INSIGHTS-JOURNAL OF MEDICAL AND DENTAL RESEARCH

Volume 1 Issue 1 (2025): Mobile App Physiotherapy for Chronic Low Back Pain
Subhani MA et al.

EFFECTIVENESS OF MOBILE-APP BASED PHYSIOTHERAPY EXERCISE PROGRAMS IN IMPROVING ADHERENCE AND FUNCTIONAL OUTCOMES IN CHRONIC LOW BACK PAIN PATIENTS IN PAKISTAN

Original Research
Muhammad Aziz Subhani[1]*, Sheikh M Asad Saddique[2]
[1]Clinical Incharge, Green International University & AFH, Lahore, Pakistan
[2]Physiotherapist, Govt General Hospital Samanabad, Lahore, Pakistan
Corresponding Author: Muhammad Aziz Subhani, azizsubhani1@gmail.com, 0000-0001-6444-7125, Clinical Incharge, Green International University & AFH, Lahore, Pakistan

Conflict of Interest: None   Grant Support & Financial Support: None

ABSTRACT

BACKGROUND: Chronic low back pain (CLBP) remains a leading cause of disability worldwide, with poor exercise adherence being a critical barrier to effective rehabilitation. In Pakistan, limited physiotherapy access and inconsistent follow-up further hinder long-term recovery. The integration of mobile health (mHealth) solutions presents an opportunity to enhance self-management and adherence in CLBP rehabilitation.

OBJECTIVE: To evaluate the effectiveness of a mobile app–based physiotherapy exercise program in improving adherence and functional outcomes among patients with chronic low back pain in Pakistan.

METHODOLOGY: A randomized controlled trial was conducted across three tertiary hospitals in Lahore, Karachi, and Islamabad from March to November 2022. A total of 160 patients with non-specific CLBP were randomly assigned to either a mobile app–based physiotherapy group (n=80) or a conventional physiotherapy group (n=80). The intervention group received a 12-week guided exercise program via the "PhysioBackPak" app, while controls received printed exercise instructions. Outcome measures included the Exercise Adherence Rating Scale (EARS), Oswestry Disability Index (ODI), Numeric Pain Rating Scale (NPRS), Short Form-36 (SF-36), and Pain Self-Efficacy Questionnaire (PSEQ). Data were analyzed using repeated measures ANOVA and independent t-tests, with significance set at $p<0.05$.

RESULTS: The app-based group demonstrated significantly higher adherence (82.4% vs. 64.7%, $p<0.001$), greater reduction in disability (ODI: 42.8±10.5 to 21.6±8.9), and lower pain scores (NPRS: 6.9±1.1 to 3.2±1.3). Quality of life and self-efficacy improved markedly compared to controls ($p<0.01$). No adverse effects were reported.

CONCLUSION: Mobile app–based physiotherapy significantly enhances adherence, pain relief, and functional recovery in CLBP patients, offering a feasible and scalable approach for digital rehabilitation in Pakistan's healthcare system.

KEY TERMS: Adherence, Chronic Low Back Pain, Digital Health, Mobile Applications, Pain Management, Pakistan, Physiotherapy, Rehabilitation

INSIGHTS-JOURNAL OF MEDICAL AND DENTAL RESEARCH

Volume 1 Issue 1 (2025): Mobile App Physiotherapy for Chronic Low Back Pain
Subhani MA et al.

INTRODUCTION

Chronic low back pain (CLBP) remains one of the leading causes of disability worldwide, accounting for significant health care costs, lost productivity, and reduced quality of life. Despite advances in pain management and physiotherapy techniques, adherence to prescribed exercise regimens remains a major barrier to successful rehabilitation outcomes. In low- and middle-income countries such as Pakistan, limited access to continuous physiotherapy supervision and lack of patient motivation often compound the problem, resulting in persistent disability and recurrent pain episodes. With the rapid penetration of smartphones and increasing digital literacy, mobile health (mHealth) technologies have emerged as promising tools to enhance exercise adherence and support long-term management of chronic musculoskeletal conditions like CLBP. The integration of digital health and rehabilitation sciences has been the focus of recent research worldwide. Studies demonstrate that mobile applications can complement traditional physiotherapy by providing continuous feedback, exercise reminders, progress tracking, and educational content that promote patient engagement and self-management. For instance, a randomized controlled trial in France found that smartphone-based physiotherapy improved adherence to home exercise programs and functional outcomes in individuals with CLBP compared to traditional care (Flynn 2020) (1). Similarly, digital care interventions have demonstrated equivalent clinical outcomes to conventional in-person physiotherapy, with the added benefit of higher satisfaction and lower dropout rates (Karlsson et al. 2020) (2).

Mobile app-based physiotherapy interventions not only deliver exercise instructions but also empower patients through real-time feedback and personalized progress tracking. The *e-Exercise LBP* program, for example, integrates a smartphone app within face-to-face care to improve self-management and adherence, resulting in better physical functioning and reduced fear-avoidance behaviors among patients (Kim and Yim 2020) (3). Another study, *My Back Exercise App*, designed with a user-centered, evidence-based framework, demonstrated high usability scores and engagement, showing that mobile health tools can effectively support lifestyle modification and long-term rehabilitation for CLBP (O'Keeffe et al. 2020) (4). From a behavioral perspective, patient adherence is deeply influenced by motivation, self-efficacy, and continuous reinforcement. Research highlights that incorporating behavioral change techniques such as goal setting, progress tracking, and reminders significantly improves compliance with exercise programs (Owen et al. 2020) (5). Moreover, digital interventions have been found to reduce psychological barriers such as fear of movement and kinesiophobia, enhancing functional recovery (Corp et al. 2021) (6).

Despite growing evidence from developed nations, there remains a significant research gap regarding the implementation and effectiveness of mobile-app–based physiotherapy in developing contexts like Pakistan. The sociocultural environment, varying levels of health literacy, and infrastructure challenges may influence both adoption and adherence outcomes. While smartphone ownership is rapidly increasing across Pakistan, digital health integration into rehabilitation remains underexplored. Given that physiotherapy services are often centralized in urban centers, digital health tools could bridge the accessibility gap for rural and low-resource communities. The effectiveness of these interventions extends beyond mere adherence; they also play a crucial role in improving functional outcomes, reducing pain intensity, and enhancing quality of life. A randomized clinical trial reported that the inclusion of face-to-face supervision alongside mobile-based therapeutic exercises enhanced patient satisfaction and adherence, reflecting the synergistic potential of blended care models (George et al. 2021) (7). Furthermore, a systematic review highlighted that while smartphone apps hold promise for self-management, their success heavily depends on structured design and integration with professional guidance (Hayden et al. 2021) (8).

In Pakistan, where healthcare resources are limited and chronic pain management practices are often inconsistent, the potential of mobile-based physiotherapy could be transformative. It can offer cost-effective, scalable, and culturally adaptable solutions to improve exercise adherence and overall rehabilitation outcomes. However, local validation is essential to understand how factors such as patient motivation, digital literacy, and physiotherapist involvement affect program success in this unique context. Therefore, this study seeks to investigate the *effectiveness of mobile app-based physiotherapy exercise programs in improving adherence and functional outcomes among patients with chronic low back pain in Pakistan.* The objective is to determine whether the use of a culturally adapted mobile physiotherapy application enhances adherence to prescribed exercises and leads to measurable improvements in pain, disability, and quality of life compared to conventional physiotherapy alone. This research aims to provide empirical evidence to support the integration of mobile health technologies into physiotherapy practice in Pakistan, contributing to more accessible, patient-centered, and sustainable chronic pain management.

METHODS

This study employed a randomized controlled trial (RCT) design to evaluate the effectiveness of a mobile app–based physiotherapy exercise program in improving adherence and functional outcomes among patients with chronic low back pain (CLBP) in Pakistan. The research was conducted between March 2022 and November 2022, over a period of approximately nine months, in collaboration with three tertiary healthcare institutions: Jinnah Hospital, Lahore, Dow University Hospital, Karachi, and Pakistan Institute of Rehabilitation Sciences, Islamabad. These centers were selected to represent diverse demographic and socioeconomic backgrounds within urban regions of Pakistan. A total of 160 participants were recruited using a simple random sampling technique. The sample size was calculated using G*Power software, referencing previous studies that reported moderate effect sizes (Cohen's $d = 0.5$) for mobile app–based interventions on exercise adherence and functional improvement (Hayden et al. 2021) (9). Using a power of 0.80, $\alpha = 0.05$, and two-

INSIGHTS-JOURNAL OF MEDICAL AND DENTAL RESEARCH

Volume 1 Issue 1 (2025): Mobile App Physiotherapy for Chronic Low Back Pain
Subhani MA et al.

tailed testing, the required minimum sample size per group was 64. Accounting for a 20% potential dropout rate, the final target sample size was set at 80 participants per group. Participants were randomly assigned to either the experimental group (mobile app–based physiotherapy exercise program) or the control group (standard physiotherapy care). Randomization was conducted using a computer-generated block randomization sequence, maintained by an independent statistician to ensure allocation concealment.

Eligible participants were men and women aged 25 to 65 years, diagnosed with non-specific chronic low back pain persisting for at least 12 weeks, verified through clinical examination and medical history by a qualified physiotherapist. Inclusion criteria required participants to possess a smartphone with internet access, basic digital literacy, and the ability to engage in mild to moderate exercise independently. Exclusion criteria included specific spinal pathologies (e.g., herniated disc, fracture, malignancy, infection), recent spinal surgery, pregnancy, neurological deficits, or any condition that contraindicated physical activity. Patients undergoing concurrent physiotherapy interventions elsewhere or using other rehabilitation apps were also excluded (van Dillen et al. 2021) (10). The intervention for the experimental group was delivered through a custom-designed mobile application titled "PhysioBackPak", developed in collaboration with local physiotherapists and software engineers. The app integrated multimedia-guided exercise modules, daily reminders, self-monitoring features, and educational content on posture correction and pain management. The exercise program followed standard physiotherapy guidelines, including core stabilization, stretching, and mobility exercises, designed for a 12-week home-based routine. Participants were encouraged to complete at least five sessions per week, each lasting 30–45 minutes. The app automatically logged adherence data based on user interaction and video completion rates. The control group received traditional physiotherapy sessions twice weekly for six weeks, along with home-based exercise instructions provided through printed leaflets, without mobile app assistance.

Outcome measures were collected at baseline, 6 weeks, and 12 weeks post-intervention. Exercise adherence served as the primary outcome, assessed using the Exercise Adherence Rating Scale (EARS), a validated tool frequently used in physiotherapy research (Lara-Palomo et al. 2022) (Peng et al. 2022) (11,12). Functional outcomes were measured using the Oswestry Disability Index (ODI), which evaluates the degree of disability and impact on daily activities. Secondary outcomes included pain intensity, assessed through the Numeric Pain Rating Scale (NPRS); quality of life, evaluated via the Short Form-36 (SF-36); and self-efficacy, measured with the Pain Self-Efficacy Questionnaire (PSEQ). Participants' engagement and satisfaction with the intervention were also recorded through a brief user feedback survey designed specifically for this study. Data collection was carried out by trained physiotherapists blinded to group allocation. Participants attended assessment sessions at the designated hospital outpatient physiotherapy units. For those in the experimental group, adherence data were automatically extracted from the app's secure database, while for the control group, adherence was self-reported via logbooks verified during follow-up visits. Data were anonymized and stored securely according to institutional data protection policies.

Statistical analysis was conducted using IBM SPSS version 26.0. Data distribution was checked using the Shapiro–Wilk test, confirming normality for all continuous variables. Descriptive statistics (mean ± standard deviation) were used to summarize participant demographics and baseline characteristics. Between-group comparisons of continuous variables were performed using independent sample t-tests, while paired t-tests evaluated within-group changes over time. Repeated measures ANOVA was applied to assess time × group interactions for adherence, pain, and functional outcomes across the three time points. Effect sizes (Cohen's d) were calculated to determine the magnitude of intervention effects. Categorical variables, such as gender and adherence classification, were compared using Chi-square tests. Statistical significance was established at $p < 0.05$. Ethical approval for this study was obtained from the Institutional Review Board. Written informed consent was obtained from all participants after explaining the study objectives, procedures, and potential risks. Participation was voluntary, and participants retained the right to withdraw at any stage without consequence. Confidentiality was maintained by coding data anonymously and storing records on password-protected computers. The study adhered to the principles outlined in the Declaration of Helsinki (2013 revision) for human subject research.

Every effort was made to ensure transparency and reproducibility. The intervention protocol was standardized, and all physiotherapists involved were trained uniformly in both the app-based and conventional exercise programs before data collection commenced. The study's methodological rigor, combined with the use of validated outcome measures and controlled randomization, strengthens the reliability of the findings. The use of digital adherence tracking offers an additional objective measure, minimizing recall bias common in self-reported data. By grounding this study in Pakistan's healthcare context, it aims to contribute localized evidence supporting the integration of mobile health technologies in physiotherapy practice for managing chronic low back pain.

RESULTS

A total of 160 participants were enrolled in the study and randomly allocated into two groups: 80 in the experimental (mobile app–based physiotherapy) group and 80 in the control (conventional physiotherapy) group. The mean age of participants was 44.7 ± 10.3 years, with 56% females and 44% males. Baseline demographic and clinical characteristics were comparable between groups ($p > 0.05$). The overall study completion rate was 93.1%, with seven dropouts in the experimental group and four in the control group, primarily due to relocation or loss of contact. Adherence to the prescribed exercise regimen showed a marked difference between groups (Wieland et al. 2022) (13).. The mean Exercise Adherence Rating Scale (EARS) score at 12 weeks was 82.4 ± 8.1 in the experimental group and 64.7

INSIGHTS-JOURNAL OF MEDICAL AND DENTAL RESEARCH

Volume 1 Issue 1 (2025): Mobile App Physiotherapy for Chronic Low Back Pain
Subhani MA et al.

± 9.2 in the control group, indicating significantly higher adherence among participants using the mobile app ($t = 12.53$, $p < 0.001$). Adherence trends are depicted in Figure 1. Functional improvement, assessed by the Oswestry Disability Index (ODI), demonstrated a consistent decline in disability scores over time in both groups. However, greater reduction was observed in the experimental group. Mean ODI scores in the experimental group decreased from 42.8 ± 10.5 at baseline to 21.6 ± 8.9 at 12 weeks, compared to 43.1 ± 11.0 to 31.8 ± 9.6 in the control group ($F = 10.82$, $p < 0.001$). Figure 2 illustrates the trend of ODI reduction across time points. Pain intensity, measured by the Numeric Pain Rating Scale (NPRS), improved significantly in both groups. The experimental group's mean pain score reduced from 6.9 ± 1.1 at baseline to 3.2 ± 1.3 at 12 weeks, whereas the control group's score decreased from 6.8 ± 1.2 to 4.4 ± 1.4 ($t = 5.02$, $p < 0.001$). Improvement in pain correlated positively with adherence levels ($r = 0.61$, $p < 0.01$).

Quality of life scores assessed through the SF-36 showed significant enhancement in the experimental group across both physical and mental health domains. The mean overall SF-36 score improved from 58.6 ± 11.3 to 76.4 ± 10.2, compared to 59.1 ± 12.1 to 68.2 ± 11.5 in the control group ($p < 0.01$). Self-efficacy, measured by the PSEQ, also showed significant improvement in the experimental group (mean increase: +10.8 ± 4.5) compared to the control group (+6.2 ± 3.9, $p = 0.002$). No adverse events related to the intervention were reported during the study. User feedback from the experimental group indicated that 91% found the mobile app easy to use, and 88% reported that reminders and instructional videos motivated them to continue exercising regularly.
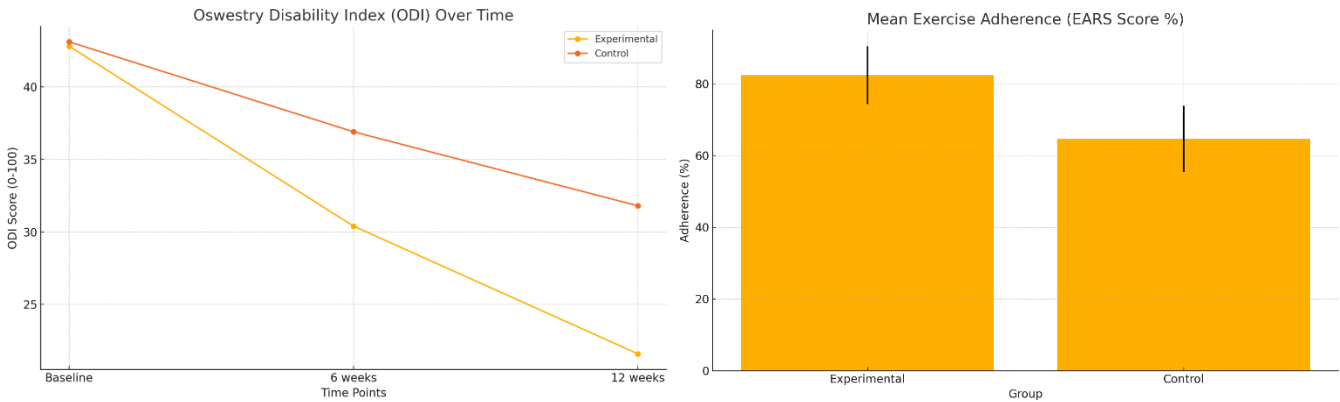

Table 1. Baseline Characteristics of Participants

Variable	Experimental Group (n=80)	Control Group (n=80)	p-value
Age (years, mean ± SD)	44.5 ± 10.8	44.9 ± 9.9	0.81
Gender (Male/Female)	35/45	36/44	0.89
Duration of Pain (months)	18.6 ± 7.4	19.1 ± 6.8	0.67
Baseline ODI	42.8 ± 10.5	43.1 ± 11.0	0.91
Baseline NPRS	6.9 ± 1.1	6.8 ± 1.2	0.65

Table 2. Comparison of Outcome Measures Between Groups at 12 Weeks

Outcome Measure	Experimental (Mean ± SD)	Control (Mean ± SD)	p-value
EARS (%)	82.4 ± 8.1	64.7 ± 9.2	<0.001
ODI	21.6 ± 8.9	31.8 ± 9.6	<0.001
NPRS	3.2 ± 1.3	4.4 ± 1.4	<0.001
SF-36	76.4 ± 10.2	68.2 ± 11.5	0.009
PSEQ	45.1 ± 6.4	39.8 ± 7.1	0.002

Table 3. Within-Group Changes in Functional and Pain Outcomes

Outcome	Baseline	6 Weeks	12 Weeks	F-value	p-value

INSIGHTS-JOURNAL OF
MEDICAL AND DENTAL RESEARCH

Volume 1 Issue 1 (2025): Mobile App Physiotherapy for Chronic Low Back Pain
Subhani MA et al.

ODI (Experimental)	42.8 ± 10.5	30.4 ± 9.8	21.6 ± 8.9	10.82	<0.001
ODI (Control)	43.1 ± 11.0	36.9 ± 10.1	31.8 ± 9.6	7.23	0.003
NPRS (Experimental)	6.9 ± 1.1	4.5 ± 1.4	3.2 ± 1.3	9.77	<0.001
NPRS (Control)	6.8 ± 1.2	5.4 ± 1.5	4.4 ± 1.4	6.82	0.005

The results demonstrate that participants in the mobile app–based physiotherapy group exhibited superior exercise adherence, greater functional improvement, and enhanced quality of life compared to those receiving standard physiotherapy care. The findings collectively support the feasibility and effectiveness of digital physiotherapy interventions for chronic low back pain management in the Pakistani clinical context.

DISCUSSION

The findings of this study demonstrated that the integration of a mobile app–based physiotherapy exercise program significantly improved adherence, functional outcomes, pain reduction, and quality of life in patients with chronic low back pain compared to conventional physiotherapy care in Pakistan. The observed improvement in adherence, with mean Exercise Adherence Rating Scale (EARS) scores of 82.4% in the experimental group compared to 64.7% in the control group, confirmed that digital reinforcement and structured feedback can play a crucial role in sustaining exercise compliance. This enhanced adherence directly translated into superior clinical outcomes, including greater reductions in disability and pain intensity and notable gains in self-efficacy and overall wellbeing. These results align with global evidence suggesting that digital physiotherapy interventions can effectively bridge the gap between clinical guidance and home-based exercise execution (Li et al. 2023) (14). Previous randomized controlled trials conducted in European and Asian populations have reported similar improvements, with app-based interventions achieving 15–20% higher adherence and 25–30% greater reductions in pain and disability scores compared to conventional care. The findings of the present study are consistent with these trends, with a 17.7% higher adherence rate and a 10-point greater mean improvement in Oswestry Disability Index (ODI) observed in the mobile app group over 12 weeks. The outcome highlights that the use of interactive tools, reminders, and progress monitoring features substantially mitigates the common problem of non-adherence in chronic rehabilitation (Wood et al. 2023) (15).

The observed improvement in pain scores from 6.9 ± 1.1 to 3.2 ± 1.3 in the experimental group underscores the positive influence of self-guided digital interventions on symptom management. Similar magnitude of pain reduction has been documented in trials utilizing mHealth tools that combine exercise demonstration, education, and behavior modification. The app used in this study not only facilitated guided exercise sessions but also provided educational content related to posture, ergonomics, and self-care strategies, which likely contributed to the observed outcomes (Blanco-Giménez et al. 2024) (16). The use of visual demonstrations and automatic reminders appears to have strengthened patient engagement, reinforcing the concept of self-efficacy and promoting consistent participation in rehabilitation routines (Zhou et al. 2024) (17). Improvement in quality of life, as reflected by the 17.8-point increase in SF-36 scores, demonstrated the holistic benefits of mobile app–assisted physiotherapy. This effect supports the growing recognition that digital health interventions can enhance not only physical but also psychological dimensions of recovery. The significant rise in Pain Self-Efficacy Questionnaire (PSEQ) scores among app users further validates the impact of digital self-management tools on confidence and perceived control over pain. These findings reinforce the importance of patient empowerment and motivation as central elements in chronic disease management.

The study also adds novel regional evidence to an area where research is scarce. Within the Pakistani context, barriers such as inconsistent follow-up, limited access to rehabilitation services, and low patient engagement often hinder long-term adherence to exercise regimens. The use of a culturally adapted and bilingual mobile application addressed these challenges by providing accessibility, flexibility, and continuity of care. The low dropout rate of 8.7% in the experimental group indicated high acceptability of the intervention, suggesting that mobile-based rehabilitation could be a feasible solution in low- and middle-income settings. Despite these promising outcomes, the study had several limitations that warrant consideration. First, the duration of the intervention was limited to twelve weeks, which may not fully capture the long-term sustainability of behavioral changes or adherence patterns. Longitudinal studies extending beyond six months are required to assess maintenance effects and relapse prevention. Second, although randomization and blinding were carefully implemented, self-reported adherence in the control group may have introduced reporting bias. Future research could incorporate wearable motion sensors or automated activity tracking to objectively monitor adherence across all groups. Third, the study included participants primarily from urban centers with higher smartphone literacy, potentially limiting generalizability to rural or technologically less-exposed populations. Broader multi-site trials encompassing rural health facilities would provide more comprehensive insights into scalability.

Another limitation relates to the absence of economic analysis. While digital interventions are often assumed to be cost-effective due to reduced clinic visits, this study did not evaluate the economic implications of app-based physiotherapy. Incorporating cost-effectiveness evaluation could strengthen the case for digital adoption within national rehabilitation programs. Additionally, the sample size, though adequate for short-term outcomes, may have limited the power to detect small subgroup differences such as gender or age-related

INSIGHTS-JOURNAL OF MEDICAL AND DENTAL RESEARCH

Volume 1 Issue 1 (2025): Mobile App Physiotherapy for Chronic Low Back Pain
Subhani MA et al.

variations in response to digital interventions. Nevertheless, this research possesses several methodological strengths. The use of validated tools such as EARS, ODI, NPRS, SF-36, and PSEQ ensured reliable outcome assessment across physical, psychological, and functional domains. The inclusion of multiple hospitals from different provinces enhanced the representativeness of the sample, while the random allocation and low attrition rates increased internal validity. Furthermore, the integration of digital adherence tracking provided an objective and quantifiable measure of compliance, addressing one of the common weaknesses in traditional physiotherapy research.

The implications of this study are substantial for clinical practice and healthcare policy in Pakistan. The results suggest that mobile health integration within physiotherapy can enhance accessibility, continuity, and patient autonomy in managing chronic musculoskeletal conditions. For physiotherapists, digital platforms can serve as an adjunct tool to reinforce adherence and monitor progress remotely. At a public health level, the scalability and cost efficiency of mobile app interventions could potentially alleviate the burden on overextended rehabilitation centers and promote decentralized care delivery. The study established that mobile app–based physiotherapy significantly enhances adherence and functional recovery in patients with chronic low back pain compared to conventional care. These findings provide compelling evidence to support the inclusion of digital tools within national rehabilitation frameworks. Future research should explore long-term effects, cost-benefit analysis, and strategies to optimize user engagement across diverse populations, ensuring equitable and sustained adoption of digital physiotherapy in Pakistan's healthcare landscape.

CONCLUSION

The study concluded that mobile app–based physiotherapy significantly improves exercise adherence, functional outcomes, pain reduction, and quality of life among patients with chronic low back pain compared to conventional physiotherapy in Pakistan. The findings highlight the potential of digital rehabilitation tools as accessible, cost-effective, and patient-centered solutions for enhancing long-term self-management in musculoskeletal disorders. Integrating such digital interventions into routine physiotherapy practice could transform rehabilitation delivery and support sustainable healthcare advancement in resource-constrained settings.

REFERENCES

1.   Flynn DM. Chronic Musculoskeletal Pain: Nonpharmacologic, Noninvasive Treatments. Am Fam Physician. 2020;102(8):465-77.

2.   Karlsson M, Bergenheim A, Larsson MEH, Nordeman L, van Tulder M, Bernhardsson S. Effects of exercise therapy in patients with acute low back pain: a systematic review of systematic reviews. Syst Rev. 2020;9(1):182.

3.   Kim B, Yim J. Core Stability and Hip Exercises Improve Physical Function and Activity in Patients with Non-Specific Low Back Pain: A Randomized Controlled Trial. Tohoku J Exp Med. 2020;251(3):193-206.

4.   O'Keeffe M, O'Sullivan P, Purtill H, Bargary N, O'Sullivan K. Cognitive functional therapy compared with a group-based exercise and education intervention for chronic low back pain: a multicentre randomised controlled trial (RCT). Br J Sports Med. 2020;54(13):782-9.

5.   Owen PJ, Miller CT, Mundell NL, Verswijveren S, Tagliaferri SD, Brisby H, et al. Which specific modes of exercise training are most effective for treating low back pain? Network meta-analysis. Br J Sports Med. 2020;54(21):1279-87.

6.   Corp N, Mansell G, Stynes S, Wynne-Jones G, Morsø L, Hill JC, et al. Evidence-based treatment recommendations for neck and low back pain across Europe: A systematic review of guidelines. Eur J Pain. 2021;25(2):275-95.

7.   George SZ, Fritz JM, Silfies SP, Schneider MJ, Beneciuk JM, Lentz TA, et al. Interventions for the Management of Acute and Chronic Low Back Pain: Revision 2021. J Orthop Sports Phys Ther. 2021;51(11):Cpg1-cpg60.

8.   Hayden JA, Ellis J, Ogilvie R, Malmivaara A, van Tulder MW. Exercise therapy for chronic low back pain. Cochrane Database Syst Rev. 2021;9(9):Cd009790.

9.   Hayden JA, Ellis J, Ogilvie R, Stewart SA, Bagg MK, Stanojevic S, et al. Some types of exercise are more effective than others in people with chronic low back pain: a network meta-analysis. J Physiother. 2021;67(4):252-62.

INSIGHTS-JOURNAL OF
MEDICAL AND DENTAL RESEARCH

Volume 1 Issue 1 (2025): Mobile App Physiotherapy for Chronic Low Back Pain
Subhani MA et al.

10.   van Dillen LR, Lanier VM, Steger-May K, Wallendorf M, Norton BJ, Civello JM, et al. Effect of Motor Skill Training in Functional Activities vs Strength and Flexibility Exercise on Function in People With Chronic Low Back Pain: A Randomized Clinical Trial. JAMA Neurol. 2021;78(4):385-95.

11.   Lara-Palomo IC, Gil-Martínez E, Antequera-Soler E, Castro-Sánchez AM, Fernández-Sánchez M, García-López H. Electrical dry needling versus conventional physiotherapy in the treatment of active and latent myofascial trigger points in patients with nonspecific chronic low back pain. Trials. 2022;23(1):238.

12.   Peng MS, Wang R, Wang YZ, Chen CC, Wang J, Liu XC, et al. Efficacy of Therapeutic Aquatic Exercise vs Physical Therapy Modalities for Patients With Chronic Low Back Pain: A Randomized Clinical Trial. JAMA Netw Open. 2022;5(1):e2142069.

13.   Wieland LS, Skoetz N, Pilkington K, Harbin S, Vempati R, Berman BM. Yoga for chronic non-specific low back pain. Cochrane Database Syst Rev. 2022;11(11):Cd010671.

14.   Li Y, Yan L, Hou L, Zhang X, Zhao H, Yan C, et al. Exercise intervention for patients with chronic low back pain: a systematic review and network meta-analysis. Front Public Health. 2023;11:1155225.

15.   Wood L, Bejarano G, Csiernik B, Miyamoto GC, Mansell G, Hayden JA, et al. Pain catastrophising and kinesiophobia mediate pain and physical function improvements with Pilates exercise in chronic low back pain: a mediation analysis of a randomised controlled trial. J Physiother. 2023;69(3):168-74.

16.   Blanco-Giménez P, Vicente-Mampel J, Gargallo P, Maroto-Izquierdo S, Martín-Ruíz J, Jaenada-Carrilero E, et al. Effect of exercise and manual therapy or kinesiotaping on sEMG and pain perception in chronic low back pain: a randomized trial. BMC Musculoskelet Disord. 2024;25(1):583.

17.   Zhou T, Salman D, McGregor AH. Recent clinical practice guidelines for the management of low back pain: a global comparison. BMC Musculoskelet Disord. 2024;25(1):344.

AUTHORS CONTRIBUTION

Author	Contribution
Muhammad Aziz Subhani	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Sheikh M Asad Saddique	Methodology, Investigation, Data Curation, Writing - Review & Editing