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Cultural Adaptation and Content Validation of an Educational Booklet in Kannada Language for Knee Osteoarthritis Patients: A Pilot Study

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ABSTRACT

Background: Knee osteoarthritis (OA) affects approximately 28.7% of India's population, with significant impact on community health by reducing quality of life and function. Despite the availability of evidence-based management strategies, culturally appropriate educational resources in regional languages remain scarce, creating barriers to effective community-level intervention. This study aimed to culturally adapt and validate the content of an educational booklet in Kannada for patients with knee OA.

Materials and method: This mixed-design(approach) pilot interventional study was conducted the institution based musculoskeletal physiotherapy department and medical college hospital, The study involved three phases: (1) Development of educational booklet through systematic literature review; (2) Content validation using Delphi consensus with five experts and patient focus group; (3) Pilot testing with 30 Kannada-speaking knee osteoarthritis patients allocated to intervention (booklet + exercises, n=15) or control (exercises only, n=15) groups.. Outcomes were measured using the Numerical Pain Rating Scale (NPRS), Knee Injury and Osteoarthritis Outcome Score (KOOS), Pain Self-Efficacy Questionnaire (PSEQ), and Tampa Scale of Kinesiophobia (TSK).

Results: Content validation achieved excellent validity (S-CVI/Ave=0.96). Both groups showed significant within-group improvements ($p<0.05$) in all outcome measures after 3 weeks. The intervention group demonstrated marginally better improvements, though between-group differences were not statistically significant ($p>0.05$), likely due to small sample size.

Conclusion: This study successfully developed a culturally appropriate, validated educational resource in Kannada for community-based knee osteoarthritis management. The findings support the integration of linguistically appropriate educational materials in community health programs for knee osteoarthritis management.

Keywords: Knee Osteoarthritis, Patient Education, Community health, Kannada language, Cultural adaptation, public health intervention.

INTRODUCTION

Osteoarthritis (OA) is a chronic condition that affects the joint and associated tissues, mainly causes articular cartilage to

deteriorate over time, which in turn damages the subchondral bone and its surrounding synovial structures. [1] In global burden of diseases, injuries and risk factors (GBI) of the last three decades it has been observed prevalence of symptomatic OA cases has increased by 2.66-fold from 23,46 million in 1990 to 62.35 million in 2019, One of the most prevalent medical conditions which leads to impairment, especially among elderly people. Knee OA is the most prevalent articular disease in the developed countries and an important factor contributing to chronic disability. [2] Overall prevalence of Knee OA was 28.7% and female gender were 31.6%,33% of participants were obese and 83.6% of participants were not performing any physical exercises, participants with sedentary life style were of with higher proportions in India. [3]

Patient education (PE), exercise therapy and weight management are regarded as first line intervention for Knee OA by major clinical practice guidelines.[4-6] Hence an well planned PE enhances overall improvement in all positive outcomes like illness perceptions, self-efficacy and fear avoidance behaviours and create positive attitude and a safer environment in which to attempt, exercise therapy.[7] Pain experienced in knee OA patients can be generated and modified by sensorial, emotional and cognitive factors, increases anxiety or depression. [8] It was also observed that a significant positive correlation between self-efficacy, pain resilience, social support and lower extremity function. [9] Kinesiophobia has to be also considered as it has its association with perceived pain, disability and functional limitations.[10] Self efficacy has also shown that it has higher level influence with hip muscle strength and physical function, as they engage in a better coping mechanisms in knee OA patients.[11]

As these psychosocial measures like anxiety, depression, low self-efficacy and heightened kinesiophobia are related with diminished physical performance adopting Biopsychosocial framework which prioritize multidisciplinary approach where Patient education on life style modification was recommended as there was a correlation between lower educational attainment and increased severity of Knee OA symptoms. [12] patient education in knee OA patients has revealed improvement in function, self-perceived health. Warranted further research in patient education with instruction in exercise and self-efficacy.[13] Combination therapy of exercise and educational intervention were used for improvement in physical activity and exercise adherence with Hip or knee OA. [14] Hence patient education booklet has to be framed with content validation by expert panel, with systematic framework on the basis of existing literature [15], as an effective comprehensive management of knee OA patients and current literature indicates that modifiable risk factors substantially contribute to this prevalence, highlighting the importance of targeted interventions. While effective patient education is considered essential for optimal management of knee OA, there is a notable absence of culturally appropriate, validated educational resources in regional languages such as Kannada. This study therefore aims to develop, culturally adapt, validate, and pilot-test a comprehensive educational booklet in Kannada for patients with knee OA, designed to enhance their knowledge and understanding of the condition and its management strategies.

MATERIALS & METHODS

Study Design and Setting:

The mixed-design (approach) pilot interventional study was conducted between January and July 2025 at the institution based musculoskeletal physiotherapy department and medical college hospital with a private university in South India, after getting the Ethical approval from the Institutional Ethics Committee (SUIP/UG22/168/2025), the trial was registered with Clinical trial registry of India, CTRI/2025/06/088305 and patient

educational booklet in Kannada language is framed and cultural adaptation and content validity was done through a mixed method design consists of developmental, content validation through a Delphi consensus process and a pilot testing process.

Development of the Booklet:

In the development phase, by consideration to comprehensive literature and various organizational guidelines recommendations, a simple patient educational booklet in Kannada language was prepared. Patient education booklet which included all the necessary information about their condition and which guided them about how to manage their condition and do exercises, it consists of five components [16], 1. Assessment of representation of patient's physical activity 2. Defining the importance of exercise in knee OA 3. Patient engagement in physical activity practice 4. Consequences of stopping the exercises 5. Assurance on restoration, two independent bilingual health professionals, fluent in both Kannada and English, performed the forward translation. The translated version was then reviewed by a panel of three subject experts to ensure linguistic and contextual appropriateness. Back-translation was performed by another bilingual expert, and the reconciled Kannada version was finalized through iterative consensus.

Content Validation process:

During the validation phase, the patient educational booklet was reviewed through a panel of a of five bilingual professionals with at least five years of clinical or academic experience, the expert panel consists of an Orthopaedic Surgeon, two musculoskeletal Physiotherapists, a Nutritionist, and a language expert in a two round Delphi consensus process. These experts independently evaluated the booklet using a structured validation form based on Lynn's model [17].

Each item in the booklet was assessed across four domains—relevance, clarity, simplicity, and ambiguity—using a four-point Likert scale (1 = not relevant, 4 = highly relevant). Experts were also invited to provide qualitative suggestions for improvement related to wording, layout, and illustrations. The Focus group of five knee OA patients were also made to go through and assess comprehensibility and cultural appropriateness, and their feedback was incorporated into the final version.

Pilot testing procedure:

Following validation, a pilot testing phase was conducted involving knee OA patients attending the outpatient department. Participants were allocated into two groups as a purposive sampling with Inclusion criteria as, confirmed diagnosis of knee OA based on the American College of Rheumatology (ACR) clinical classification criteria, at least 3 of the following should be positive (Age between 50yrs to 80 yrs [3,8,18], morning stiffness < 30 minutes, crepitus on knee motion, bony tenderness, bony enlargement, no palpable warmth.[6], Having unilateral or bilateral grade 2 or 3 of knee OA according to the Kellgren and Lawrence radiological gradings. a TSK-KA-11 score 23 or higher.[19,20] and Exclusion criteria included with cognitive impairment, who have underwent a history of knee surgery, with Joint infection, suffering with Rheumatoid arthritis of knee, any form of Inflammatory arthritis, Any past six-month history of hip or knee replacement surgeries, intraarticular steroidal injections, arthroscopic surgeries, Persons who are all in need of external support for walking, Any lower extremity related neuro-related, musculoskeletal diseases that affect the strength and balance.

The experimental group that received education through the newly developed Kannada booklet in addition to supervised conventional exercises, and a conventional group that received with supervised conventional exercises with standard verbal advice alone at the frequency-five days per week and a duration of total three weeks period. Outcome measures were assessed at baseline and three weeks post-intervention

using four validated instruments: the Knee Injury and Osteoarthritis Outcome Score (KOOS) to assess pain, symptoms, activities of daily living, sport/recreation function, and knee-related quality of life; Pain Self-Efficacy Questionnaire (PSEQ) to evaluate participants' confidence in managing daily activities despite pain; Tampa Scale for Kinesiophobia (TSK) to measure fear related to movement, and the Numeric Pain Rating Scale (NPRS) to quantify pain intensity.

Statistical Analysis

Data were analysed using SPSS Version 29.0 (IBM Corp., Armonk, NY, USA) and Microsoft Excel. The Shapiro-Wilk test was used to check the normality of the data. For content validation, Item-level Content Validity Index (I-CVI) and Scale-level Content Validity Index (S-CVI) were computed using the universal agreement approach [15], An I-CVI threshold of 1.00 was used for item retention [21], consistent with best practices in health communication research. [22] This is based on Lynn's model, which requires unanimous agreement among five experts to consider an item valid. Inter-rater agreement among the 5 experts was further evaluated using Fleiss' Kappa which is considered as valid statistical measure to evaluate the consistency of categorical ratings among multiple raters. [23] A Kappa value ≥0.75 was considered excellent.

For pilot testing analysis, paired t-tests or Wilcoxon signed-rank tests were used to assess within-group changes from pre- to post-intervention, while independent t-tests or Mann–Whitney U tests were used for between-group comparisons. Effect sizes were estimated using Cohen's d and interpreted as small (0.2), medium (0.5), or large (0.8 and above).[24] Visualizations, including bar graphs, box plots, and heatmaps, were created using R (version 4.3.1) to represent group-wise distributions and expert-level agreement metrics. A p-value <0.05 was considered statistically significant.

RESULT

The structured study process, encompassing three key phases: development of the patient education booklet, validation through Delphi rounds using content validity indices, and pilot testing with participant allocation into experimental and control groups (n = 15 each). Both groups underwent pre- and post-intervention assessments of KOOS, PSEQ, TSK, and NPRS over three weeks, with complete data analysed for all 30 participants, Illustrated in Figure 1.

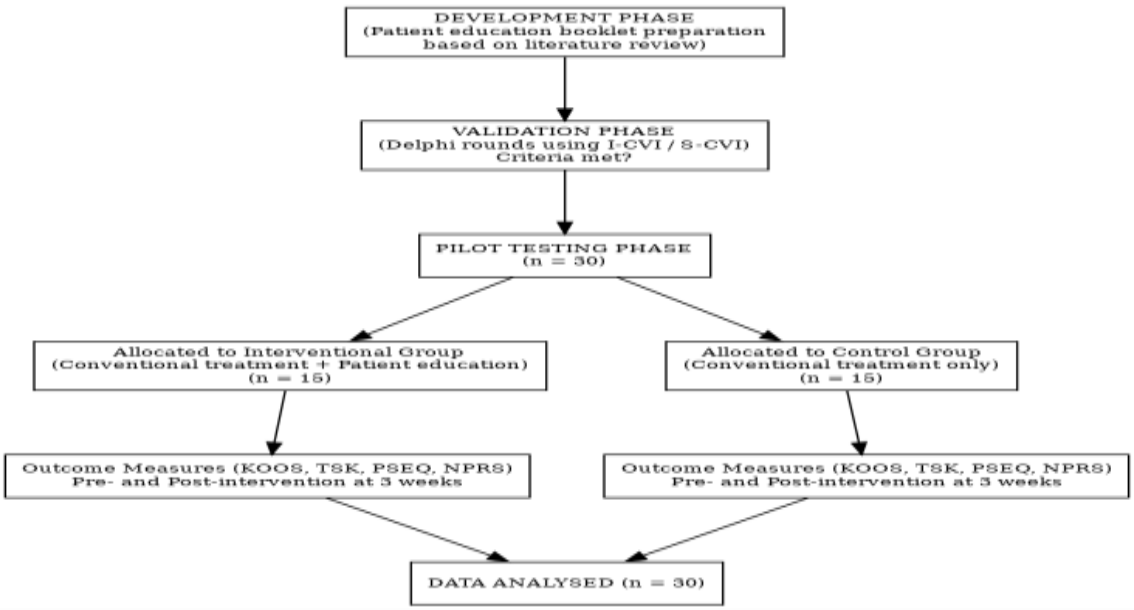

Figure 1. Flowchart demonstrating the study process.

Content validity analysis demonstrated a high level of expert agreement. The item-level content validity index (I-CVI) ranged from 0.80 to 1.00, with four of the five items achieving perfect consensus (I-CVI = 1.00). The third item (Q3) yielded an I-CVI of 0.80, falling below the minimum acceptable threshold of 1.00 for five raters; however, it was retained based on qualitative feedback and high relevance consensus in other domains. The scale-level content validity index using the average method (S-CVI/Ave) was 0.96, and the universal agreement method (S-CVI/UA) was 0.80. Fleiss' Kappa was calculated as 0.78, indicating substantial agreement among raters on item relevance beyond chance.[23] These findings are presented in Table 1 and further visualized in Figure 2, a heatmap of reviewer agreement across items. The I-CVI scores by item are also illustrated in Figure 3, showing consistent expert consensus across all domains.

Table 1. Expert Ratings and Content Validity Index (CVI) for Kannada Educational Booklet Items

Q. No	OS	PT-P	PT-AP	NT	KLE	Experts in Agreement	I-CVI	UA
Q1	1	1	1	1	1	5	1	1
Q2	1	1	1	1	1	5	1	1
Q3	0	1	1	1	1	4	0.8	0
Q4	1	1	1	1	1	5	1	1
Q5	1	1	1	1	1	5	1	1
Proportion Relevance	1	1	1	1	1			
S-CVI/Ave							0.96	
S-CVI/UA								0.80
Fleiss' Kappa								0.78

OS = Orthopedic Surgeon; PT-P = Physiotherapist (Professor); PT-A = Physiotherapist (Associate Professor); NT = Nutritionist; KLE = Kannada Language Expert; Agreement = Number of Experts in Agreement; I-CVI = Item-Level Content Validity Index; UA = Universal Agreement; S-CVI/Ave = Scale-level CVI (Average); S-CVI/UA = Scale-level CVI (Universal Agreement); Fleiss' Kappa = Inter-rater Agreement

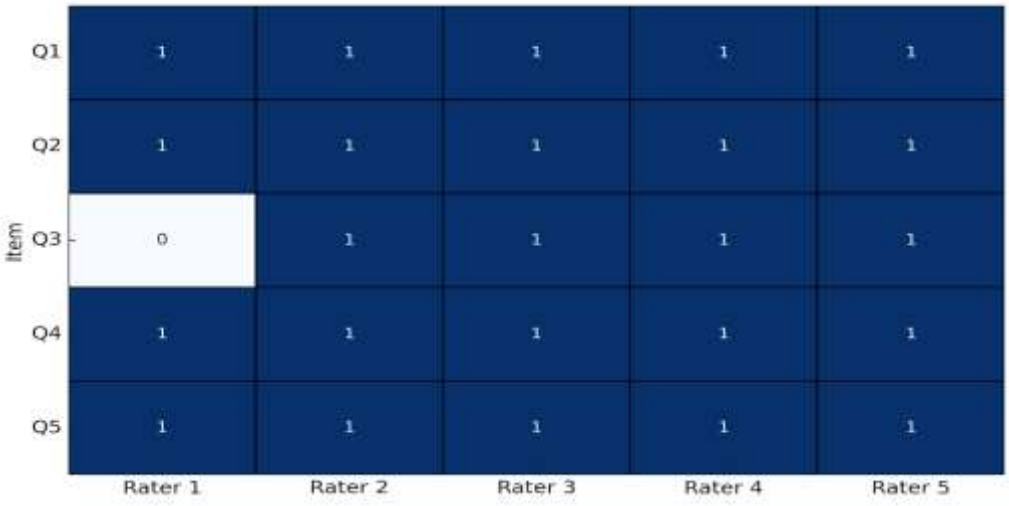

Figure 2. Heatmap of reviewer agreement across five items during Delphi validation. Note: 1 = agreement; 0 = disagreement between reviewer and item rating.

Table 2 describes the experimental intervention comprising a Kannada-language patient education booklet in addition to conventional exercises. The booklet covered disease pathology, prognosis, and detailed home exercise guidance [25-27]. Strengthening, stretching, and knee range of motion exercises were provided as outlined.

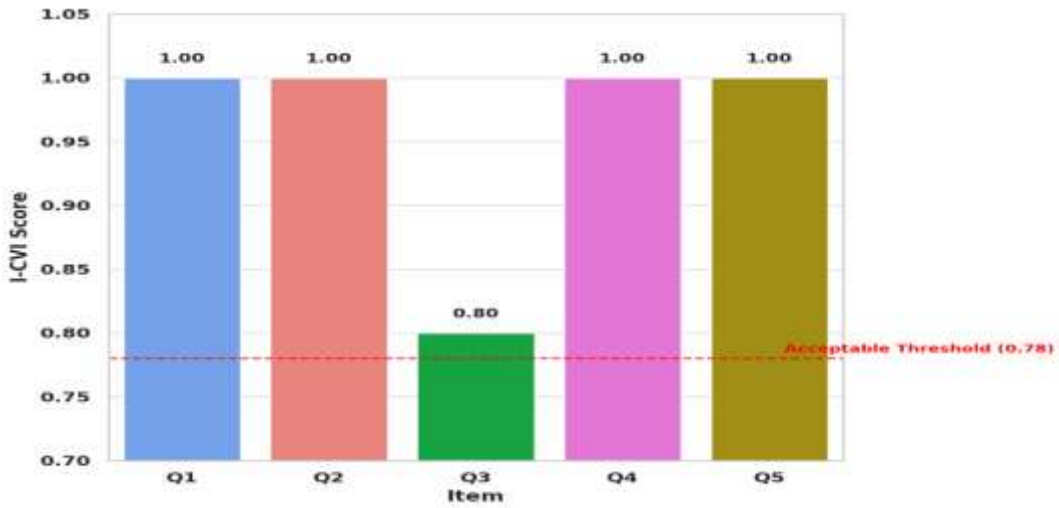

Figure 3. Item-level Content Validity Index (I-CVI) scores for five items.

Dashed red line indicates the minimum acceptable threshold (I-CVI = 0.78).

Table 2 Experimental group:(Patient Education Booklet plus Conventional Exercises)[7,25–27]. A booklet consisting of patient education was provided to the patients, which includes education on disease pathology and progression, treatments including exercise prescription.		
Strengthening Exercises 1. Static quad sets in knee extension 2. Standing terminal knee extension 3. Side-lying abduction 4. Leg press in sitting 5. Half squats [arm support can be made to alter the weight distribution] 6. Stepping	**Stretching Exercises:** 1. Standing calf stretch 2. Hamstring muscle stretch 3. Quadriceps muscle stretch	**Knee Range of Motion Exercises** 1. Knee extension from mid-flexion to full extension 2. Knee flexion from mid-flexion to full-flexion 3. Quadriceps short arc exercise [28] 4. Straight leg raise [28]. 5. Quadriceps long arc exercises [28]. 6. Stationary bicycle

Table 3 outlines the initiation and progression strategy for strengthening exercises. Training was guided by a percentage of 1-repetition maximum (1-RM) (40–60%), with an RPE (Rating of Perceived Exertion) target between 13 and 15. As a Safety measures no exercise on the next day if pain persists and any gait alterations. [11,29]

Table 3. Initiation and progression with strengthening exercises[11,29]
Intensity: 40-60% 1-RM, 2-4 sets of 15-20 reps, 2–3-minute rest intervals. **Progression:** Adjust every two weeks based on 1-RM changes. **RPE:** 13-15 (somewhat hard to hard). **Safety:** No next-day pain persistence or gait alterations; intensity has been reduced when aggravation of pain is noted.

The baseline demographic and clinical characteristics of participants are presented in Table 4. No statistically significant differences were observed between the experimental and conventional groups in age, gender distribution, height, weight, BMI, KOOS, PSEQ, TSK, or NPRS baseline scores ($p > 0.05$). This confirms group homogeneity at baseline. Total sample values for each parameter are also reported for comparison. Gender distribution was balanced ($p = 0.699$), and both groups showed near-identical means and standard deviations for each clinical score. All continuous variables were assessed for normality using the Shapiro–Wilk test. The distribution of KOOS, PSEQ, TSK, and NPRS scores met the assumption of normality (all $p > 0.05$), supporting the

use of parametric tests in subsequent analyses.

Table 4. Baseline Demographic and Clinical Characteristics Comparison

Variable	Total (n=30)	Experimental (n=15)	Conventional (n=15)	p-value
Age	62.03 ± 6.18	63.67 ± 4.97	60.40 ± 6.98	0.152
Gender: Female	20 (67%)	11 (73%)	9 (60%)	0.699
Height (Cm)	163.43 ± 10.30	162.80 ± 11.42	164.07 ± 9.42	0.743
Weight (Kg)	66.83 ± 10.10	67.80 ± 11.23	65.87 ± 9.11	0.609
Bmi/Kg.M2	24.91 ± 2.42	25.47 ± 2.29	24.36 ± 2.49	0.213
Pre Koos	36.40 ± 19.41	33.78 ± 18.53	39.02 ± 20.55	0.470
Pre Pseq	28.80 ± 12.04	28.00 ± 12.85	29.60 ± 11.57	0.723
Pre Tsk	29.37 ± 7.18	28.87 ± 8.27	29.87 ± 6.15	0.710
Pre-NPRs	5.37 ± 1.54	5.73 ± 1.16	5.00 ± 1.81	0.200
Baseline demographic and clinical characteristics of participants, presented as mean ± SD or n (%). BMI = Body Mass Index; KOOS = Knee Injury and Osteoarthritis Outcome Score; PSEQ = Pain Self-Efficacy Questionnaire; TSK = Tampa Scale of Kinesiophobia; NPRS = Numerical Pain Rating Scale. No significant differences were observed between groups in demographic or baseline clinical variables (all $p > 0.05$				

Following the intervention, both groups exhibited statistically significant improvements in KOOS, PSEQ, TSK, and NPRS scores. As detailed in Table 4, paired t-tests revealed significant pre–post differences within each group ($p < 0.01$). In the conventional group, KOOS scores increased by 21.17 points ($t = 11.68$, $p < 0.001$), with a large effect size (Cohen's $d = 3.02$). In the experimental group, KOOS increased by 27.22 points ($t = 9.46$, $p < 0.001$), with a Cohen's d of 2.44. PSEQ scores improved in both groups, with moderate effect sizes (Conventional: $d = 1.13$; Experimental: $d = 0.70$). Substantial reductions in kinesiophobia were also observed via TSK, with large effect sizes (Conventional: $d = 1.18$; Experimental: $d = 1.44$). Pain intensity (NPRS) decreased significantly in both groups ($p < 0.001$), with a greater reduction in the experimental group (Cohen's $d = –3.24$) than the conventional group (Cohen's $d = –2.00$). These within-group effect sizes are summarized in Table 5.

Table 5. Within-Group and Between-Group Comparisons for Clinical Outcome Measures

Outcome	Group	Comparison	Mean Change ± SD	t	p-value	Cohen's d
KOOS	Experimental	Within-group	27.23 ± 11.15	9.46	0.000	2.44
KOOS	Conventional	Within-group	21.17 ± 7.02	11.68	0.000	3.02
KOOS	Experimental vs Conventional	Between-group	6.05	1.78	0.088	0.65
PSEQ	Experimental	Within-group	-6.07 ± 6.01	-3.91	0.002	-1.01
PSEQ	Conventional	Within-group	-6.40 ± 5.67	-4.37	0.001	-1.13
PSEQ	Experimental vs Conventional	Between-group	0.33	0.16	0.877	0.06
TSK	Experimental	Within-group	-7.13 ± 5.01	-5.51	0.000	-1.42
TSK	Conventional	Within-group	-5.60 ± 4.72	-4.60	0.000	-1.19
TSK	Experimental vs Conventional	Between-group	-1.53	-0.86	0.396	-0.32
NPRS	Experimental	Within-group	-2.07 ± 0.70	-11.37	0.000	-2.94
NPRS	Conventional	Within-group	-2.00 ± 1.00	-7.75	0.000	-2.00
NPRS	Experimental vs Conventional	Between-group	-0.07	-0.21	0.834	-0.08
Mean change ± standard deviation, t-values, p-values, and effect sizes (Cohen's d) are reported for Knee Injury and Osteoarthritis Outcome Score (KOOS), Pain Self-Efficacy Questionnaire (PSEQ), Tampa Scale of Kinesiophobia (TSK), and Numeric Pain Rating Scale (NPRS), comparing within-group and between-group differences post-intervention.						

Figure 4 presents a consolidated boxplot of pre- and post-intervention scores for both groups. KOOS scores show a clear upward shift post-intervention, indicating functional improvement. In contrast, PSEQ, TSK, and NPRS scores demonstrate downward shifts, reflecting gains in self-efficacy, reduced kinesiophobia, and pain relief, respectively. The experimental group exhibits slightly narrower interquartile ranges post-intervention, particularly for NPRS and TSK, suggesting more consistent improvements.

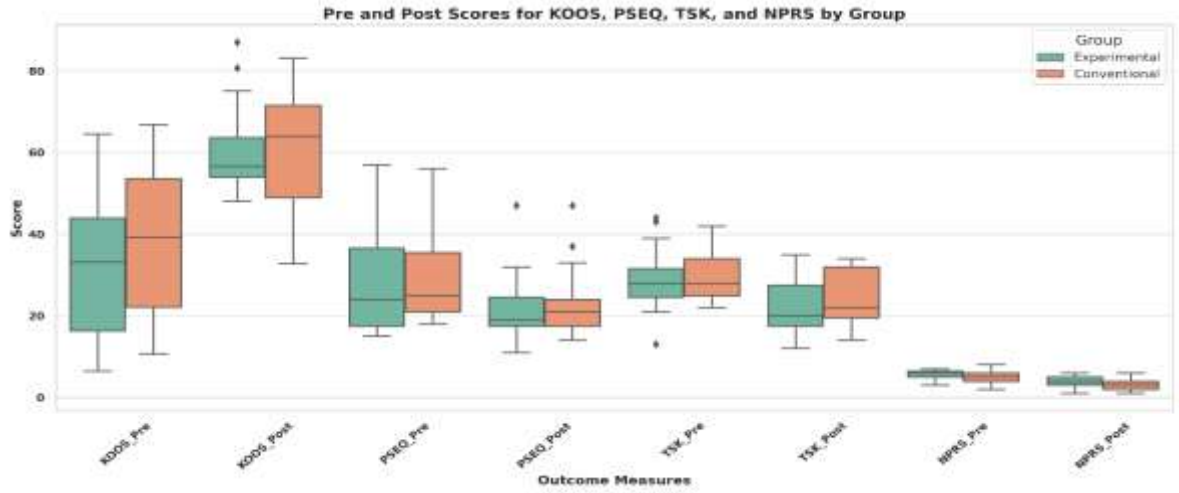

Figure 4. Boxplots comparing pre- and post-intervention scores for KOOS, PSEQ, TSK, and NPRS across experimental and conventional groups.

DISCUSSION

This pilot study aimed to develop, culturally adapt, and validate a Kannada-language patient education booklet for individuals with knee osteoarthritis (OA). The results demonstrate strong content validity (S-CVI = 0.96) and substantial inter-rater agreement (Fleiss' Kappa = 0.78), confirming the appropriateness of the adapted material for the intended population. A Scale-CVI value above 0.90 is generally considered excellent, indicating near-unanimous agreement among raters on item relevance, while a Kappa value of 0.78 reflects substantial agreement beyond chance, further validating the consistency of expert ratings. [21] These findings align with prior validation studies of patient education tools, which emphasize that linguistic, contextual, and cultural relevance enhance the usability of health communication resources across diverse groups. [4,15,21,22]

Pilot testing revealed significant within-group improvements in functional ability (KOOS), pain intensity (NPRS), self-efficacy (PSEQ), and fear of movement (TSK) across both the experimental and conventional arms. Although the between-group differences did not reach statistical significance, possibly due to the limited sample size, the experimental group consistently demonstrated greater mean improvements across all outcome measures. A moderate effect size was observed for KOOS (d = 0.65), suggesting a potentially meaningful clinical advantage of integrating culturally tailored educational interventions with standard physiotherapy. These findings underscore the hypothesis that language-adapted educational materials can support improved patient engagement and rehabilitation response, even when delivered over a short intervention period. [7]

The pattern of improvement observed is consistent with the biopsychosocial model of care, which advocates for multimodal, patient-Centered strategies in managing chronic musculoskeletal conditions. Educational components that address patients' beliefs, fears, and knowledge gaps may play a key role in enhancing adherence, reducing fear-avoidance behaviors, and

facilitating long-term self-management. [12,27] The findings in this study reinforce this model by demonstrating concurrent improvements in physical function and psychological readiness following booklet-based education. These dual-domain effects are especially relevant in early OA care, where behavior change and reassurance are often as critical as exercise therapy. [17,30]

Previous randomized trials have reported that combining exercise therapy with structured patient education yields better outcomes than exercise alone. [7] The present study adds to that evidence by demonstrating the feasibility and early-stage impact of a cost-effective, language-adapted booklet in a regional Indian context. Considering that Kannada is spoken by over 50 million people, the lack of culturally relevant patient education tools for knee OA rehabilitation highlights the value of this intervention.

This study also offers methodological value by combining quantitative measures (CVI, Kappa) with expert qualitative review, ensuring both statistical reliability and practical relevance. The use of validated patient-reported instruments such as KOOS, PSEQ, and TSK further enhances the robustness of outcome interpretation. As seen in prior educational tool evaluations, including culturally familiar illustrations, idiomatic language, and locally relevant examples likely improved patient comprehension and engagement. [4]

Nevertheless, some limitations must be acknowledged. The small sample size and brief follow-up period constrain the generalizability and durability of the observed effects. The absence of blinding among participants and assessors introduces potential bias. Furthermore, reliance on self-reported measures may have introduced response bias or social desirability effects. To strengthen evidence, future research should employ randomized controlled trials with larger and more diverse samples, extended follow-up, and incorporation of objective functional outcomes.

CONCLUSION

This pilot study effectively developed and culturally adapted a Kannada-language patient educational booklet for individuals with knee osteoarthritis, demonstrating strong content validity (CVI = 0.96). Significant improvements were observed within both experimental and conventional groups in key outcome measures pain intensity, functional ability, self-efficacy, and kinesiophobia following the intervention. Although no statistically significant differences were found between the groups, the study highlights the value of culturally and linguistically appropriate educational materials in improving patient engagement and self-management. These findings support the integration of such tools into conservative OA care, with further research needed to explore long-term benefits in larger populations.

Declaration by Authors:

Ethical Approval: The study was reviewed and approved by the Institutional Ethics Committee of Institute of physiotherapy, Srinivas University. (SUIP/UG22/168/2025).

Acknowledgement: None

Source of Funding: None

Conflict of Interest All authors declare no conflicts of interest.

Patient consent statement:

Written informed consent in accordance with the Declaration of Helsinki II was obtained from all patients before inclusion.

Permission to reproduce material from other sources:

No materials have been used in the study to get permission for reproduce materials.

Study registration: The trial was registered with Clinical trial registry of India, CTRI/2025/06/088305 [Registered on: 05/06/2025].

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