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Research Article

Anthropometric Indicators and Age as Risk Factors for Low Back Pain in General Hospital Staff

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ABSTRACT

Low back pain (LBP) is a leading cause of global disability, significantly impacting work productivity. Known risk factors include age and obesity. However, while Body Mass Index (BMI) is a common indicator of obesity, BMI provides limited insight into true body composition. This study used Bioelectrical Impedance Analysis (BIA) to provide a more precise measurement of fat mass and to analyze its correlation with LBP, along with age and BMI, among employees at the University of Muhammadiyah Malang (UMM) General Hospital. The study used a cross-sectional design involving 112 hospital employees. Age was collected through a questionnaire. Fat mass was measured using the Tanita BC-418, and LBP was assessed using the Nordic Body Map (NBM) questionnaire, which distinguishes between complaints and disabilities. Statistical analysis used the Kruskal-Wallis test for correlations involving LBP complaints (age and fat mass) and the Spearman correlation test for correlations involving LBP disabilities (age and BMI). This study found no statistically significant correlations between the analyzed variables and LBP complaints or disabilities. Spearman's correlation test showed a weak, insignificant relationship between age and LBP disability (r=0.141; p=0.130) and between BMI and LBP disability (r=0.148; p=0.116). Similarly, the Kruskal-Wallis test did not show a significant correlation between age and LBP complaints (p=0.299) or between fat mass and LBP complaints (p=0.564). Conclusion: Age, fat mass, and BMI were not found to be significant predictors of LBP complaints or disability in this specific hospital employee population. These findings suggest that occupational or ergonomic factors may play a more dominant role in the etiology of LBP in hospital staff than anthropometric parameters alone.

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INTRODUCTION

Low back pain (LBP) is a major health problem worldwide and consistently ranks as one of the leading causes of disability worldwide (Halipa & Febriyanto, 2022). LBP is a complex musculoskeletal disorder affecting soft tissues, joints, and the nervous system, manifesting as chronic low back pain that significantly impairs function and daily activities. Importantly, LBP poses significant occupational challenges by limiting workers' capacity, reducing productivity, and imposing substantial economic burdens on healthcare systems and employers. The etiology of work-related LBP is multifactorial and typically results from risk factors such as high workload, poor posture, and repetitive tasks (Rahmadiani et al., 2021). The global prevalence of work-related AJS has been reported to vary from 15% to 45%, highlighting the urgent need to identify specific factors contributing to this condition in high-risk workplace environments such as healthcare settings.

Low back pain (LBP) has an extremely high incidence rate and requires continuous monitoring. The World Health Organization (WHO) reports that the annual prevalence of low back pain varies widely globally, ranging from 15% to 45%, with a prevalence as high as 33% in developing countries (Kumbea et al., 2020). Furthermore, data from the U.S. Bureau of Labor Statistics (BLS) shows that despite a decrease in occupational hazards, approximately 33% of the more than 2.8 million low back pain incidents annually are related to musculoskeletal disorders (Sumigar et al., 2022). This high prevalence is attributed to reduced non-occupational risk factors, particularly age and obesity (Aprilia et al., 2020). The risk of low back pain is known to increase with age, primarily due to natural changes in bone structure and intervertebral discs, which begin around age 30 (Rahmawati, 2021). Similarly, obesity (BMI ≥ 25 kg/m²), typically assessed via body mass index (BMI), leads to a sustained reduction in risk due to increased mechanical load on the spine (Maulana et al., 2016).

Previous studies have consistently confirmed the association between low back pain and occupational factors, including age, body mass index (BMI), workload, and poor posture, particularly among high-risk populations such as hospital staff (Alfiansyah & Febriyanto, 2021; Pangestuti et al., 2020). However, using BMI as a primary indicator of obesity in clinical studies has significant limitations. Although BMI is a simple, easy-to-use indicator of nutritional status, it cannot distinguish between fat mass and lean muscle mass, making it insufficient to accurately assess the true biomechanical and metabolic risk factors for the development of low back pain. Individuals with high muscle mass (good body composition) may be classified as "overweight" based on their BMI, masking the actual obesity risk of individuals with high fat mass. To address this research gap and provide more robust analyses, this study introduces a key innovative technology: bioelectrical impedance analysis (BIA), specifically the Tanita BC-418, to accurately and objectively measure body fat. By combining these superior anthropometric measurements with age and body mass index (BMI), we aim to more precisely identify which factors have more substantial predictive value for back pain in the multifactorial, high-intensity work environment of employees at Muhammadiyah University Malang General Hospital, providing a basis for further research into targeted prevention strategies.

Given the current global problem of low back pain among healthcare workers, the limitations of traditional BMI assessment, and the high prevalence of low back pain among healthcare workers at the University Muhammadiyah (UMM) General Hospital,

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there is a need for targeted research. Therefore, this study aimed to investigate the relationships among age, BMI, and body fat composition (fat mass), and low back pain and disability among healthcare workers at the University Muhammadiyah (UMM) General Hospital. The main objective was to determine which anthropometric measures, especially fat mass, which are not commonly used in this context, are the most critical risk factors for low back pain among healthcare workers. The comprehensive, evidence-based analysis is expected to provide essential insights into the development of evidence-based prevention strategies and ergonomic interventions tailored to the work environment to reduce the prevalence of low back pain in healthcare settings (Refresitaningrum & Paskarini, 2019; Ardeline et al., 2021). Ultimately, this research aims to improve employee health, reduce occupational back diseases, and maximize employee productivity, which is essential for maintaining the quality of medical services in clinical settings.

METHODS

This cross-sectional observational study investigated relationships among independent variables (age, body fat percentage, and BMI) and the dependent variable (back pain) among active employees of Muhammadiyah University Hospital Malang (UMM). All participants were hospital employees. The minimum sample size (N) was calculated using descriptive survey methods (if available) for known populations and Lemeshow methods for unknown populations. This usually provides a sample size of $N \approx 97$ (assuming $Z = 1.96$, $P = 50\%$, and $d = 10\%$). A total of 112 participants were included in the study using stratified sampling until the required sample size was reached. Participants were active UMM employees who provided written informed consent, completed all questionnaires, and had their anthropometric parameters measured. Exclusion criteria included certain medical conditions that were the primary cause of their back pain. These conditions included herniated discs, scoliosis, history of vertebral fractures, and systemic inflammatory diseases (e.g., rheumatoid arthritis). This study was approved by the ethics committee of Muhammadiyah University of Malang with number E.5.a/178/KEPKUMM/VI/2023.

Data collection included anthropometric measurements and back pain assessment. Body mass index (BMI) was calculated using the following formula: BMI = weight (kg) / height (m)². BMI classification was performed according to WHO/Asia Pacific standards (underweight, normal weight: ≥ 18.5–22.9 kg/m²; overweight: ≥ 23.0 kg/m²; obesity: ≥ 25.0 kg/m²). Body fat percentage (percentage and/or tissue fat content) was objectively measured using a Tanita BC-418 bioelectrical impedance analysis (BIA) device according to the instructions for use. Low back pain was assessed using the Nordic Body Map Questionnaire (NBM). The NBM assesses the presence, location, and intensity of pain while walking over the past 12 months and 7 days. In this study, low back pain was defined in two ways: 1) presence of low back pain (yes/no) and 2) worsening/intensity of low back pain: severe or disabling symptoms, as assessed by specific components of the NBM or relevant worsening scales (e.g., Oswestry Disability Index, if available and used). Age was divided into hierarchical groups (e.g., 17–25 years, 26–35 years, 36–45 years). Data analysis was performed using SPSS version 26. Bivariate analyses examined relationships between variables. Since the low back pain data were considered ordinal (and not normally distributed), the Mann-Whitney U test was used to correlate low back pain with age and obesity.

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Because the data did not meet the assumption of normality (or the Pearson correlation test was not applicable), Spearman's rank correlation coefficient was used to assess the association between worsening/severity of back pain and age and BMI. The significance threshold was set at $p < 0.05$.

RESULTS

Characteristics of Respondents

Table 1. Distribution of respondents based on age, fat mass, BMI, and LBP

No	Variable	Respondents	Percentage (%)
1	Age		
	Late adolescence (17–25)	27	24.1
	Early Adulthood (26–35)	49	43.8
	Late Adulthood (36–45)	27	24.1
	Early Elderly (46–55)	9	8.0
	Total	112	100.0
2	Fat mass		
	Healthy (VFR 1 – 12)	97	86.6
	Excessive (VFR 13 – 59)	15	13.4
	Total	112	100.0
3	BMI		
	Underweight	5	4.5
	Normoweight	32	28.6
	Overweight	44	39.3
	Obese	31	27.7
	Total	112	100.0
	LBP complaints		
4	Without complaint	52	46.4
	With complaints	60	53.6
	Total	112	100.0
	LBP disability		
5	Mild disability (0 – 20%)	102	91.1
	Moderate disability (21 – 40%)	5	4.5

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	Severe disability (41 – 60%)	5	4.5
	Total	112	100.0
	Gender		
6	Male	50	44.6
	Female	62	55.4
	Total	112	100.0
	Division		
7	Medical	24	21.4
	Nonmedical	88	78.6
	Total	112	100.0

Table 1 presents the frequency distribution, indicating that the most prevalent age group among the study participants was 26–35 years (43.8%). Most respondents had a healthy fat mass category (VFR 1–12), accounting for 86.6%. The highest proportion of respondents was in the overweight category, at 39.3%. Complaints of LBP were reported by 53.6% of respondents, whereas the most common level of LBP disability was mild.

Age-LBP Correlation

Table 2. Association between Age and Low Back Pain (LBP) Complaints

Age Group	No Complaint n (%)	Mild Complaint n (%)	Moderate Complaint n (%)	Total n (%)	P-value
Late Adolescence (17–25)	7 (25.9%)	20 (74.1%)	0 (0.0%)	27 (100%)	0.299[a]
Early Adulthood (26–35)	29 (59.2%)	18 (36.7%)	2 (4.1%)	49 (100%)	
Late Adulthood (36–45)	11 (40.7%)	15 (55.6%)	1 (3.7%)	27 (100%)	
Early Elderly (46–55)	5 (55.6%)	4 (44.4%)	0 (0.0%)	9 (100%)	
Total	52	57	3	112	

Note:
[a] Analyzed using the Kruskal-Wallis Test (Global p-value)

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Table 2 shows that the percentage of moderate LBP in the early adulthood group (26–35 years) was lower than in the 36–45 and 46–55 age groups (36.7%, 55.6%, and 44.4%, respectively). Meanwhile, the rate of mild LBP in the 26–35 age group was higher compared to the 36–45 and 46–55 age groups, with respective percentages of 4.1%, 3.7%, and 0.0%.

Based on the Kruskal-Wallis test results presented in Table 2, there was no statistically significant relationship between age and LBP complaints ($p > 0.05$). A more detailed analysis of LBP severity by age group is presented in Table 3.

Table 3 shows a significant difference in LBP severity between respondents aged 17–25 and those aged 26–35 ($p = 0.013$). However, no significant differences were found in other age group comparisons ($p > 0.05$). Descriptively, respondents in the 26–35 age group exhibited moderate LBP, whereas those aged 17–25 years predominantly experienced mild LBP.

Based on Table 4, among 112 respondents, the most frequent category was mild disability, with the highest prevalence in early adulthood, accounting for 52 respondents. The Spearman correlation analysis presented in the table indicates no significant relationship between age and LBP ($p> 0.05$). The correlation coefficient was positive, suggesting that the risk of LBP increases with age. However, with a correlation coefficient of 0.144, the relationship between age and LBP is classified as weak. Overall, the findings of this study indicate no significant association between age and LBP complaints.

Table 3. Post Hoc Mann-Whitney test for age-LBP complaints correlation

Age	P-Value
Late adolescence and early adulthood	0.013
Late adolescence and late adulthood	0.360
Late adolescence and early elderly	0.107
Early adulthood and late adulthood	0.152
Early adulthood and early elderly	0.921
Late adulthood and early elderly	0.404

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Table 4. Distribution of Low Back Pain (LBP) Disability Levels by Age Group and Statistical Correlation Analysis

Age Group	LBP Disability Level				Statistical Analysis	
	Mild	Moderate	Severe	Total (n)	p-value	Coefficient (r)
	n	n	n			
Late Adolescence (17–25)	22	2	0	24		
Early Adulthood (26–35)	52	1	1	54		
Late Adulthood (36–45)	22	1	4	27	0.13	0.144
Early Elderly (46–55)	6	1	0	7		
Total	102	5	5	112		

Fat Mass-LBP Correlation

Table 5. Crosstabs test and Statistical Correlation Analysis for fat mass-LBP complaints

Fat mass	LBP Complaints			Total	P value
	No complaint	Mild	Moderate		Chi square
Healthy (VFR 1 – 12)	44	50	3	97	
Excessive (VFR 13 – 59)	8	7	0	15	
Total	52	57	3	112	0.564

Table 5 indicates that among 97 respondents with a healthy fat mass, the majority (51.5%) experienced mild LBP, while 45.4% reported no LBP complaints. Additionally, all respondents who experienced moderate LBP were within the healthy fat mass category. Meanwhile, among respondents with excessive fat mass, the majority (53.3%) reported no LBP; however, the difference compared with the healthy fat mass group was not substantial. Table 5 shows no significant relationship between fat mass and LBP complaints ($p > 0.05$). In the correlation analysis of these two variables, the chi-square test assumptions were not met (expected counts <5 or >20% of cells), necessitating the Mann-Whitney test as an alternative to the chi-square test for a 2×2 analysis. Results for fat mass analysis by LBP severity are presented in Table 6.

Table 6 indicates that no significant relationship exists between fat mass and LBP complaints ($p = 0.504$).

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Table 6. Mann-Whitney test for fat mass-LBP correlation

	Fat Mass	N	Mean Rank	Sum of Ranks
LBP	Healthy	97	57.21	5549.00
	Excessive	15	51.93	779.00
	Total	112		

Body Mass Index-LBP Correlation

Table 7. Crosstabs test for age-LBP disability correlation

BMI	LBP Disability			Total	P-Value	Correlation Coefficient (r)
	Mild	Moderate	Severe			
Underweight	5	0	0	5	0.116	0.149
Normoweight	29	2	1	32		
Overweight	42	1	0	44		
Obese	25	2	4	31		
Total	102	5	5	112		

Based on the tables above, among the 112 respondents, the most common category was mild disability, with 43 respondents classified as overweight. The results of the Spearman correlation analysis presented in the table indicate a non-significant relationship (>0.05) between Body Mass Index (BMI) and LBP. The positive correlation coefficient suggests that the risk of LBP increases with increasing BMI and vice versa. However, the correlation coefficient of 0.149 falls within the weak range for the association between BMI and LBP. The study results indicate no significant relationship between BMI and LBP complaints.

DISCUSSION

Characteristics of Respondents

These results suggest that age is not a statistically significant factor affecting the prevalence of low back pain among hospital staff. These findings are consistent with the hypothesis that the prevalence of low back pain increases with age, especially in adults in their 30s and 40s, which is generally attributed to degenerative changes in the intervertebral discs and bones that occur around the age of 30 (Grace et al, 2021). Although aging is a natural biological process that leads to morphological changes and decreased tissue strength (Rios, 2019; Asvina et al., 2023), the lack of significant correlations observed in this study may be due to the work- and work-high-demand roles of respondents. Thus, in this particular population, exposure to individual or cumulative workplace risk factors (e.g., patient handling, prolonged static postures) may have a greater impact on the incidence of low back pain than early physical age. This highlights the need to emphasize ergonomic interventions in hospitals, rather than focusing solely on demographic risk reduction.

Based on respondents' characteristics, most had a BMI that was classified as overweight. Increased BMI is associated with multiple mechanisms contributing to LBP, including (1) increased risk of accidental injury; (2) chronic inflammation

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due to overweight and obesity, leading to elevated production of pro-inflammatory cytokines and acute-phase reactants that can cause pain; (3) a strong correlation between LBP and conditions such as hypertension and dyslipidemia; and (4) overweight and obesity contributing to bone degeneration, resulting in reduced spinal mobility due to increased body weight (Mahfud et al., 2022). According to Siddiqui et al., excessive weight gain places greater mechanical stress on the lumbar vertebrae, triggering a series of changes that can worsen LBP. Studies have demonstrated that overweight or obese patients undergoing treatment for LBP experience better outcomes when they lose weight. This improvement is often associated with intervertebral disc degeneration, as increased body weight can damage spinal structures, including the discs, joints, and ligaments.

Age-LBP Correlation

The analysis revealed no statistically significant correlation between age and low back pain complaints in the study population. This lack of correlation suggests that although biological aging is known to be associated with tissue degeneration and reduced spinal stability (Aswina et al., 2023), it does not represent a significant risk factor for low back pain in this specific work setting. Furthermore, when examining the severity of low back pain across age groups, we observed a higher prevalence of mild low back pain in the youngest age group (early adolescence) than in older age groups. In contrast, the prevalence of moderate-to-low back pain was more pronounced in late and early old age. This suggests that although the incidence (number of complaints) of low back pain remains statistically consistent across age groups, the nature or severity of low back pain may change over time. Our finding of no significant correlation between age and low back pain complaints is consistent with previous research, such as the study by Nurjannah and Situngkir (2022) among factory workers, which also reported no significant correlation between age and low back pain. This result supports the hypothesis that within the workforce, factors directly related to the work environment and job demands may have a greater influence than demographic variables such as age.

However, these findings contradict previous studies conducted by (Kusumaningsih et al., 2022; Syarlina & Hidayat, 2019; Wijaya et al., 2019), which reported a significant association between age and LBP complaints. Theoretically, according to (Lyu et al., 2021; Shokri et al., 2023; Xu et al., 2025) The risk of LBP increases with age due to degenerative changes in the bones. Additionally, muscle and bone stability decline as body fluid content decreases over time. This statement aligns with the present study, which found that LBP among individuals aged 26–35 years was moderate, whereas those aged 17–25 predominantly experienced mild LBP.

A comparative analysis of low back pain severity across different age groups revealed important findings. People aged 26 to 35 were more likely to suffer from moderate low back pain, while those aged 17 to 25 predominantly reported mild low back pain. This observation is important because low back pain symptoms typically begin to manifest between the ages of 25 and 65, which coincides with the peak of human productivity (Saputra, 2020). The greater severity of low back pain in the 26-35 age group compared to younger individuals may not be primarily due to biological degeneration (which typically peaks around age 35), but rather to cumulative workplace exposure. As workers transition from late adolescence to early adulthood, they often take on more demanding roles, work longer hours, and are chronically exposed to poor

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ergonomic conditions and high-intensity workloads (Ardeline et al., 2021). Cumulative work stress can accelerate the increase in pain frequency and severity (Saputra, 2020). On the other hand, other studies have observed a decrease in the prevalence of back pain in older populations (e.g., comparing 70-year-old women with 50-year-old women) (Uehara et al., 2021), which can often be explained by a reduction in work exposure and strenuous daily activities. This supports the idea that in working populations, workload and exposure, rather than age alone, are more important determinants of pain severity.

The findings of this study indicate no significant association between age and LBP complaints. This study aligns with the findings of (Alshahrani, 2020), who investigated the prevalence of LBP among nursing staff in Saudi Arabia and concluded that no significant association was found between age and LBP. Age is not considered a primary factor in causing LBP, but rather a contributing factor that interacts with other more dominant factors (Ardeline et al., 2021). Other individual factors that may influence LBP complaints include gender and physical activity (Nikaputra et al., 2020).

The study from Makkiyah suggest that women are at a higher risk of experiencing LBP due to hormonal imbalances (Makkiyah et al., 2023). Pregnancy, contraceptive use, and menopause contribute to fluctuations in estrogen levels. Increased estrogen levels during pregnancy and contraceptive use lead to elevated relaxin hormone levels, which can weaken joints and ligaments, particularly in the lower back region (Nurhafizhoh, 2019). Hormonal imbalances during pregnancy may loosen vertebral ligaments, reducing lower back muscle strength and increasing the risk of LBP. Additionally, menopausal osteoporosis is another factor contributing to LBP in women. Women tend to have a lower pain threshold than men, making them more likely to report LBP symptoms (Makkiyah et al., 2023).

One study highlights that a lack of regular physical activity is a risk factor associated with LBP among healthcare workers (Rezaei et al., 2021). Regular exercise is believed to help maintain proper lumbar alignment by strengthening the core muscles surrounding the lumbar region, thereby increasing tolerance to spinal load. Improving movement patterns through physical activity can prevent excessive strain caused by improper posture. Furthermore, strengthening the back muscles enhances spinal endurance against continuous and repetitive movements. Increased flexibility improves the load tolerance of intervertebral discs, demonstrating the significant role of regular exercise in alleviating and preventing LBP.

According to Aswina et al., one occupational factor influencing LBP among nurses at Bunda Lhokseumawe General Hospital is ergonomics, particularly awkward postures such as bending forward. This posture is often unavoidable for nurses, especially when caring for bedridden patients. Bending forward strains intervertebral discs and increases ligament and muscle contractions that support the spine (Wahyuliyanti et al., 2023). Further, it is emphasized that workload is another risk factor for LBP complaints. The workload experienced by respondents in this study varied significantly, as evidenced by the diverse characteristics of the respondents, which may contribute to the lack of a significant relationship. The absence of a significant correlation may be due to the fact that some workers aged ≤30 years reported LBP, while others aged >30 years did not.

Fat Mass-LBP Correlation

Table 5 shows no significant relationship between fat mass and LBP complaints. This study contrasts with the findings of Indra et

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al. (2021), which investigated the relationship between body fat percentage and the risk of non-specific LBP in university students and found a significant association.

Theoretically, excessive visceral fat contributes to an increase in waist circumference. From a biomechanical perspective, this can lead to additional loading on the intervertebral discs. An increase in waist circumference alters spinal curvature, placing extra strain on the back muscles (Hashimoto et al., 2017). Excess abdominal fat mass can also restrict torso movement, resulting in muscle shortening, reduced joint mobility, and decreased muscle flexibility, all of which increase the risk of pain. Moreover, an increase in abdominal fat mass weakens muscle strength and affects other factors, such as neuromuscular activation and muscle fatigue, ultimately contributing to reduced spinal stability (Park et al., 2018).

Table 6 indicates that there is no significant relationship between fat mass and LBP. When analyzed by LBP severity, respondents with mild or moderate LBP were more often categorized as having healthy visceral fat than as having excessive visceral fat. In other words, most LBP complaints were experienced by respondents with normal visceral fat mass. This phenomenon may be attributed to the multifactorial nature of LBP, suggesting that LBP among employees at UMM General Hospital is not primarily caused by visceral fat mass but rather influenced by other factors. According to research by Ardeline et al. (2021) and Tarwaka & Bakri (2016), external factors play a more significant role in the risk of LBP among hospital employees. These external factors include occupational elements such as work duration, workstation ergonomics, and working posture.

Additionally, a study by (Devi, 2021) found that most individuals with LBP (76.2%) had normal visceral fat levels. However, when analyzed based on subcutaneous fat, they fell into the obese and overfat categories. In this study, LBP was assessed using only one body composition component—visceral fat mass. This limitation may explain why the findings of this study do not align with previous research.

Body Mass Index-LBP Correlation

The study results indicate no significant relationship between BMI and LBP complaints. This finding aligns with the study conducted by (Mahfud et al., 2022), which examined the impact of nutritional status on the prevalence of LBP among nurses at the Masamba Health Center and concluded that no significant association between BMI and LBP complaints was found.

The absence of a significant relationship may be attributed to some workers with a BMI < 30 kg/m² reporting LBP. In comparison, others with a BMI > 30 kg/m² did not experience LBP. According to (Baek et al., 2022) Abdominal fat mass appears to be associated with the development of LBP. While BMI does not correlate significantly with LBP complaints, parameters related to abdominal fat mass such as waist circumference, total fat mass, visceral fat mass, and the fat-to-muscle ratio in the trunk show a significant association with LBP.

Furthermore, total trunk, back, psoas, and abdominal muscle mass is generally higher in men. Although total fat mass does not differ significantly between sexes, fat distribution varies: visceral fat is substantially higher in men, whereas subcutaneous fat is markedly higher in women. As a result, the fat mass-to-trunk muscle mass ratio is considerably higher in women than in men. Subcutaneous fat is beneath the skin, while visceral fat surrounds internal organs. Subcutaneous fat predominantly accumulates in the hip and lower body regions, whereas visceral fat tends

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to accumulate around the waist and abdomen (Mittal, 2019; Susantini, 2021).

LBP is significantly associated with fat mass parameters and the fat-to-muscle mass ratio in women, whereas muscle mass and BMI are not. The narrowing of disc space at the L3/4, L4/5, and L5/S1 levels has been linked to increased fat mass, decreased muscle mass, and an elevated fat-to-muscle mass ratio (Baek et al., 2022). Another possible explanation for this study's lack of a significant relationship is the sample distribution, as most respondents had a BMI < 30 kg/m². According to (Arwinno, 2018), individuals with a high BMI who have strong muscle and bone mass may be protected against LBP. Conversely, individuals with a standard or low BMI who have weak muscle and bone mass may be at an increased risk of experiencing LBP complaints.

This study has several limitations that need to be considered. First, because this study used a cross-sectional design, the causal relationship between anthropometric factors (age, body fat mass, and BMI) and low back pain must be considered. Future research should adopt a longitudinal design to examine the progression of low back pain over time. Second, while the Northern Body Map (NBM) can reliably screen for low back pain symptoms and their severity, it cannot provide the detailed functional assessments found in tools like the Oswestry Disability Index. This indicates that future research should use multiple instruments to assess low back pain. However, this study represents a significant innovation by overcoming the limitations of BMI and introducing bioelectrical impedance analysis (BIA) to measure body fat mass accurately. This method allows for a more detailed analysis of body composition. It confirms that body fat mass itself is not a significant predictor of low back pain in this specific population. Given that non-anthropometric factors may help explain the etiology of low back pain in this context, a possible future direction would be to conduct comprehensive observational studies that combine key physiological variables (age, body composition) with detailed occupational and ergonomic data (e.g., location, functional differences, duration and severity of workplace stress), but this is beyond the scope of this study.

CONCLUSION

Based on the findings and discussion, it can be concluded that neither age nor fat mass significantly influences LBP complaints among employees at Universitas Muhammadiyah Malang General Hospital. However, there is a significant difference in LBP severity between the ages of 17–25 and 26–35. Additionally, the study indicates no significant association between age and Body Mass Index (BMI) with LBP complaints among hospital employees.

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