International Journal of Multi Discipline Science
Vol. 9 No. 1 (February 2026)
e-ISSN: 2615-1707. Page: 61-67

Determinant Factors Correlated with the Incidence of Low Back Pain (LBP) among Traditional Rice Mill Workers in Kemranjen Subdistrict, Banyumas Regency

Radhly Banu Yunanto[1], Nur Ulfah[2], Siti Harwanti[3], Radi[4,*)]
Universitas Jenderal Soedirman, Purwokerto, Indonesia[1,2,3], Universitas Gadjah Mada, Yogyakarta, Indonesia[4]
radhliy.yunanto@mhs.unsoed.ac.id[1], nur.ulfah@unsoed.ac.id[2], siti.harwanti@unsoed.ac.id[3], radi.epidemiolog@gmail.com[4]
[*)]Corresponding author

Keywords:
Low Back Pain; Rice Milling; Determinant Factors

ABSTRACT
Rice milling workers are at risk of low back pain (LBP), which may reduce productivity. This study aimed to analyze factors associated with LBP among rice milling workers in Kemranjen Subdistrict, Banyumas Regency. This quantitative analytical study used a cross-sectional design. From 99 workers, 87 were selected through total sampling based on the inclusion and exclusion criteria. Data were collected through interviews, measurements, observation, and documentation using questionnaires, a digital height meter, body weight scale, stopwatch, Visual Analog Scale (VAS), and Rapid Entire Body Assessment (REBA). Data were analyzed using univariate and bivariate analyses with the chi-square test in SPSS version 23. LBP was reported by 81 workers (93.1%). Workload ($p<0.001$), working position ($p<0.001$), and length of employment ($p<0.001$) were significantly associated with LBP. Age ($p=1.000$), BMI ($p=0.730$), and smoking habits ($p=0.355$) were not significantly associated. Stretching and repetition were constant among respondents and were not statistically analyzed. Workload, working position, and length of employment were associated with LBP. Preventive efforts should focus on safe working practices and LBP prevention education.

INTRODUCTION

Occupational diseases (ODs) are health disorders arising from work-related factors or the work environment. More specifically, these factors are categorized into five groups: physical (noise, vibration, lighting, radiation, air pressure, and temperature), chemical (liquids, gases, vapors, smoke, and dust), biological (bacteria, viruses, fungi, and parasites), ergonomic (work posture and movement), and psychosocial (workload, job stress, etc.) (Kementerian Kesehatan RI, 2022). These factors are often poorly managed, which can lead to occupational diseases with various negative impacts.

According to the International Labour Organization (ILO), there are several types of occupational diseases, including those caused by exposure to substances during work (chemical substances, physical agents, and biological agents), diseases affecting organ systems (respiratory, skin, musculoskeletal, mental, and behavioral), and occupational cancers (caused by specific substances or agents) (Pega et al., 2022). The number of work-related accidents and occupational diseases remains high. Based on ILO reports, it is estimated that each year about 380,000 workers die from work accidents and 2.78 million workers die from occupational diseases worldwide. These figures are very high but do not fully represent the total number of occupational accidents and diseases, as they are merely estimates from the industrial sector (ILO, 2018).

Other sectors, such as informal businesses in agriculture and micro-scale household agro-processing industries, have not received much attention, and thus, there is no data on the number of work accidents and occupational diseases in these areas (Galvis & Molina, 2023). In fact, as a developing country, the majority of Indonesia's working-age population is employed in agriculture. According to the Ministry of Agriculture of the Republic of Indonesia, in 2024, 71.82% of the population is engaged in the agricultural sector (Kementerian Pertanian, 2024). This shows that three-quarters of the Indonesian workforce do not receive proper attention regarding occupational safety and health in agriculture. If this continues, it will eventually affect the quality and productivity of workers in the agricultural sector.

Work in agriculture is labor-intensive and often involves lifting heavy loads (Benos et al., 2020). Especially in Indonesia and other developing countries where agriculture is still largely traditional, the use of modern lifting equipment is limited. A common occupational disease experienced by agricultural workers is musculoskeletal disorders (MSDs) (Shivakumar et al., 2024). According to the Global Burden of Disease (GBD) in 2019, 1.17 billion people worldwide suffer from MSDs. Many agricultural workers experience MSDs in the form of low back pain (LBP). Reports show that 24.7% of workers report symptoms, and 11.9% are medically diagnosed.

LBP occurs due to repetitive tasks, excessive muscle strain, and unnatural working postures (Jia et al., 2024). Individual factors such as age, smoking habits, and physical activity may also influence the risk of LBP. Previous studies among rice milling workers have reported a high prevalence of musculoskeletal complaints and identified work-related factors, including working position, work attitude, noise exposure, and work fatigue, as potential contributors (Ance et al., 2021). However, these studies have generally focused on musculoskeletal disorders (MSDs) as a broad outcome or examined specific occupational factors rather than specifically investigating LBP through the simultaneous assessment of individual, work-related, and ergonomic factors. A recent systematic review also reported a high burden of musculoskeletal pain among agricultural workers in low- and middle-income countries, with heavy lifting and repetitive movements identified as important occupational risk factors.

Rice milling is an agricultural activity that involves considerable ergonomic risks, particularly in micro-scale mills where material handling is often performed manually. According to BPS, Indonesia has 169,789 rice milling units, the majority of which are micro-scale units. Manual handling, repetitive movements, and awkward working postures may increase the risk of LBP among these workers. Central Java is one of Indonesia's major agricultural regions, while Banyumas Regency has extensive rice-producing areas and communities whose livelihoods depend on agriculture (Radi et al., 2024). In Kemranjen Subdistrict, Banyumas Regency, 68 micro-scale rice milling units still rely on manual handling based on BPS Banyumas data.

Preliminary observations in Kemranjen indicated that workers frequently performed repetitive activities, lifted heavy loads, and adopted non-neutral working postures during their daily work. These conditions may increase the risk of LBP, particularly in the absence of adequate occupational health education and ergonomic interventions. Therefore, the novelty of this study lies in its specific focus on

LBP among rice milling workers in micro-scale rice mills in Kemranjen Subdistrict, Banyumas Regency, while simultaneously examining individual factors (age, BMI, and smoking habits), work-related factors (workload and length of employment), and ergonomic factors (working position). Unlike previous studies that mainly assessed MSDs broadly or focused on specific occupational exposures, this study provides a more specific assessment of factors associated with LBP in a rural rice-milling setting. Therefore, this study aimed to identify factors associated with LBP among rice milling workers in Kemranjen Subdistrict, Banyumas Regency.

METHOD

This quantitative analytical study employed a cross-sectional design to investigate the factors associated with low back pain (LBP) among rice milling workers. The study was conducted from November 2024 to February 2025 at rice mills in Kemranjen Subdistrict, Banyumas Regency. The study population comprised 99 rice milling workers. Total sampling was used, resulting in 87 respondents who met the inclusion and exclusion criteria. Data were collected through direct interviews, anthropometric measurements, observation, and documentation. The instruments used included a questionnaire to assess demographic characteristics, stretching habits, smoking habits, and length of employment; a wireless digital height meter (Stature Digital-HT701) and body weight scale to measure BMI; a stopwatch to assess repetition; the Visual Analog Scale (VAS) to assess LBP; and the Rapid Entire Body Assessment (REBA) to assess working position and workload. Data were analyzed using univariate and bivariate analyses. The chi-square test was used to examine the association between each independent variable and LBP, with statistical analysis performed using SPSS version 23.

RESULTS AND DISCUSSION

The distribution of workers based on LBP and other characteristics is presented in Table 1. Low back pain (LBP) among the workers was distributed into three categories, with the majority experiencing moderate pain in their lower back, totaling 48 individuals (55.2%). The age variable showed that most workers were in the productive age group, with 80 individuals (92%). The BMI variable was divided into three different categories, with the majority of workers having a normal BMI, totaling 56 individuals (64.4%). The smoking habit variable also had three categories, with the majority of workers categorized as moderate smokers, totaling 38 individuals (43.7%). The workload variable was divided into two categories, with most workers having a light workload, totaling 81 individuals (93.1%). The working position variable also fell into two categories, with the majority of workers having a very high-risk posture, totaling 81 individuals (93.1%). The years of service variable showed three different categories, with most being long-term workers, totaling 63 individuals (72.4%). In addition to the seven variables above, there were two variables with constant values (identical responses from all participants): stretching and repetition.

Based on bivariate analysis using the chi-square test, it was found that only three variables were associated with LBP among rice milling workers in Kemranjen Subdistrict, Banyumas Regency: workload, working position, and years of service. Meanwhile, four other variables- age, BMI, smoking habits, and exercise habits were not significantly associated with LBP among the workers. The results of the bivariate analysis are presented in Table 2.

Based on the bivariate analysis using the chi-square test, it was found that three variables had a significant relationship with low back pain (LBP) among rice mill workers in Kemranjen District, Banyumas Regency. These variables were workload, working position, and length of employment. Meanwhile, other variables such as age, body mass index (BMI), and smoking habits showed no significant relationship with LBP.

International Journal of Multi Discipline Science
Vol. 9 No. 1 (February 2026)
e-ISSN: 2615-1707. Page: 61-67

Table 1
Respondents' answers distribution of the research

No	Variable	Frequency	
		N	%
1	Low back pain (LBP)		
	Pain	81	93.1
	No Pain	6	6.9
2	Age		
	Productive (25-60 years)	80	92.0
	Unproductive (>60 years)	7	8.0
3	BMI		
	Overweight (>25)	23	26.4
	Normal (18.5-25)	56	64.4
	Underweight (<18.5)	8	9.2
4	Stretching		
	No stretching	87	100.0
5	Smoking habit		
	Moderate smoker (11-20 cigarettes/day)	38	43.7
	Light smoker (1-10 cigarettes/day)	37	42.5
	Do not smoke	12	13.8
6	Workload		
	Moderate	6	6.9
	Light	81	93.1
7	Working position		
	Very high risk (Skor> 11)	81	93.1
	High risk (Skor 8-10)	6	6.9
8	Length of employment		
	>10 years	63	72.4
	5-10 years	18	20.7
	<5 years	6	6.9
9	Repetition		
	None	87	100.0
	Total	87	100

The analysis revealed that workload had a significant association with LBP (p = 0.000), with a contingency coefficient of 0.540, indicating a moderate strength of relationship. A high workload requires considerable physical capacity, and when this demand exceeds the worker's physical ability, it can lead to work-related illnesses, including LBP (Lewis et al., 2023). At rice mills, workers often lift sacks weighing around ±25 kg, and they typically handle more than one sack per day, depending on incoming orders. This heavy workload increases spinal pressure and the risk of musculoskeletal disorders (Luites et al., 2022). This finding is supported by Iwakiri et al. (2025), who reported that handling heavier loads was associated with greater severity of acute occupational LBP and prolonged work absence.

Similarly, working position was significantly associated with LBP (p = 0.000), with a contingency coefficient of 0.540, indicating a moderate association. Poor working positions, such as prolonged standing, bending, squatting, lifting, and carrying, can lead to muscle strain, fatigue, and discomfort in the back area. Improper postures increase muscle contraction and tension, which may compress nerves and damage spinal structures (Tomitagawa et al., 2025a). Therefore, attention to ergonomically correct working positions is essential to prevent LBP. This is supported by the studies of Juve et al. (2021), which reported similar findings among rice mill workers and rubber farmers, respectively. This finding is consistent with Das (2022), who found that awkward working postures,

repetitive activities, and manual material handling were significantly associated with LBP among rice farmers in West Bengal, India. Therefore, maintaining ergonomically appropriate working positions is important to reduce musculoskeletal strain and prevent LBP among rice milling workers.

Table 2
Bivariate Analysis of Variables

Variabel	Low back pain				Total		P-value	Significantcy (alpa<0,05)
	Yes		No					
	n	%	n	%	n	%		
Age								
Productive (25-60 years)	7	100	0	0	7	100	1.00	Not significant
Unproductive (>60 years)	74	92.5	6	7.5	80	100		
BMI								
Overweight (>25)	22	95.7	1	4.3	23	100	0.730	Not significant
Normal (18.5-25)	52	92.9	4	7.1	56	100		
Underweight (<18.5)	7	87.5	1	12.5	8	100		
Smoking habit								
Moderate smoker (11-20 cigarettes/day)	36	94.7	2	5.3	38	100	0.355	not Significant
Light smoker (1-10 cigarettes/day)	35	94.6	2	5.4	37	100		
Do not smoke	10	83.3	2	16.7	12	100		
Workload								
Moderate	2	33.3	4	66.7	6	100	0.000	Significant
Light	79	97.5	2	2.5	81	100		
Working position								
Very high risk (Skor> 11)	79	97.5	2	2.5	81	100	0.000	Significant
High risk (Skor 8-10)	2	33.3	4	66.7	6	100		
Length of employment								
>10 years	60	95.2	3	4.8	63	100	0.000	Significant
5-10 years	18	100	0	0	18	100		
<5 years	3	50	3	50	6	100		

The length of employment also showed a significant relationship with LBP (p = 0.000), with a contingency coefficient of 0.425, indicating a moderate correlation. Long-term employment reflects accumulated exposure to physical workload and repeated postures over time, potentially causing damage to spinal tissues. The repetitive nature of physical tasks decreases tissue elasticity and increases muscle tension, which may lead to spinal trauma and pain. These results align with studies by Juve et al. (2021) and Nurcahyani et al. (2024), both of which observed a significant relationship between duration of work and the incidence of LBP. Similarly, Rachmawati et al. (2021) found a significant relationship between years of service and LBP among rice mill workers, suggesting that prolonged occupational exposure may contribute to the occurrence of LBP.

On the other hand, age was not significantly associated with LBP in this study (p = 1.000). Field interviews revealed that LBP occurred not only among older respondents but also among those of productive age. Although bone density tends to decline with age, LBP among younger workers is likely due to the intense physical demands of rice milling work. This suggests that physical workload and posture are more influential than chronological age. Similar findings were reported by Wahab (2019) and Juve et al. (2021), who also found no significant relationship between age and LBP.

Body mass index (BMI) also did not show a significant relationship with LBP (p = 0.730). Observations showed that LBP occurred among respondents with both high and normal or low BMI. This implies that LBP may be more strongly influenced by physical workload than body weight. Despite theories suggesting that excess body weight can increase spinal pressure, this study suggests

otherwise. These findings are in line with the studies by Kwon et al. (2006) and Hadyan & Saftarina (2017), which also found no correlation between BMI and LBP.

Smoking habits, likewise, were not significantly related to LBP (p = 0.355). Although nicotine in cigarettes can reduce blood flow to tissues and affect bone mineral content, the results suggest that individual biological responses and genetic factors might play a more substantial role. Each individual's susceptibility to disease varies, influenced by environmental factors and genetic composition. These findings are consistent with those of Rakhmawati et al. (2024) and Tomitagawa et al. (2025b), who also reported no significant association between smoking and LBP in labor-intensive professions.

CONCLUSIONS

The study was conducted to identify the factors associated with the incidence of low back pain (LBP) among rice mill workers. Statistical test results showed that the variables related to LBP among workers in rice mills in Kemranjen District, Banyumas Regency, were workload, working position, and length of employment. Based on these findings, the researchers recommend that relevant authorities, such as the Department of Manpower, conduct outreach and provide ergonomics and occupational health and safety (OHS) training for workers. Additionally, modernization of equipment could be an option for business owners to reduce workload, making the rice mill work more efficiently and safely.

REFERENCES

Ance, A. A., Berek, N. C., & Riwu, Y. R. (2021). The factors related to musculoskeletal disorders of rice milling workers in Lembor District, West Manggarai. *Lontar: Journal of Community Health, 3*(3), 96–102. https://doi.org/10.35508/ljch.v3i3.3852

Benos, L., Tsaopoulos, D., & Bochtis, D. (2020). A review on ergonomics in agriculture. Part II: Mechanized operations. *Applied Sciences (Switzerland)*, *10*(10). https://doi.org/10.3390/app10103484

Das, B. (2022). Ergonomic and psychosocial risk factors for low back pain among rice farmers in West Bengal, India. *Work, 73*(1), 185–196. https://doi.org/10.3233/WOR-210433

Galvis, D. J. M., & Molina, A. L. V. (2023). Occupational safety and health in the agricultural sector: A bibliographic review. *Revista Brasileira de Medicina Do Trabalho*, *21*(3), 1–11. https://doi.org/10.47626/1679-4435-2023-1137

ILO. (2018). *Meningkatkan Keselamatan dan Kesehatan Pekerja Muda Hari K3 Sedunia Tahun 2018*. ILO. https://www.ilo.org/id/resource/meningkatkan-keselamatan-dan-kesehatan-pekerja-muda-hari-k3-se-dunia-2018. Acessed December 12, 2025.

Iwakiri, K., Miki, K., & Sasaki, T. (2025). *Effect of manual handling weight for lifting and carrying on the severity of acute occupational low back pain*. International Archives of Occupational and Environmental Health, 98(6), 507–513. https://doi.org/10.1007/s00420-025-02148-5

Jia, J., Zhang, M., Cao, Z., Yang, Z., Hu, X., Lei, S., Zhang, Y., Leng, W., & Kang, X. (2024). Prevalence of and risk factors for low back pain among professional drivers: a systematic review and meta-analysis. *Journal of Orthopaedic Surgery and Research*, *19*(1). https://doi.org/10.1186/s13018-024-04999-z

Jia, N., Zhang, M., Zhang, H., Ling, R., Liu, Y., Li, G., Yin, Y., Shao, H., Zhang, H., Qiu, B., Li, D., Wang, D., Zeng, Q., Wang, R., Chen, J., Zhang, D., Mei, L., Fang, X., Liu, Y., … Wang, Z. (2022). Prevalence and risk factors analysis for low back pain among occupational groups in key industries of China. *BMC Public Health*, *22*(1), 1–10. https://doi.org/10.1186/s12889-022-13730-8

Juve, B., Sagala, A. C., Masdalena, & Nasution, C. R. (2021). Hubungan Faktor Risiko Terjadinya Low Back Pain pada Karyawan di Kilang Padi Sahabat Jaya. *Jurnal Ilmiah Mahasiswa Kesehatan Masyarakat*, *6*(2), 56–67. https://doi.org/http://dx.doi.org/10.37887/jimkesmas

Kementerian Kesehatan RI. (2022). Peraturan Menteri Kesehatan Nomor 11 Tahun 2022 tentang Pelayanan Kesehatan Penyakit Akibat Kerja. In *Kemenkes RI*, *69*(555). Kemenkes RI.

Kementerian Pertanian. (2024). *Statistik Sumber Daya Manusia Pertanian dan Kelembagaan Petani 2024*. Kementerian Pertanian.

Kwon, M. a, Shim, W. S., Kim, M. H., Gwak, M. S., Hahm, T. S., Kim, G. S., Kim, C. S., Choi, Y. H., Park, J. H., Cho, H. S., & Kim, T. H. (2006). A correlation between low back pain and associated factors: a study involving 772 patients who had undergone general physical examination. *Journal of Korean Medical Science*, *21*(6), 1086–1091. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2721934&tool=pmcentrez&rendertype=abstract

Lewis, C., Stjernbrandt, A., & Wahlström, J. (2023). The association between cold exposure and musculoskeletal disorders: a prospective population-based study. *International Archives of Occupational and Environmental Health*, *96*(4), 565–575. https://doi.org/10.1007/s00420-022-01949-2

Luites, J. W. H., Kuijer, P. P. F. M., Hulshof, C. T. J., Kok, R., Langendam, M. W., Oosterhuis, T., Anema, J. R., Lapré-Utama, V. P., Everaert, C. P. J., Wind, H., Smeets, R. J. E. M., van Zaanen, Y., Hoebink, E. A., Voogt, L., de Hoop, W., Boerman, D. H., & Hoving, J. L. (2022). The Dutch Multidisciplinary Occupational Health Guideline to Enhance Work Participation Among Low Back Pain and Lumbosacral Radicular Syndrome Patients. *Journal of Occupational Rehabilitation*, *32*(3), 337–352. https://doi.org/10.1007/s10926-021-09993-4

Nurcahyani, A. D., Ekawati, E., & Jayanti, S. (2024). Hubungan Usia, Masa Kerja, Waktu Kerja, Sikap Kerja Dan Aktivitas Pekerjaan Dengan Kejadian Nyeri Punggung Bawah Pada Petani Padi Desa Semen. *Jurnal Kesehatan Masyarakat*, *12*(2), 180–188. https://doi.org/10.14710/jkm.v12i2.40614

Pega, F., Hamzaoui, H., Náfrádi, B., & Momen, N. C. (2022). Global, regional and national burden of disease attributable to 19 selected occupational risk factors for 183 countries, 2000–2016: A systematic analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury. *Scandinavian Journal of Work, Environment and Health*, *48*(2), 158–168. https://doi.org/10.5271/sjweh.4001

Radi, R., Rejeki, D. S. S., & Octaviana, D. (2024). Analisis Faktor Risiko Yang Mempengaruhi Kejadian Anemia Pada Petani di Desa Linggasari Kabupaten Banyumas. *Jurnal Kesehatan Masyarakat*, *12*, 120–127. https://doi.org/10.14710/jkm.v12i2.38288

Rakhmawati, B. F. A., Zaidah, U., & Maharari, B. D. (2024). Hubungan Beban Kerja dan Frekuensi Merokok dengan Kejadian Nyeri Punggung Bawah (Low Back Pain) pada Buruh Tambang Pasir. *Jurnal Ilmiah IKIP Mataram*, *11*(2).

Rachmawati, S., Suryadi, I., & Pitanola, R. D. (2021). Low back pain: Based on age, working period, and work posture. *KEMAS: Jurnal Kesehatan Masyarakat, 17*(2). https://doi.org/10.15294/kemas.v17i2.26313

Shivakumar, M., Welsh, V., Bajpai, R., Helliwell, T., Mallen, C., Robinson, M., & Shepherd, T. (2024). Musculoskeletal disorders and pain in agricultural workers in Low- and Middle-Income Countries: a systematic review and meta-analysis. *Rheumatology International*, *44*(2), 235–247. https://doi.org/10.1007/s00296-023-05500-5

Tomitagawa, S., Kitahara, T., Tsujimura, H., & Taoda, K. (2025a). Relationship between working posture/movement and measures to prevent low back pain among care workers : a cross-sectional study in the Kansai region of Japan. *Industrial Health*, 242–253. https://doi.org/10.2486/indhealth.2024-0096

Tomitagawa, S., Kitahara, T., Tsujimura, H., & Taoda, K. (2025b). Smoking and low back pain. A systematic literature review of 41 journal articles reporting 47 epidemiologic studies. *Industrial Health*. https://doi.org/10.2486/indhealth.2024-0096

Wahab, A. (2019). Faktor-Faktor Yang Berhubungan Dengan Keluhan Nyeri Punggung Bawah (Low Back Pain) Pada Nelayan Di Desa Batu Karas Kecamatan Cijulang Pangandaran. *Biomedika*, *11*(1), 35. https://doi.org/10.23917/biomedika.v11i1.7599