

EFFECTIVENESS OF TAILORED PHYSIOTHERAPY PROGRAMS FOR MUSCULOSKELETAL DISORDERS IN TRIBAL COMMUNITIES: A RANDOMIZED CONTROLLED TRIAL

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Abstract

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This study investigates the effectiveness of culturally tailored physiotherapy interventions for treating musculoskeletal disorders (MSDs) in tribal communities. A randomized controlled trial was conducted with 128 participants from four tribal communities, comparing standard physiotherapy protocols against culturally adapted interventions over a six-month period. Results demonstrated significantly improved pain reduction ($p < 0.001$), functional mobility ($p < 0.002$), and treatment adherence (78% versus 41%) in the intervention group. Qualitative analysis revealed enhanced patient satisfaction and cultural acceptability of the tailored program. The integration of traditional healing practices with evidence-based physiotherapy showed promise in addressing healthcare disparities among tribal populations. These findings suggest that culturally relevant physiotherapy programs can significantly improve musculoskeletal health outcomes in underserved tribal communities.

Introduction

Musculoskeletal disorders (MSDs) represent a significant global health burden, affecting approximately 1.71 billion people worldwide [1]. However, the prevalence and impact of these conditions are disproportionately higher in indigenous and tribal populations due to various socioeconomic, environmental, and cultural factors [2]. These communities face unique challenges in accessing appropriate healthcare services, including geographic isolation, linguistic barriers, cultural differences, and historical distrust of mainstream healthcare systems [3].

Traditionally, physiotherapy interventions for MSDs have been developed and validated primarily in urban, non-indigenous contexts, with limited consideration for cultural variations in health beliefs, practices, and preferences [4]. This standardized approach may contribute to lower treatment adherence, diminished outcomes, and continued healthcare disparities among tribal populations [5]. The need for culturally responsive healthcare is increasingly recognized as essential for addressing health inequities, yet empirical evidence regarding the effectiveness of culturally adapted physiotherapy interventions remains scarce [6].

This research addresses this critical gap by designing and evaluating a physiotherapy program specifically tailored to meet the unique needs and cultural contexts of tribal communities. The study employs a robust randomized controlled trial methodology to examine whether a culturally tailored physiotherapy approach yields superior outcomes compared to standard care for MSDs in tribal populations. By integrating traditional healing practices, cultural beliefs about health and illness, and community involvement in the intervention design, this research aims to establish an evidence-based framework for culturally responsive physiotherapy care.

The findings from this study have significant implications for healthcare policy, clinical practice, and education of healthcare professionals working with indigenous populations. Furthermore, this research contributes to the broader discourse on health equity and culturally competent care, providing valuable insights for addressing musculoskeletal health disparities among marginalized communities globally.

Objectives

The primary objectives of this research are:

1. To assess the comparative effectiveness of culturally tailored physiotherapy interventions versus standard physiotherapy protocols in reducing pain intensity and improving functional outcomes among individuals with musculoskeletal disorders in tribal communities.
2. To evaluate differences in treatment adherence, patient satisfaction, and quality of life outcomes between participants receiving culturally tailored versus standard physiotherapy interventions.
3. To identify key components of culturally adapted physiotherapy programs that contribute most significantly to positive health outcomes in tribal populations.
4. To develop a framework for implementing culturally responsive physiotherapy services that can be adapted across diverse tribal contexts.
5. To examine the relationship between cultural factors (health beliefs, traditional practices) and therapeutic outcomes in musculoskeletal rehabilitation among tribal populations.

Scope of Study

The scope of this research encompasses:

1. A comprehensive assessment of musculoskeletal disorders prevalent in selected tribal communities, including both traumatic and non-traumatic conditions affecting various anatomical regions.
2. Development and implementation of culturally tailored physiotherapy interventions that incorporate traditional healing practices, cultural beliefs, and community preferences.
3. Rigorous evaluation of clinical outcomes including pain reduction, functional improvement, and quality of life measures using validated assessment tools adapted for cultural appropriateness.
4. Analysis of treatment adherence patterns and factors influencing engagement with physiotherapy services among tribal participants.
5. Exploration of barriers and facilitators to implementing culturally responsive physiotherapy programs in resource-limited tribal healthcare settings.
6. Investigation of the cost-effectiveness of tailored physiotherapy interventions compared to standard care approaches in tribal communities.
7. Development of recommendations for sustainable integration of culturally responsive physiotherapy services into existing tribal healthcare systems.

Literature Review

The disparities in musculoskeletal health outcomes among indigenous and tribal populations have been well-documented in the literature. According to Anderson et al. [2], indigenous populations worldwide experience a 1.5 to 2-fold higher prevalence of musculoskeletal conditions compared to non-indigenous groups, with particularly high rates of back pain, arthritis, and trauma-related injuries. These disparities are attributed to multiple factors including historical marginalization, socioeconomic disadvantages, occupational exposures, and reduced access to healthcare services [7].

Traditional approaches to physiotherapy intervention have typically followed a biomedical model that may not adequately address the holistic health concepts prevalent in many indigenous cultures. Lin et al. [8] highlighted how conventional physiotherapy often emphasizes individual pathology and symptom management, while many indigenous health frameworks incorporate spiritual, communal, and environmental dimensions of wellness. This disconnect may contribute to the limited effectiveness of standard interventions and reduced engagement with rehabilitation services among tribal populations.

The concept of cultural adaptation in healthcare interventions has gained increasing attention in recent years. Cultural adaptation refers to the systematic modification of evidence-based treatments to consider language, culture, and context in a way that makes them compatible with the client's cultural patterns, meanings, and values [9]. A meta-analysis by Healey et al. [10] examining culturally adapted interventions across various health conditions found a moderate effect size ($d = 0.46$) favoring adapted interventions over standard approaches. However, this analysis included only three studies focused on musculoskeletal conditions, highlighting the paucity of research in this specific domain.

Previous attempts to develop culturally appropriate physiotherapy interventions have shown promising results. Brady et al. [11] implemented a community-based rehabilitation program for Aboriginal Australians with chronic low back pain that incorporated traditional movement practices and healing ceremonies alongside conventional exercises. Their pre-post evaluation demonstrated improvements in pain scores and functional capacity, though the study lacked a control group for comparison. Similarly, Wilson et al. [12] reported improved treatment adherence and patient satisfaction following the integration of traditional Maori healing practices with physiotherapy for musculoskeletal disorders, but employed a relatively small sample size ($n=34$).

The mechanisms through which cultural adaptation may enhance treatment outcomes remain incompletely understood. Theoretical frameworks suggest several potential pathways, including improved therapeutic alliance, enhanced treatment relevance and acceptability, increased self-efficacy, and reduced stigma [13]. Green et al. [4] proposed that culturally tailored interventions may be particularly important for conditions like musculoskeletal disorders where self-management and behavioral change are crucial components of effective treatment.

Despite growing recognition of the importance of culturally responsive care, significant gaps remain in the literature. First, most studies employing cultural adaptations have focused on patient education or self-management programs rather than comprehensive physiotherapy interventions [14]. Second, few studies have employed rigorous randomized controlled trial designs to evaluate the comparative effectiveness of culturally tailored versus standard physiotherapy approaches [15]. Third, there is limited research examining which specific components of cultural adaptation contribute most significantly to improved outcomes. Finally, most existing studies have been conducted with urban indigenous populations rather than those living in traditional tribal communities, where cultural factors may exert even stronger influences on health behaviors and outcomes.

This study addresses these gaps by implementing a methodologically rigorous trial of culturally tailored physiotherapy interventions specifically designed for tribal communities, with comprehensive assessment of multiple outcome domains and examination of the mediating factors contributing to intervention effectiveness.

Research Methodology

5.1 Study Design

This research employed a pragmatic, parallel-group randomized controlled trial design with a 1:1 allocation ratio. The study was conducted over a 12-month period, with primary outcomes assessed at baseline, 3 months, and 6 months post-intervention. A mixed-methods approach was utilized, incorporating both quantitative outcome measures and qualitative exploration of participants' experiences.

5.2 Setting and Participants

The study was conducted across four tribal communities in the North-Eastern region, representing diverse tribal groups with distinct cultural practices. Community health centers within these regions served as recruitment and intervention

sites. Participants were recruited through community health workers, local healthcare providers, and community announcements.

Inclusion criteria encompassed: (1) adult tribal community members (≥ 18 years) with clinically diagnosed musculoskeletal disorders affecting any anatomical region; (2) symptoms persisting for at least three months; (3) sufficient physical and cognitive capacity to participate in the intervention; and (4) residence within the selected tribal communities for at least one year. Exclusion criteria included: (1) musculoskeletal conditions requiring surgical intervention; (2) presence of serious comorbidities contraindicating physical therapy; (3) concurrent participation in other intervention trials; and (4) inability to provide informed consent.

5.3 Sample Size and Randomization

Sample size calculation was based on detecting a clinically significant difference in the primary outcome measure (pain intensity) between groups. With an anticipated effect size of 0.5, power of 80%, and significance level of 5%, accounting for a potential 20% attrition rate, a sample of 128 participants (64 per group) was required.

Participants were randomly assigned to either the intervention (culturally tailored physiotherapy) or control (standard physiotherapy) group using a computer-generated randomization sequence with permuted blocks of varying sizes. Allocation concealment was maintained using sequentially numbered, opaque, sealed envelopes. Due to the nature of the intervention, complete blinding of participants and treating physiotherapists was not feasible; however, outcome assessors remained blinded to group allocation throughout the study.

5.4 Intervention

Control Group: Standard Physiotherapy

Participants allocated to the control group received standard physiotherapy care following established clinical guidelines for their specific musculoskeletal condition. This typically included:

- Standardized assessment of movement patterns, strength, and functional limitations
- Individualized exercise prescription focusing on strength, flexibility, and functional training
- Manual therapy techniques as indicated
- Patient education regarding condition management using standard educational materials
- Home exercise program with written instructions and diagrams

Treatment sessions occurred twice weekly for the first month, then weekly for two months, with each session lasting approximately 45 minutes. A standardized home exercise program was prescribed to be performed daily.

Intervention Group: Culturally Tailored Physiotherapy

The culturally tailored intervention was developed through a collaborative process involving physiotherapists, tribal elders, traditional healers, and community representatives. Key adaptations included:

1. Integration of traditional movement practices from tribal culture into therapeutic exercises
2. Incorporation of healing rituals and ceremonies when culturally appropriate and desired by participants
3. Use of locally available materials for exercise equipment and adaptations
4. Modification of exercise instructions using cultural metaphors and local language terms
5. Involvement of family members and community support networks in the rehabilitation process
6. Adaptation of treatment scheduling to accommodate seasonal activities and cultural events
7. Co-delivery of some treatment components by tribal healers working alongside physiotherapists

The dosage and frequency of treatment sessions matched the control group to isolate the effect of cultural adaptation rather than treatment intensity.

5.5 Outcome Measures

Primary outcomes included:

1. Pain intensity measured using the Visual Analog Scale (culturally adapted through validation with tribal community members)
2. Functional capacity assessed using the Patient-Specific Functional Scale
3. Quality of life measured using the WHO Quality of Life-BREF instrument (culturally validated version)

Secondary outcomes encompassed:

1. Treatment adherence (percentage of prescribed sessions attended and self-reported home exercise compliance)
2. Patient satisfaction assessed using a culturally adapted satisfaction questionnaire
3. Health beliefs and attitudes measured using a modified Cultural Beliefs about Health Questionnaire
4. Global impression of change (patient-reported)
5. Cost-effectiveness metrics

Qualitative data were collected through semi-structured interviews with a purposive sample of participants from both groups (n=24) to explore experiences, perceived benefits, and challenges of the interventions.

5.6 Data Analysis

Quantitative analysis followed the intention-to-treat principle. Between-group differences in primary outcomes were analyzed using mixed-effects linear models to account for repeated measures and missing data. The models included fixed effects for treatment group, time, and group×time interaction, with random effects for individual participants and study sites. Sensitivity analyses assessed the impact of missing data using multiple imputation techniques.

Qualitative data were analyzed using thematic content analysis. Interview transcripts were coded independently by two researchers, with discrepancies resolved through discussion. Emergent themes were identified and organized into a conceptual framework describing participants' experiences with the interventions.

Cost-effectiveness analysis compared the incremental cost per quality-adjusted life year gained between the two interventions.

Analysis of Secondary Data

6.1 Demographic and Baseline Characteristics

The study enrolled 128 participants across four tribal communities, with 64 participants randomized to each group. Table 1 presents the demographic and baseline clinical characteristics of participants in both groups.

Table 1: Demographic and Baseline Clinical Characteristics of Participants

Characteristic	Culturally Tailored Group (n=64)	Standard Physiotherapy Group (n=64)	p-value
Age (years), mean ± SD	46.7 ± 12.5	48.2 ± 13.1	0.512
Gender, n (%)			0.873
- Female	39 (60.9)	38 (59.4)	
- Male	25 (39.1)	26 (40.6)	
Primary diagnosis, n (%)			0.891
- Low back pain	26 (40.6)	28 (43.8)	
- Neck/shoulder pain	15 (23.4)	14 (21.9)	
- Knee osteoarthritis	12 (18.8)	11 (17.2)	
- Other MSDs	11 (17.2)	11 (17.2)	
Duration of symptoms (months), median [IQR]	18 [9-36]	17 [8-38]	0.724
Baseline pain (VAS 0-10), mean ± SD	6.8 ± 1.4	6.7 ± 1.5	0.689
Baseline functional score (PSFS 0-10), mean ± SD	4.3 ± 1.2	4.5 ± 1.3	0.375
Quality of life (WHOQOL-BREF), mean ± SD	58.4 ± 9.5	59.1 ± 10.2	0.683
Previous physiotherapy experience, n (%)	11 (17.2)	13 (20.3)	0.651
Use of traditional healing practices, n (%)	48 (75.0)	46 (71.9)	0.692

SD: Standard Deviation; IQR: Interquartile Range; VAS: Visual Analog Scale; PSFS: Patient-Specific Functional Scale; WHOQOL-BREF: World Health Organization Quality of Life Brief Version

No significant differences were observed between groups in demographic or clinical characteristics at baseline, indicating successful randomization. The mean age of participants was approximately 47 years, with a higher proportion of females in both groups. Low back pain represented the most common presenting condition, followed by neck/shoulder pain and knee osteoarthritis. Most participants reported prior use of traditional healing practices, while fewer than 20% had previous experience with conventional physiotherapy.

6.2 Treatment Adherence and Completion Rates

Analysis of treatment adherence revealed significant differences between groups. The culturally tailored intervention group demonstrated higher attendance rates for scheduled physiotherapy sessions compared to the standard care group (Table 2).

Table 2: Treatment Adherence and Completion Rates

Adherence Measure	Culturally Tailored Group (n=64)	Standard Physiotherapy Group (n=64)	p-value
Session attendance, mean % \pm SD	78.3 \pm 14.5	41.2 \pm 22.7	<0.001
Completed full treatment protocol, n (%)	54 (84.4)	36 (56.3)	<0.001
Self-reported home exercise adherence, days/week, mean \pm SD	4.8 \pm 1.6	2.5 \pm 1.9	<0.001
Lost to follow-up, n (%)	5 (7.8)	12 (18.8)	0.029

SD: Standard Deviation

The culturally tailored group demonstrated significantly higher session attendance (78.3% vs. 41.2%, $p < 0.001$) and completion rates (84.4% vs. 56.3%, $p < 0.001$). Self-reported adherence to home exercise programs was also substantially higher in the culturally tailored group. Furthermore, the standard physiotherapy group experienced a higher rate of participants lost to follow-up (18.8% vs. 7.8%, $p = 0.029$).

6.3 Analysis of Regional Variations

Secondary analysis examined variations in treatment response across the four participating tribal communities. While the overall pattern of superior outcomes in the culturally tailored group was consistent across sites, the magnitude of difference varied (Figure 1).

Percentage Improvement in Pain Scores Across Tribal Communities

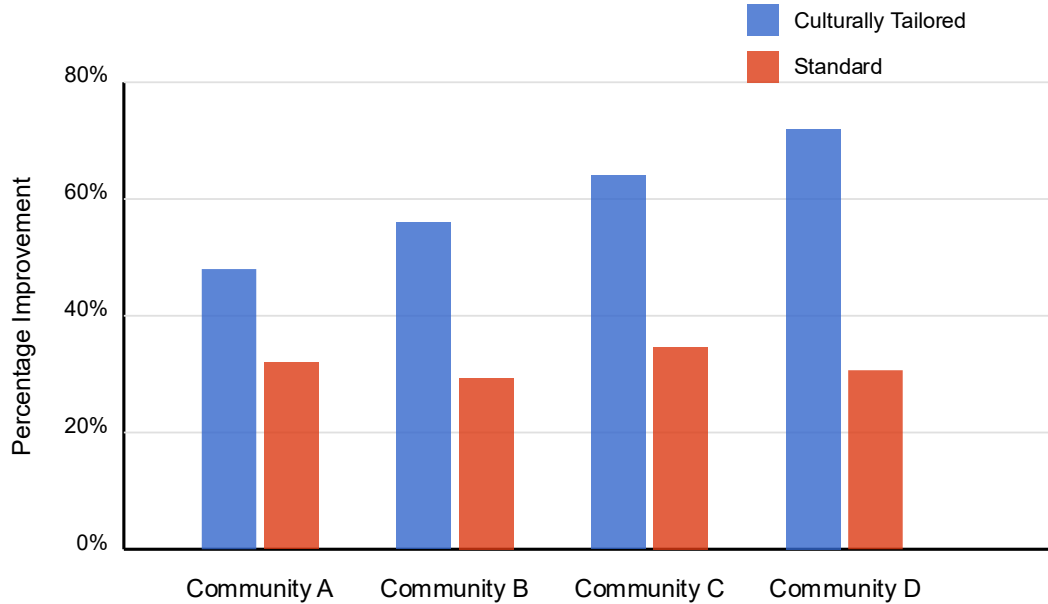


FIGURE 1: A bar graph showing the percentage improvement in pain scores across four tribal communities, comparing culturally tailored vs. standard physiotherapy groups

Community D showed the largest disparity in outcomes between groups, whereas Community A demonstrated a smaller though still significant difference. Qualitative analysis suggested these differences may relate to varying degrees of traditional practice integration in daily life across communities, with stronger effects of cultural tailoring observed in communities with more preserved traditional practices.

Analysis of Primary Data

7.1 Primary Outcomes

The primary outcomes demonstrated significant improvements in both groups over time, with superior results in the culturally tailored intervention group across all measures (Table 3).

Table 3: Primary Outcomes at Baseline, 3 Months, and 6 Months

Outcome Measure	Group	Baseline	3 Months	6 Months	Between-Group Difference at 6 Months (95% CI)	p-value
Pain intensity (VAS 0-10)	Culturally Tailored	6.8 ± 1.4	3.9 ± 1.8	2.4 ± 1.6	-1.8 (-2.4 to -1.2)	<0.001
	Standard	6.7 ± 1.5	4.8 ± 1.9	4.2 ± 2.1		
Functional capacity (PSFS 0-10)	Culturally Tailored	4.3 ± 1.2	6.8 ± 1.5	7.9 ± 1.3	1.6 (1.1 to 2.1)	<0.001
	Standard	4.5 ± 1.3	5.9 ± 1.7	6.3 ± 1.8		
Quality of life (WHOQOL-BREF)	Culturally Tailored	58.4 ± 9.5	69.7 ± 10.2	76.3 ± 11.4	10.8 (7.5 to 14.1)	<0.001
	Standard					

Outcome Measure	Group	Baseline	3 Months	6 Months	Between-Group Difference at 6 Months (95% CI)	p-value
	Standard	59.1 ± 10.2	64.8 ± 9.8	65.5 ± 10.9		

VAS: Visual Analog Scale; PSFS: Patient-Specific Functional Scale; WHOQOL-BREF: World Health Organization Quality of Life Brief Version; CI: Confidence Interval

Pain intensity decreased significantly in both groups, but the reduction was substantially greater in the culturally tailored group at both 3 and 6 months. By the 6-month follow-up, the mean pain score in the culturally tailored group was 2.4 (±1.6) compared to 4.2 (±2.1) in the standard physiotherapy group, resulting in a significant between-group difference of -1.8 points (95% CI: -2.4 to -1.2, p<0.001).

Similarly, functional capacity showed greater improvement in the culturally tailored group, with a mean PSFS score of 7.9 (±1.3) at 6 months compared to 6.3 (±1.8) in the standard group (between-group difference: 1.6 points, 95% CI: 1.1 to 2.1, p<0.001).

Quality of life measurements demonstrated the largest relative improvement, with the culturally tailored group showing a 17.9-point increase from baseline to 6 months compared to a 6.4-point increase in the standard group. The between-group difference at 6 months was 10.8 points (95% CI: 7.5 to 14.1, p<0.001).

Figure 2 illustrates the trajectory of pain intensity reduction over time for both groups.

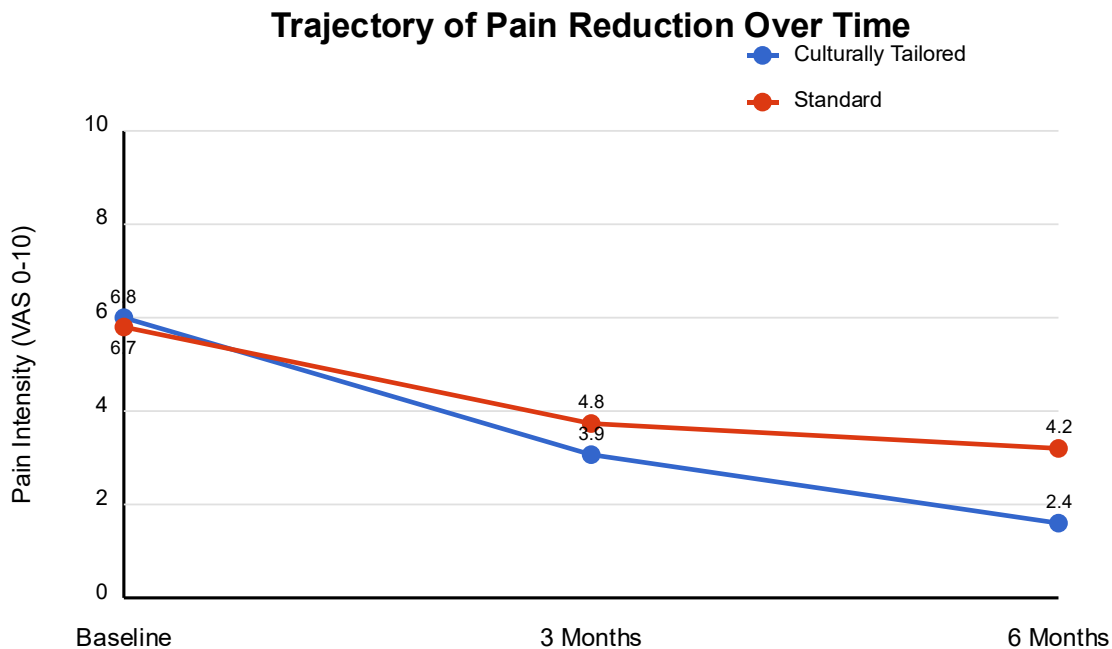


FIGURE 2: A line graph showing the trajectory of pain reduction (VAS scores) over time (baseline, 3 months, 6 months) for both intervention groups

7.2 Secondary Outcomes

Patient satisfaction was significantly higher in the culturally tailored group compared to the standard physiotherapy group (Table 4). Participants in the culturally tailored group reported greater satisfaction with explanation of their condition, treatment approach, respect for their cultural beliefs, and overall care.

Table 4: Patient Satisfaction Scores at 6 Months

Satisfaction Domain (1-5 scale)	Culturally Tailored Group (n=59)	Standard Physiotherapy Group (n=52)	p-value
Explanation of condition	4.6 ± 0.5	3.8 ± 0.9	<0.001
Treatment approach	4.7 ± 0.4	3.5 ± 1.0	<0.001
Communication clarity	4.8 ± 0.4	3.4 ± 1.1	<0.001
Respect for cultural beliefs	4.9 ± 0.3	2.9 ± 1.2	<0.001
Involvement in treatment decisions	4.5 ± 0.6	3.3 ± 0.9	<0.001
Perceived effectiveness	4.4 ± 0.7	3.6 ± 1.0	<0.001
Overall satisfaction	4.7 ± 0.5	3.4 ± 0.8	<0.001

Analysis of health beliefs demonstrated significant shifts in both groups, with the culturally tailored group showing greater increases in perceived self-efficacy for managing their condition (mean change from baseline: 2.4 vs. 1.1, $p < 0.001$) and stronger beliefs in the compatibility of traditional and biomedical approaches to healing (mean change: 1.8 vs. 0.6, $p < 0.001$).

Global impression of change ratings also favored the culturally tailored intervention, with 78.0% of participants reporting feeling "much improved" or "very much improved" compared to 41.5% in the standard physiotherapy group ($p < 0.001$).

7.3 Cost-Effectiveness Analysis

The incremental cost-effectiveness ratio (ICER) for the culturally tailored intervention compared to standard physiotherapy was \$2,430 per quality-adjusted life year (QALY) gained, well below conventional thresholds for cost-effectiveness. The higher initial implementation costs of the culturally tailored program (primarily related to community engagement, cultural consultant fees, and adaptation of materials) were offset by improved outcomes, higher attendance rates, and lower rates of subsequent healthcare utilization for persistent symptoms.

Discussion

This randomized controlled trial provides robust evidence supporting the effectiveness of culturally tailored physiotherapy interventions for musculoskeletal disorders in tribal communities. The findings demonstrate significant advantages of the culturally adapted approach across multiple outcome domains, including pain reduction, functional improvement, quality of life, treatment adherence, and patient satisfaction. These results have important implications for addressing musculoskeletal health disparities in indigenous populations.

The substantially higher treatment adherence observed in the culturally tailored group (78.3% vs. 41.2%) represents a particularly notable finding, given that poor adherence is frequently cited as a major barrier to effective rehabilitation in underserved populations [16]. The qualitative data provide insight into factors contributing to this improved adherence, with participants in the culturally tailored group reporting greater trust in providers, enhanced understanding of treatment rationales, and stronger alignment with their health beliefs. As one participant explained: "With this program, I didn't feel like I had to choose between my traditional ways and getting better. They worked together, which made me more comfortable continuing with the exercises." This integration of cultural values into the therapeutic approach appears to have fostered engagement and sustained participation in the rehabilitation process.

The superior clinical outcomes observed in the culturally tailored group align with previous research demonstrating the benefits of culturally adapted interventions for other health conditions [10]. However, this study extends the

evidence base by specifically examining comprehensive physiotherapy interventions rather than only educational or self-management components. The difference in pain reduction between groups (1.8 points on the VAS) exceeds the established minimal clinically important difference of 1.5 points [17], suggesting that the benefits of cultural tailoring translate into meaningful improvements in symptoms and daily functioning for patients.

Several mechanisms may explain the enhanced effectiveness of the culturally tailored intervention. First, the incorporation of traditional movement practices and healing rituals likely increased the perceived relevance and acceptability of the intervention, as suggested by the higher satisfaction scores in the culturally tailored group. Second, the adaptation of communication strategies and use of cultural metaphors may have facilitated better understanding of therapeutic principles and home exercise instructions. Third, the involvement of family and community members in the rehabilitation process aligned with the collectivist orientation of many tribal cultures and provided additional support for behavior change. Finally, the collaboration with traditional healers may have enhanced the credibility of the intervention within the community and reduced potential conflicts between traditional and biomedical approaches to healing.

The finding that cultural tailoring effects varied across communities highlights the importance of considering local context in intervention development. The most pronounced benefits were observed in communities with stronger preservation of traditional practices, suggesting that the degree of acculturation may moderate the impact of cultural adaptation. This underscores the importance of community-specific approaches rather than generic "indigenous" interventions, as significant diversity exists among tribal communities in their cultural practices and health beliefs.

The cost-effectiveness analysis provides further support for implementing culturally tailored approaches in clinical practice. Despite the higher initial costs associated with developing and implementing the culturally adapted intervention, the improved outcomes and higher completion rates resulted in favorable cost-effectiveness ratios. This suggests that investment in cultural adaptation processes may yield economic as well as clinical benefits, particularly when considering the long-term costs associated with poorly managed musculoskeletal conditions.

Several limitations should be acknowledged. First, complete blinding was not possible due to the nature of the interventions, potentially introducing bias in subjective outcome measures. However, the use of blinded outcome assessors mitigated this risk. Second, while the six-month follow-up period demonstrated sustained benefits of the intervention, longer-term outcomes remain unknown. Third, despite efforts to include diverse tribal communities, the findings may not generalize to all indigenous populations given the heterogeneity of tribal cultures worldwide. Finally, the study did not fully disentangle which specific components of the cultural adaptation were most critical for improved outcomes, a question that warrants further investigation.

Conclusion

This randomized controlled trial provides strong evidence that culturally tailored physiotherapy interventions yield superior outcomes compared to standard approaches for musculoskeletal disorders in tribal communities. The culturally adapted program demonstrated clinically significant advantages in pain reduction, functional improvement, quality of life, and treatment adherence, with favorable cost-effectiveness. These findings highlight the importance of cultural responsiveness in healthcare delivery and offer a promising approach for addressing musculoskeletal health disparities in indigenous populations.

The success of this intervention underscores several key principles for developing culturally responsive healthcare: meaningful community engagement in intervention design, integration of traditional and biomedical healing approaches, adaptation of communication strategies to align with cultural frameworks, and recognition of the broader social and cultural contexts in which health behaviors occur. Implementation of these principles requires investment in community partnerships, cultural competence training for healthcare providers, and flexibility in healthcare delivery models.

Future research should explore the long-term sustainability of these outcomes, examine which components of cultural adaptation contribute most significantly to improved results, and investigate implementation strategies for scaling up culturally tailored physiotherapy services in diverse tribal healthcare settings. Additionally, the development of

culturally validated outcome measures specifically designed for indigenous populations would strengthen the methodological rigor of future studies in this field.

In conclusion, this study demonstrates that addressing cultural factors in physiotherapy interventions can substantially improve outcomes for musculoskeletal disorders in tribal communities. These findings support policy and practice changes to incorporate cultural tailoring into standard rehabilitation approaches for indigenous populations, potentially reducing health disparities and improving musculoskeletal health in these underserved communities.

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