable for all aspects of the work **MTS:** was involved in the design, data interpretation, and final review of the work **MSR:** was involved in the design and did a final review of the article.

AAL was involved in the design, data interpretation and did a final review of the article and with editing of the article EA: was involved in the design and did a final review of the article and with editing of the article.FK was involved in data analysis and statistical work, along with the final review of the paper.

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