ASLI QoL2026
Annual Serial Landmark International Conference on QoL2026
Indexed in Clarivate Analytics WoS

E-B
Environment - Behaviour
Proceedings Journal

AicQoL2026Jakarta

e-IPH
e-International Publishing House Ltd., United Kingdom

https://www.amerabra.org/
14th AMER International Conference on Quality of Life
Sunlake Waterfront Resort & Convention, Jakarta, Indonesia, 02-03 Jan 2026

Influence of Demographic, Occupational and Pain Intensity on Low Back Pain among Office Workers

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Abstract
Low back pain (LBP) is highly prevalent among office workers and can impair productivity and quality of life. This study investigated demographic and occupational factors contributing to LBP among administrative employees. A cross-sectional design recruited 105 eligible participants aged 18–60 years. Data were collected using a demographic questionnaire and a Numeric Rating Scale for pain. Significant group differences were found for gender, height, and pain intensity. Logistic regression identified female gender, taller stature, and moderate pain intensity as independent predictors of LBP. These findings underscore the importance of ergonomic interventions tailored to individual worker characteristics.

Keywords: Low back Pain; Office Workers; Occupational Factors; Ergonomics

DOI: https://doi.org/10.21834/e-bpj.v11i35.7548

1.0 Introduction

Experiences of low back pain (LBP) can interfere with daily activities and productivity, and if left unmanaged, may lead to long-term disability and reduced quality of life (Silva et al., 2025). Globally, the burden of LBP continues to rise, increasing from 165 million to 266 million cases between 1990 and 2021, indicating more than a 60% escalation (Wei et al., 2025). In Indonesia, approximately 40.5% of the population is affected, emphasizing LBP as a significant national health concern (Mahmud et al., 2021). LBP is multifactorial, with biological, mechanical, and psychosocial factors contributing to its onset and persistence. Office workers are particularly vulnerable due to prolonged sitting, altered spinal mechanics, and muscle imbalance (Nishimura et al., 2025). Additionally, workplace stress and poor ergonomic conditions further increase risk (Intan et al., 2025).

DOI: https://doi.org/10.21834/e-bpj.v11i35.7548

Although previous studies have extensively examined demographic and occupational factors associated with low back pain among office workers, evidence integrating pain intensity alongside these factors remains limited, particularly within office-based populations in Indonesia. Despite growing attention to occupational health, LBP remains under-recognized and inadequately addressed in office settings, where understanding the interplay between individual and work-related factors is essential to strengthen preventive measures, improve workforce productivity, and reduce healthcare costs. Based on these considerations, this study aimed to: (1) identify the demographic characteristics linked to LBP, (2) determine work-related risk factors that contribute to its development, and (3) establish independent predictors of LBP in an administrative worker population.

2.0 Literature Review

2.1 Office Workers with LBP

Low back pain (LBP) is commonly defined as pain localized to the lumbar spine and is among the most prevalent musculoskeletal conditions among working adults. Among office workers, the severity of LBP is exacerbated by prolonged sedentary work, low physical activity, high job demands, and inadequate sleep duration, all of which contribute to cumulative mechanical and physiological strain on the lumbar spine (Jiang et al., 2025). Consistent with this, Zhang et al. (2025) reported that more severe LBP is strongly associated with improper sitting posture and prolonged static working positions, leading to reduced functional capacity and diminished work performance. Despite growing evidence linking occupational and lifestyle factors to LBP severity, there remains a lack of context-specific data examining how these modifiable risk factors interact within office-based work environments, particularly with respect to physical performance and functional outcomes. This gap highlights the need for further investigation to inform the development of targeted ergonomic and preventive interventions for office workers.

2.2 Demographic Factors Related to LBP

The highest prevalence of LBP was observed in the 35–39-year age group among both male and female participants (Safiri et al., 2023). Women have been reported to experience LBP approximately 2.5 times more frequently than men, potentially due to hormonal factors, particularly estrogen, which may accelerate intervertebral disc degeneration (Intan et al., 2025). Being overweight further increases the risk of LBP, as the additional mechanical load on the lumbar spine can heighten stress on surrounding anatomical structures, leading to cumulative microtrauma and progression toward chronic, disabling pain (Khadour et al., 2025). Accordingly, this study examined demographic characteristics to better understand their association with LBP among office workers. While age, gender, and overweight status remain important predictors of LBP, these factors interact with occupational and psychosocial determinants; therefore, interpretations should consider confounding effects, measurement limitations, and the need for longitudinal data to establish causal pathways.

2.3 Occupational Related to LBP

The widespread prevalence of LBP imposes a significant burden on both individuals and society, as it impairs quality of life, reduces work productivity, and increases healthcare expenditures through complex and multifactorial mechanisms that contribute to chronic stress (Liu, 2025). Individuals with lower educational attainment and limited employment stability have been reported to experience LBP more frequently (Piva et al., 2025). Therefore, this study aimed to examine workplace-related determinants and expectations associated with LBP among office workers, focusing on factors such as job satisfaction, daily sitting time, years of work experience, number of rest days per week, educational level, and prior LBP experience. Although workplace-related determinants such as prolonged sitting, low job satisfaction, limited rest days, and lower levels of education are closely linked to LBP among office workers, the complex interactions among physical, psychosocial, and socioeconomic factors make clear causal interpretation difficult. Most data rely on self-report measures, which may introduce recall and measurement bias. Therefore, longitudinal studies integrating objective ergonomic assessments and psychosocial evaluation are needed to clarify causality and improve targeted prevention strategies.

2.4 Pain Intensity Related to LBP

Chronic low back pain is frequently associated with nociplastic pain mechanisms, which arise from altered nociception without clear evidence of actual or potential tissue damage that would activate peripheral nociceptors, nor any identifiable disease or lesion affecting the somatosensory system (Bonezzi et al., 2020). This concept is supported by previous research indicating that pain intensity in individuals with LBP does not necessarily correlate with structural changes observed in lumbar spine imaging, such as MRI findings (Babińska et al., 2019). Therefore, in this study, it was essential to accurately assess LBP intensity to better understand its clinical impact. While emphasizing nociplastic mechanisms advances understanding of chronic LBP beyond structural pathology, its clinical application is limited by diagnostic ambiguity and the absence of objective biomarkers. Consequently, comprehensive assessment approaches that combine pain intensity measures with functional and psychosocial evaluations are required to better capture the complexity of chronic LBP.

Pain intensity is frequently treated as an outcome measure rather than as an independent predictor, despite growing evidence that pain perception may reflect underlying functional and neuromuscular impairment. Furthermore, many studies rely heavily on structural explanations, such as imaging findings, which do not consistently correlate with pain experience. Finally, context-specific evidence focusing on office workers in Indonesia remains limited. These unresolved issues highlight the need for an integrated approach, which serves as the basis for the current study, which simultaneously examines demographic, occupational, and pain-intensity factors associated with low back pain among office workers.

3.0 Methodology

3.1 Study design and Participants

This study employed a cross-sectional design following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement (Jung et al., 2020). Ethical approval was obtained from the Research Ethics Committee of UiTM (REC/09/2025, PG/MR/486) and the ethics committee of UPNVJ (134/VII/2025/KEP). Faculty members were informed about the study objectives and invited to participate voluntarily. Those expressing interest attended an informational briefing, and written informed consent was obtained before enrollment.

Participants were recruited by the research team based on predefined eligibility criteria. Inclusion criteria were age between 18 and 60 years, independent ambulation with or without assistive devices, and stable, well-controlled comorbid conditions (e.g., diabetes mellitus, hypertension, managed asthma, or controlled thyroid disorders). Exclusion criteria included inability to maintain an upright posture, history of cancer, spinal fracture or neurological disorders, current participation in LBP-focused rehabilitation or fitness programs, spinal surgery within the past six months, pregnancy, or use of medications affecting pain perception or musculoskeletal integrity. A confirmed medical diagnosis of low back pain (LBP) was not required; participants were classified into LBP and non-LBP groups based on self-reported work-related discomfort at recruitment. Eligible administrative staff were enrolled using purposive convenience sampling through informational briefings and voluntary participation, which may have introduced selection bias; therefore, findings should be interpreted cautiously when generalizing to broader office worker populations.

3.2 Outcome Measure

This study employed a structured questionnaire and the Numeric Rating Scale (NRS) as primary outcome measures. Anthropometric data, including height and body weight, were measured objectively using a standard stadiometer and a calibrated digital weighing scale to ensure accuracy and consistency. Pain intensity was assessed using the NRS, which has demonstrated excellent test–retest reliability (ICC ≈ 0.95) and strong construct validity for evaluating chronic and musculoskeletal pain conditions. Participants rated their pain on a scale from 0 (no pain) to 10 (worst imaginable pain), enabling clear classification of pain severity among individuals with LBP (Alessandro et al., 2019).

The structured questionnaire consisted of eight items examining occupational risk factors, including job satisfaction (Yes/No), daily sitting duration (<8 hours, 8 hours, >8 hours), years of work experience (<5 years, 5–10 years, >10 years), and number of rest days per week (Never, 1 day, 2 days, >2 days). These items were adapted from previous occupational health research and reviewed to ensure clarity and content validity. Additional demographic and clinical variables, such as education level and previous history of LBP (Yes/No), were also collected to support risk factor analysis.

3.3 Statistical Analysis

This study's statistical analyses were conducted using IBM SPSS version 25. Descriptive statistics were applied to summarize demographic and occupational characteristics, with quantitative variables presented as means and standard deviations and qualitative variables reported as frequencies and percentages. Group comparison between with and without LBP using the Mann-Whitney U test for continuous data due to the non-normal distribution of data, while the X^2 or chi-square test was used for categorical variables. Associations between potential risk factors and LBP were initially examined using univariate analysis, and variables with a p-value < 0.05 were subsequently entered into a multivariable logistic regression model to identify independent predictors of LBP.

4.0 Findings

This study included 105 administrative office workers aged 22 to 58 years who met the inclusion criteria and participated. The equality of variances was first assessed using Levene's Test. The results indicated that the variances were homogeneous (p > 0.05) for age, body weight, height, and BMI, but not for NRS scores (p = 0.009), suggesting unequal variances for this variable.

The comparison of means between groups showed no significant differences in age (p = 0.054), body weight (p = 0.736), or BMI (p = 0.763) between participants with and without low back pain (LBP). However, a significant difference was observed in height (t = 3.173, p = 0.002), indicating that participants in one group had a significantly higher mean height than those in the other group. Similarly, the NRS score demonstrated a highly significant difference between groups (t = −6.910, p < 0.001), showing that the LBP group experienced greater pain intensity.

Table 1 Demographic Characteristics, Work-Related Factors, and Pain Intensity

Variables	LBP Group (n=64)	Non-LBP Group (n=41)	*p*-value
Gender			
Men	30(28.57%)	32(30.48%)	**X^2=10.04, *p*=0.002**
Female	34(32.38%)	9(8.57%)	
BMI	20 (19.05%)	8 (7.62%)	X^2=3.91, *p*=0.309
Underweight (< 18.5)	30 (28.57%)	27 (25.71%)	

Normal (<24.9)	10 (9.52%)	5 (4.76%)	
Overweight (<29.9)	10 (3.81%)	1 (0.95%)	
Obese			
Age (years)	38.05±11.02	42.51±11.77	U= 1029.5, t=0.063
Under 30 (<31)	20 (19.05%)	9 (8.57%)	
Early middle age (31-39)	18 (17.14%)	11 (10.48%)	X^2=6.69, *p*=0.082
Midlife (40-48)	8 (7.62%)	1 (0.95%)	
50 and older/senior (>48)	18 (17.14%)	20 (19.05%)	
Weight (kg)	69.67±20.57	70.90±13.20	U= 1133.5, t=0.241
Height (cm)	159.7±8.0	164.8±7.9	**U=846.5, t=0.002**
Short (<159)	28 (26.67%)	6 (5.71%)	
Medium (159-173)	33 (31.43%)	28 (26.67%)	**X^2=11.77, *p*=0.002**
Tall (>173)	3 (2.86%)	7(6.67%)	
BMI (kg/m^2)	21.80±6.28	21.47±3.66	U=1246.5, t=0.667
Job satisfaction			
Yes	62 (59.05%)	39 (37.14%)	X^2=0.21, *p*=0.643
No	2 (1.90%)	2 (1.90%)	
Physical exercise every week			
Yes	39 (37.14%)	28 (26.67%)	X^2=0.58, *p*=0.444
No	25 (23.81%)	13 (12.38%)	
Prolonged sitting (hours)			
<8	28 (26.67%),	19 (18.10%),	
8	19 (18.10%),	10 (9.52%),	X^2=035, *p*=0.836
>8	17 (16.19%)	12 (11.43%)	
Length of employment (years)			
<5	17 (16.19%),	9 (8.57%),	
5-10	17 (16.19%),	5(4.76%),	X^2=4.49, *p*=0.114
>10	30 (28.57%)	27(25.71%)	
Rest a week (day)			
Never	4 (3.81%),	1 (0.95%),	
1	21 (20%),	10 (9.52%),	X^2=2.64, *p*=0.473
2	38 (36.19%),	28 (26.67%),	
>2	1 (0.95%)	2 (1.90%)	
Education level			
High school	11 (10.48%)	6 (5.71%)	
Diploma	14 (13.33%)	6 (5.71%)	X^2=2.74, *p*=0.433
Bachelor	27 (25.71%)	26 (24.76%)	
Magister	13 (12.38%)	6 (5.71%)	
LBP experience at work			
Never	-	19 (18.10%)	
Rarely	30 (28.57%)	22 (20.95%)	
Once a month	9 (8.57%)	-	**X^2=51.67, *p*=0.000**
Once a week	11 (10.48%)	-	
Everyday	14 (13.33%)	-	
NRS (0-10)	4.08±2.41	1.17±1.43	**U=377.5, t=0.000**
Light (0 – 3)	12 (11.43%)		
Medium (3.1 – 6)	27 (25.71%)	37 (25,24%)	**X^2=24.92, p=0.000**
High (6.1 – 10)	25 (23.81%)	4 (3.81%)	

Table 1 presents the baseline characteristics of the study population, comparing office workers with and without low back pain (LBP). Significant differences ($p < 0.05$) were observed for height ($p = 0.002$) and Numeric Rating Scale (NRS) scores ($p < 0.001$). Significant differences were observed for gender ($p = 0.002$), height ($p = 0.002$), LBP experience ($p < 0.001$), and Numeric Rating Scale (NRS) pain intensity ($p < 0.001$). In contrast, work-related factors such as job satisfaction ($p = 0.643$), physical exercise ($p = 0.444$), prolonged sitting ($p = 0.836$), length of employment ($p = 0.114$), weekly rest ($p = 0.473$), and education level ($p = 0.433$) were not significantly associated with LBP. Therefore, gender, body height, and pain intensity were included in the multivariable analysis, whereas LBP experience was excluded due to missing data in some categorical responses.

Table 2 Multiple logistic regression analyses among LBP and Non-LBP group

	Model 1			Model 2			Model 3		
	Crude OR	95% CI	*p*-value	Adjusted OR	95% CI	*p*-value	Adjusted OR	95% CI	*p*-value
Gender									
Men	.248	.102-.603	**.002**	.218	.079-.602	**.003**	.150	.039-.573	**.006**
Women									
Height									
Short	-	-	**.005**	-	-	.214	-	-	**.011**
Moderate	2.750	.649-11.644	.170	2.860	.574-14.253	.200	8.012	1.215-52.839	.031
Tall	10.889	2.167-54.722	**.004**	6.834	.767-58.591	.080	25.910	3.004-223.488	**.003**
NRS									
Light	-	-	**.001**	-	-	**.013**	-	-	**.006**
Medium	.117	.036 – .375	**.000**	.003	.040 – .524	**.001**	.046	.07 – .304	**.001**
High	258475978.291	.000	.999	254116165.374	.000	.999	133941493.287	.000	.999

Note: Model 1: unadjusted. Model 2: Gender, Age (categoric), BMI. Model 3: Gender, Age (categoric), BMI, Job satisfaction, physical exercise, prolonged sitting, length of employment, rest a week, education level. BMI = Body Mass Index. NRS = Numeric Rating Scale

Table 2 shows the results of multiple logistic regression analyses to identify factors associated with low back pain (LBP) and demonstrated that gender, height, and pain intensity remained independently associated with LBP after adjustment for potential confounders. Model 1: (unadjusted) without controlling for any confounding factors. Model 2: (gender, age and BMI) includes adjustments for potential confounders related to participant characteristics. Model 3: (gender, age, BMI, Job satisfaction, physical exercise, prolonged sitting, length of employment, rest a week, education level) further adjusts for both participant characteristics and work-related factors. Gender remained consistently associated with LBP across all models, with the odds ratio (OR) decreasing from model 1 to 3 (0.248 to 0.218 to 0.150). An OR less than 1 indicates that men had a lower likelihood of experiencing LBP compared to women, suggesting that females were more likely to report LBP even after adjusting for confounding factors. Participants with greater height were approximately 25 times more likely to experience LBP when occupational factors were considered, compared to those with shorter stature. Regarding pain intensity measured by the Numeric Rating Scale (NRS), participants with moderate NRS scores were significantly more likely to report LBP than those with mild NRS scores (Adjusted OR = 0.046; 95% CI = 0.070–0.304; p = 0.001). No significant association was found for participants with high NRS scores (p = 0.999).

5.0 Discussion

The complex interaction between individual characteristics and work-related factors was examined in this study to differentiate participants with and without LBP. The findings indicate that female gender, moderate pain intensity, and greater height were independent predictors of LBP after adjusting for potential confounders. The confounding variables considered in this analysis included occupational factors such as job satisfaction, engagement in physical exercise, prolonged sitting duration, length of employment, number of weekly rest days and education level. These finding may reflect adaptive behaviors or ergonomic accommodations among office workers, which could mitigate the effects of prolonged sitting and explain the lack of significant associations observed for occupational variables.

In this study, a higher proportion of female participants reported experiencing LBP compared to males. This finding suggests that female office workers may be more vulnerable to occupational LBP. One plausible explanation is the biomechanical differences between genders. Females tend to have a greater degree of lumbar lordosis and anterior pelvic tilt, which may increase mechanical strain on the lumbar spine. In addition, differences in trunk extensor muscle strength and balance between males and females may contribute to the increased susceptibility of females to LBP (Marijancic et al., 2024).

In our findings, taller participants ranging from 144 to 188 cm showed a higher prevalence of LBP, indicating that height may contribute to mechanical strain on the spine. This finding aligns with reports by Hershkovich et al. (2013), who noted that taller stature can increase spinal loading, especially when growth occurs rapidly and disrupts postural alignment. Hormonal and stress-related factors have also been proposed to elevate spinal sensitivity in individuals with greater height (Grazio, 2022). On the other hand, Xie et al., (2025) suggest that excessive abdominal fat rather than height alone may have a more direct influence on lumbar stress, highlighting the importance of considering interactions between height and body composition when identifying risk contributors for LBP.

Meanwhile, BMI in this study did not demonstrate a significant association with LBP (p = 0.309). This contrasts with Liechti et al., (2025), who reported a modest increased risk of LBP among those in overweight and obese BMI categories compared with individuals of normal weight. Because BMI does not distinguish between lean mass and fat mass, its use may overlook the specific role of central adiposity in lumbar spine loading. Supporting this, Vitale et al., (2024) found that fat accumulation surrounding the lumbar muscles, particularly around L4–L5, may alter muscle structure and function, thereby contributing to the onset of LBP. These differing findings suggest that weight-related risk is more nuanced than BMI alone can capture and may depend on the distribution of body composition rather than overall size.

Pain intensity, assessed using the Numeric Rating Scale (NRS), showed a strong association with low back pain (LBP), with higher scores indicating greater pain severity. Participants with light to moderate pain were more frequently classified in the LBP group, while no individuals without LBP reported high pain scores, which likely explains the lack of statistical significance in the high-intensity category. This finding suggests that moderate pain may be a more sensitive indicator of functional impairment related to LBP among office workers, particularly in early or recurrent stages. Previous evidence supports this interpretation, as persistent LBP is known to disrupt normal neuromuscular control, reduce core muscle activation, and negatively influence postural stability and movement efficiency (Alshahrani et al., 2025). Therefore, routine clinical monitoring of moderate pain levels rather than waiting for severe pain to develop, may help facilitate earlier intervention and prevent the progression of LBP into chronic disability.

This study has several limitations. First, the data were obtained from a single center, which may restrict the generalizability of the results to wider office worker populations. Second, the use of self-reported information could have introduced recall or reporting biases, potentially affecting the accuracy of the data. Future studies are recommended to adopt a longitudinal, multicenter design and incorporate objective ergonomic evaluations to provide stronger evidence regarding LBP risk factors in occupational settings. Additionally, integrating more comprehensive anthropometric measurements such as height, waist circumference, and body fat percentage may offer deeper insights into the biomechanical burden contributing to LBP among office workers.

6.0 Conclusion

This study identified female gender, taller height, and moderate pain intensity as significant predictors of low back pain (LBP) among administrative office workers, suggesting that anatomical and biomechanical characteristics may have a stronger influence on LBP development than occupational demands alone. Conversely, work-related variables such as job satisfaction, physical activity, prolonged sitting, duration of employment, weekly rest, and education level were not significantly associated with LBP, indicating that commonly presumed workplace factors may not be primary contributors in this population. These findings underscore the importance of considering individual physical characteristics when designing preventive strategies and ergonomic interventions.

Acknowledgement

The authors sincerely thank the administrative workers at Universitas Pembangunan Nasional Veteran Jakarta (UPNVJ) for their participation in this study. Appreciation is also extended to the Faculty of Health Sciences, Universiti Teknologi MARA (UiTM), the Research Management Centre, and the Institute of Postgraduate Studies, UiTM, for financial support through the Conference and Journal Support Funds, as well as to UPNVJ for providing institutional support and facilities that enabled the completion of this research.
Conflict of Interest: The authors declare no conflict of interest related to this publication.
Disclaimer: Artificial intelligence tools, including ChatGPT and Grammarly, were used strictly to enhance the clarity and readability of the manuscript. All research design, data collection, analysis, and interpretation were conducted independently by the authors.

Paper Contribution to Related Field of Study

This study contributes evidence on low back pain among office workers by highlighting the role of demographic and occupational factors within an office-based environment. It provides a contextualized perspective on sedentary work settings and supports occupational health policies and ergonomic strategies aimed at reducing LBP and improving productivity.

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