www.ijarp.com ISSN 2456-9992 Page: 01-10

International Journal Advanced Research Publications

Review Article

Volume: 02
Issue: 02

ASSOCIATION BETWEEN CARDIORESPIRATORY ENDURANCE AND FUNCTIONAL DISABILITY IN INDIVIDUALS WITH CHRONIC LOW BACK PAIN: AN OBSERVATIONAL STUDY

[*1]Meghna Panchbhayye, [2]Dr Shubhangi Jondhale (PT)

[1]Intern, Pravara Institute of Medical Sciences, Dr.APJ Abdul Kalam College of Physiotherapy.

[2]Associate Professor, Pravara Institute of Medical Sciences, Dr APJ Abdul Kalam College of Physiotherapy.

Article Received: 05 January 2026, Article Revised: 25 January 2026, Published on: 13 February 2026

***Corresponding Author: Meghna Panchbhayye**

Intern, Pravara Institute of Medical Sciences, Dr.APJ Abdul Kalam College of Physiotherapy.

DOI: https://doi-doi.org/101555/ijarp.7346

ABSTRACT

Question: Is reduced cardiorespiratory endurance associated with greater functional disability in individuals with chronic low back pain?

Design: Observational descriptive study.

Participants: Sixty individuals aged 35–60 years with chronic low back pain of more than 12 weeks duration, recruited from a tertiary care hospital.

Outcome measures: Cardiorespiratory endurance was assessed using the 6-Minute Walk Test (6MWT) to estimate VO_2max. Functional disability was measured using the Roland–Morris Disability Questionnaire (RMDQ). Pain intensity was assessed using the Visual Analogue Scale (VAS).

Results: Most participants had decreased cardiorespiratory endurance, with 60% of participants having VO2max values of less than 25 ml/kg/min. The degree of functional disability was mostly moderate (62%). There was an inverse relationship between cardiorespiratory endurance and functional disability. Participants with lower 6MWT performance and lower estimated VO2max scores had higher RMDQ scores.

Conclusion: Reduced cardiorespiratory endurance is associated with increased functional disability in individuals with chronic low back pain. Incorporation of aerobic conditioning into physiotherapy rehabilitation programs may improve functional outcomes and reduce disability in this population.

KEYWORDS: chronic low back pain, cardiorespiratory endurance, functional disability, 6-minute walk test, physiotherapy.

INTRODUCTION

Chronic low back pain (CLBP) is one of the leading causes of disability worldwide and represents a major public health challenge. It is defined as pain or discomfort localized between the costal margin and the inferior gluteal folds, persisting for more than 12 weeks. The majority of cases are classified as non-specific chronic low back pain, in which no identifiable structural pathology adequately explains the symptoms.

Beyond persistent pain, individuals with CLBP commonly experience reduced physical activity, fear-avoidance behavior, altered movement patterns, and progressive physical deconditioning. These factors contribute to functional limitations and reduced participation in activities of daily living, ultimately impairing quality of life.

Cardiorespiratory endurance, a key component of health-related physical fitness, reflects the ability of the cardiovascular and respiratory systems to supply oxygen during sustained physical activity. Adequate aerobic capacity is essential for performing routine tasks such as walking, stair climbing, lifting, and prolonged standing. Evidence indicates that individuals with CLBP demonstrate lower cardiorespiratory endurance compared to pain-free controls, likely due to inactivity, deconditioning, altered neuromuscular control, and autonomic dysfunction.

Reduced aerobic capacity may lead to early fatigue, decreased exercise tolerance, and increased functional disability. However, the association between cardiorespiratory endurance and functional disability in individuals with CLBP remains insufficiently explored in clinical physiotherapy settings, particularly within the Indian population.

Therefore, the purpose of this study was to examine the association between cardiorespiratory endurance and functional disability in individuals with chronic low back pain.

METHODS

Design

An observational descriptive study was conducted over six months.

Participants

Sixty participants aged 35–60 years with chronic low back pain of more than 12 weeks duration were recruited from the outpatient department of Pravara Rural Hospital, Loni, using simple random sampling.

Inclusion criteria were: persistent low back pain for more than 12 weeks, ability to understand instructions, and willingness to participate.

Exclusion criteria included recent fractures or surgery, neurological or metabolic disorders, and conditions limiting independent ambulation.

Outcome measures

Cardiorespiratory endurance was assessed using the 6-Minute Walk Test (6MWT) conducted on a 30-m flat walkway according to standard guidelines. The distance walked was recorded and VO_2max was estimated.

Functional disability was assessed using the Roland–Morris Disability Questionnaire (RMDQ), a validated 24-item questionnaire assessing limitations in daily activities related to low back pain.

Pain intensity was measured using the Visual Analogue Scale (VAS).

Procedure

After obtaining institutional ethical approval and written informed consent, demographic and clinical data were collected. Participants performed the 6MWT following standardized instructions, with vital signs monitored before and after the test. The RMDQ and VAS were completed on the same day. Data were recorded and prepared for statistical analysis.

RESULTS

Participant characteristics

Sixty participants with chronic low back pain were included in the analysis. The majority of participants were female (62%), and the largest proportion belonged to the 55–60-year age group. Most participants reported pain duration exceeding 30 months and moderate to severe pain intensity on the Visual Analogue Scale.

TABLE.1. AGE GROUP DISTRIBUTION.

Age Group	Count	PERCENTAGE
35–39	9	15%
40–44	10	17%
45–49	11	18%
50–54	10	17%
55–60	20	33%
TOTAL	**60**	**100%**

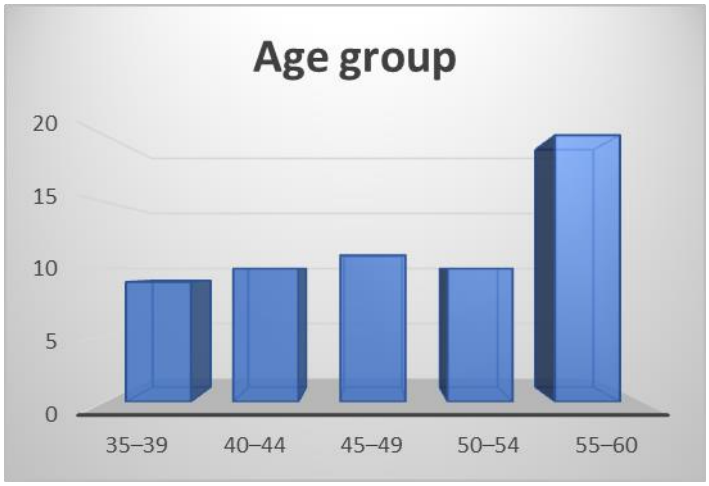


TABLE 2. GENDER DISTRIBUTION.

Gender	No. of patients	Percentage
Female	37	62%
Male	23	38%
TOTAL	**60**	**100%**

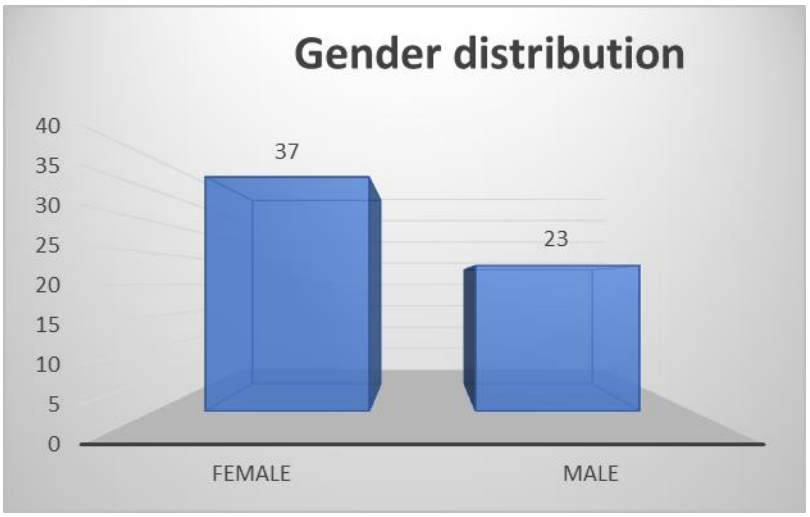
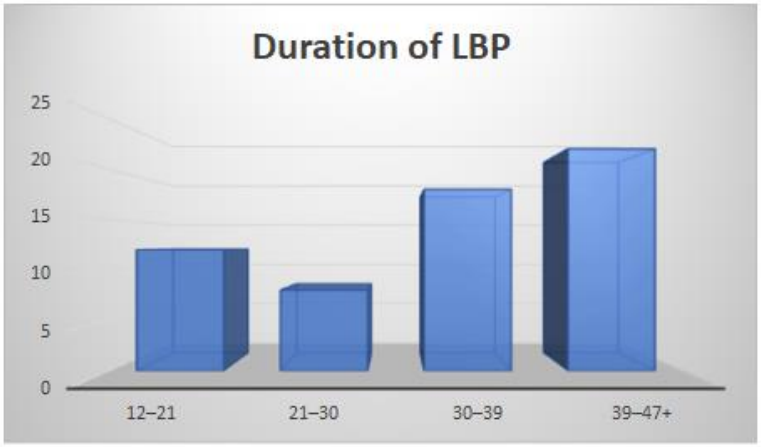


TABLE 3. LBP Duration Classification.

Duration (months)	No. of patients	Percentage
12–21	12	20%
21–30	8	13%
30–39	18	30%
39–47+	22	37%
TOTAL	**60**	**100%**



Cardiorespiratory endurance and disability

Cardiorespiratory endurance was markedly reduced in the study population. A total of 93% of participants demonstrated VO_2max values below age-appropriate normative ranges, with 60% exhibiting values below 25 ml/kg/min.

Functional disability, assessed using the Roland–Morris Disability Questionnaire, was predominantly moderate (62%), followed by mild disability (38%). No participants reported either no disability or severe disability.

TABLE 4: VO_2 max Classification.

VO_2 Max Criteria (ml/kg/min)	No. of patients	Percentage
< 20	12	20%
20 – 25	24	40%
26 – 32	20	33%
33 – 42	4	7%
43 – 52	0	0%
53 – 60	0	0%
> 60	0	0%
Total	**60**	100%

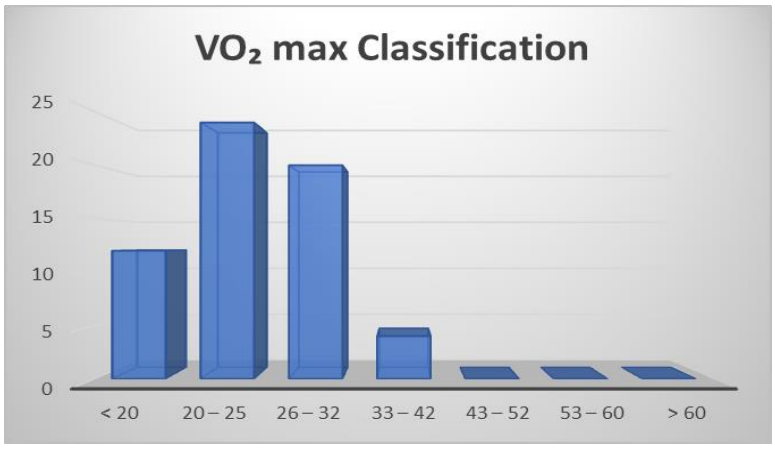
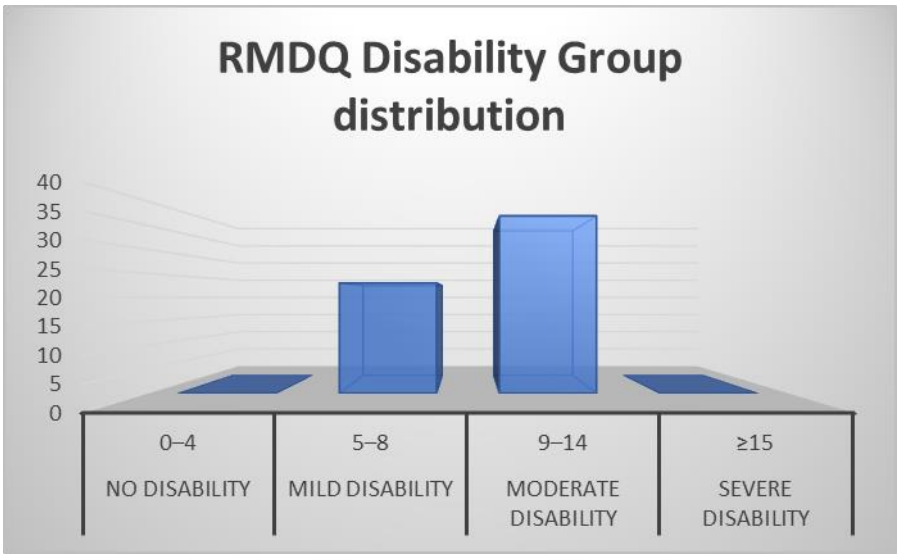


TABLE 5: RMDQ Disability Group Distribution.

Group	RMDQ Score Range	Participants	Percentage
No Disability	0–4	0	0%
Mild Disability	5–8	23	38%
Moderate Disability	9–14	37	62%
Severe Disability	≥15	0	0%
TOTAL		**60**	**100%**



Association between endurance and disability

Pearson correlation analysis demonstrated a statistically significant inverse relationship between cardiorespiratory endurance and functional disability. Lower 6-Minute Walk Test distances and lower estimated VO_2max values were associated with higher RMDQ scores ($r = -0.62$, $p < 0.001$), indicating greater functional limitation with poorer aerobic capacity.

DISCUSSION

This study clearly shows a strong inverse relationship between cardiorespiratory fitness and functional disability in patients with chronic low back pain. Patients with lower cardiorespiratory fitness showed significantly higher limitations in their functional activities, even after adjusting for pain intensity. These results clearly indicate that reduced cardiorespiratory fitness is a major contributing factor for disability in chronic low back pain, rather than the intensity of pain.

This study clearly shows that patients with chronic low back pain have reduced cardiorespiratory fitness and that the lower the fitness, the higher the functional disability. These results are in agreement with previous studies, which have shown reduced aerobic fitness and early fatigue in patients with CLBP.

Physical deconditioning because of pain-related avoidance of physical activity seems to be a major contributing factor for reduced aerobic fitness. Abnormalities in neuromuscular control, inefficient movement patterns, and autonomic dysfunction may also add to the increased cost of daily activities, resulting in early fatigue and disability.

The inverse relationship between cardiorespiratory endurance and functional disability found in this study supports the biopsychosocial model of CLBP, emphasizing the importance of disability being affected not only by the intensity of pain but also by the level of physical fitness. These results emphasize the importance of aerobic capacity assessment in the physiotherapy evaluation of patients with CLBP.

Clinical implications

Physiotherapists should consider routine assessment of cardiorespiratory endurance in individuals with chronic low back pain. Incorporating structured aerobic exercise into rehabilitation programs may improve endurance, enhance functional capacity, and reduce disability.

CONCLUSION

The study concluded an inverse relation between cardiorespiratory endurance and functional limitation in chronic low back pain patients. Poor endurance related to greater functional limitations underlined the importance of assessment of endurance and physiotherapy intervention to improve function and quality of life.

Acknowledgement

The authors gratefully acknowledge the participants for their time, cooperation, and commitment to this research. We also thank the Department of Physiotherapy for institutional support and an enabling research environment. The guidance and encouragement received from faculty members and peers are sincerely appreciated.

REFERENCES

1. Andersson GBJ. Epidemiological features of chronic low-back pain. *Lancet.* 1999;354(9178):581–585.
2. Balagué F, Mannion AF, Pellisé F, Cedraschi C. Non-specific low back pain. *Lancet.* 2012;379(9814):482–491.

3. Vos T, Flaxman AD, Naghavi M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Ann Rheum Dis.* 2012;71(4):646–654.
4. Hartvigsen J, Hancock MJ, Kongsted A, et al. What low back pain is and why we need to pay attention. *Lancet.* 2018;391(10137):2356–2367.
5. GBD 2021 Low Back Pain Collaborators. Global, regional, and national burden of low back pain, 1990–2021: results from the Global Burden of Disease Study 2021. *Lancet Rheumatol.* 2023;5(6):e316–e329.
6. Hoy D, Bain C, Williams G, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum.* 2012;64(6):2028–2037.
7. Vlaeyen JWS, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. *Pain.* 2000;85(3):317–332.
8. Foster NE, Anema JR, Cherkin D, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. *Lancet.* 2018;391(10137):2368–2383.
9. American College of Sports Medicine. *ACSM's Guidelines for Exercise Testing and Prescription.* 11th ed. Philadelphia: Wolters Kluwer; 2021.
10. Blair SN, Kohl HW, Paffenbarger RS, Clark DG, Cooper KH, Gibbons LW. Physical fitness and all-cause mortality: a prospective study of healthy men and women. *JAMA.* 1989;262(17):2395–2401.
11. Verbunt JA, Seelen HAM, Vlaeyen JWS, et al. Disuse and deconditioning in chronic low back pain: concepts and hypotheses on contributing mechanisms. *Pain.* 2003;104(1–2):1–12.
12. Mannerkorpi K, Hernelid C. Physical activity in patients with chronic pain: the role of pain, disability, and fear of movement. *Clin J Pain.* 2010;26(4):300–308.
13. Duque IL, Parra JH. Aerobic fitness and limiting factors of maximal performance in chronic low back pain patients. *J Back Musculoskelet Rehabil.* 2009;22(1):1–7. PMID: 20023339.
14. Smeets RJEM, Wittink H, Hidding A, Knottnerus JA. Do patients with chronic low back pain have a lower level of aerobic fitness than healthy controls? *Spine (Phila Pa 1976).* 2006;31(1):E69–E76.
15. Leeuw M, Goossens MEJB, Linton SJ, Crombez G, Boersma K, Vlaeyen JWS. The fear-avoidance model of musculoskeletal pain: current state of scientific evidence. *Pain.* 2007;130(1–2):77–94.

16. Booth FW, Roberts CK, Laye MJ. Lack of exercise is a major cause of chronic diseases. *J Appl Physiol.* 2012;112(11):1789–1794.
17. Hodges PW, Richardson CA. Inefficient muscular stabilization of the lumbar spine associated with low back pain: a motor control evaluation of transversus abdominis. *Spine.* 1996;21(22):2640–2650.
18. Martinez-Lavin M. Biology and therapy of fibromyalgia: stress, the stress response system, and fibromyalgia. *Semin Arthritis Rheum.* 2007;36(6):351–360.
19. Courtney R. The functions of breathing and its dysfunctions and their relationship to breathing therapy. *J Bodyw Mov Ther.* 2009;13(1):11–23.
20. Linton SJ. A review of psychological risk factors in back and neck pain. *Pain.* 2000;85(3):317–332.
21. Fairbank JCT, Pynsent PB. The Oswestry Disability Index. *Spine.* 2000;25(22):2940–2953.
22. Roland M, Morris R. A study of the natural history of back pain: part I. Development of a reliable and sensitive measure of disability in low-back pain. *Spine.* 1983;8(2):141–144.
23. Waddell G. *The Back Pain Revolution.* 2nd ed. Edinburgh: Churchill Livingstone; 2004.
24. Hayden JA, van Tulder MW, Malmivaara A, Koes BW. Exercise therapy for treatment of non-specific low back pain: a systematic review of randomized clinical trials. *Ann Intern Med.* 2005;142(9):765–775.
25. Wormgoor MEA, Indahl A. The impact of aerobic fitness on functioning in chronic low back pain. *Eur Spine J.* 2007;16(12):2074–2081.
26. Rasmussen-Barr E, Nilsson-Wikmar L, Arvidsson I. Aerobic fitness, pain intensity, and disability in patients with chronic low back pain. *Physiother Theory Pract.* 2011;27(4):247–256.
27. Steenstra IA, Verbeek JH, Heymans MW, Bongers PM. Prognostic factors for duration of sick leave in patients with low back pain. *Occup Environ Med.* 2005;62(12):851–860.
28. Effects of aerobic exercise added to core stabilization in geriatric chronic non-specific low back pain: a randomized controlled trial. *BMC Sports Sci Med Rehabil.* 2025;17:—.
29. Efficacy of aerobic exercise for chronic low back pain: a systematic review and meta-analysis. 2025;—.
30. Galmés-Panadés AM, et al. Association between physical fitness and low back pain: a cross-sectional study. *Glob Pediatr Health.* 2022;9:1–9.

31. Vachalathiti R, Sakulsriprasert P, et al. Decreased functional capacity in individuals with chronic non-specific low back pain: a cross-sectional comparative study. *J Pain Res.* 2020;13:1865–1874.
32. McQuade KJ, Turner JA, Buchner DM. Physical fitness and chronic low back pain: an analysis of the relationships among fitness, functional limitations, and depression. *Clin Orthop Relat Res.* 1988;(233):198–204.
33. Home physical exercise interventions in chronic non-specific low back pain: a systematic review and multivariate meta-analysis. 2025.
34. Huskisson EC. Measurement of pain. *Lancet.* 1974;2(7889):1127–1131.
35. ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories. ATS statement: guidelines for the six-minute walk test. *Am J Respir Crit Care Med.* 2002; 166(1): 111–117.
36. Åstrand PO, Rodahl K, Dahl HA, Strømme SB. *Textbook of Work Physiology: Physiological Bases of Exercise.* 4th ed. Champaign (IL): Human Kinetics; 2003.
37. Deconditioning and physical inactivity in chronic pain populations: physiological mechanisms and clinical implications. *Pain.* 2003; 104(1–2):1–12.