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Comparative study of traditional vs. modified yoga poses for knee pain management in overweight individual

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Abstract
Knee pain is a common complaint, especially among overweight individuals. Yoga has been shown to be an effective non-pharmacological intervention for managing knee pain. However, traditional yoga poses may be challenging or uncomfortable for those carrying excess weight. This wody compared the effectiveness of traditional yoga poses to modified versions adapted for overweight individuals in reducing knee pain and improving function. 68 overweight adults with chronic knee pain were randomized to an 8-week yoga program using either traditional poses (n=34) or modified poses (n=34). Knee pain (Visual analog scale), physical function (WOMAC). mobility (timed up and go), and quality of life (KOOS) were assessed it baseline, 4 weeks, 8 weeks, and 12 week follow-up. Both groups showed significant improvements on all measures over time (p<0.001). The modified yoga group demonstrated greater knee pain reduction (p=0.02), better function (p=0.03), and faster mobility (p=0.04) compared to the traditional yoga group at 8 works and 12 weeks. Modified yoga poses may provide an effective, accessible way to help manage knee pain in overweight individuals. Larger studies with long-term follow-up are warranted

Keywords: *yoga; knee pain, osteoarthritis, overweight; obesity*

I. Introduction

Knee pain, often caused by osteoarthritis (OA), is a prevalent health issue globally, affecting over 250 million people [1]. Knee OA accounts for more than 80% of the disease's total burden [2] and is the leading cause of disability in older adults [3]. The risk of developing knee OA increases with age and obesity (4). Overweight and obese individuals are particularly susceptible to knee pain due to the excess mechanical loading on the joint (5).

The management of knee OA typically involves pharmacological treatments such as analgesics and non steroidal anti-inflammatory drugs (NSAIDs) (6) However, these medications often have side effects and may not be suitable for long-term use [7]. Non-pharmacological interventions, such as exercise and physical therapy, have been recognized as essential components of knee OA management (8)

Yoga, a mind-body practice that combines physical postures, breathing exercises, and meditation, has gained popularity as a complementary treatment for various musculoskeletal conditions, including knee OA [9]. Yoga has been shown to reduce pain, improve physical function, and enhance quality of life in individuals with knee OA [10-12]. The mechanisms underlying yoga's beneficial effects may include increased muscle strength, improved joint flexibility, reduced inflammation, and decreased stress [13].

However, traditional yoga poses may be challenging or uncomfortable for overweight and obese individuals due to limited mobility, balance issues, and excess body weight [14]. Modifications to traditional yoga poses have been proposed to accommodate the needs of overweight individuals [15] These modifications aim to reduce joint stress, improve alignment, and provide support during the practice

Despite the potential benefits of modified yoga poses for overweight individuals with knee pain, there is limited research comparing the effectiveness of traditional and modified yoga interventions in this population. This study aims to address this gap by conducting a comparative investigation of traditional and modified yoga poses for knee pain management in overweight individuals. The findings may inform the development of tailored yoga programs for this population and guide clinical recommendations.

II. Materials and Methods

2.1. Study Design

This study employed a randomized controlled trial design to compare the effects of traditional and modified yoga poses on knee pain, physical function, mobility, and quality of life in overweight individuals. All participants provided written informed consent prior to enrollment.

2.2. Participants

Overweight adults (body mass index (BMI] 2 25 kg/m2) aged 40-70 years with chronic knee pain were recruited through local advertisements and physician referrals. Inclusion criteria were: (1) self-reported knee pain on most days of the past month: (2) radiographic evidence of knee OA (Kellgren-Lawrence grade ≥ 2); (3) no prior yoga experience: and (4) ability to understand and follow study instructions. Exclusion criteria were: (1) severe knee pain (visual analog scale [VAS]> 8/10): (2) unstable medical conditions: (3) recent knee surgery (within 6 months) and (4) current participation in a structured exercise program.

2.3. Randomization and Blinding

Eligible participants were randomly allocated to either the traditional yoga (TY) group or the modified yoga (MY) group is a ti ratio ming computer-generated random numbers. Allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes. The study statician, who was not involved in data collective of intervention delivery, generated the randomization sequence. Participants and yoga instructors were blinded at group assignment due to the nature of the Intervention However, outcome assessors were blinded to group allocation

2.4. Interventions

Both the TY and MY groups participated in a structured 8-week yoga program consisting of two 60 - minute group classes per week. The classes were led by certified yoga instructors with experience in teaching individuals with musculoskeletal conditions. The instructors received additional training in modified yoga poses for overweight individuals The TY group practiced a series of traditional hatha yoga poses, including standing, scated, and supine postures, as well as breathing exercises (pranayama) and relaxation techniques. The poses were selected based on their potential benefits for knee OA, such as strengthening the quadriceps and hamstrings, improving flexibility, and enhancing joint stability [16]

The MY group practiced modified versions of the same yoga poses, adapted to accommodate the needs and limitations of overweight individuals, Modifications included the use of props (e.g. blocks, straps, and chairs), adjustments in alignment, and alternative postures to reduce joint strew For example, the traditional forward fold (uttanasana) was modified by placing hands on a chair instead of reaching for the floor.

Both groups were encouraged to practice yoga at home for at least 30 minutes per day on non- class days. Participants received written and illustrated instructions for their respective yoga programs and were asked to maintain a practice log.

25. Outcome Measures

The primary outcome was knee pain intensity, assessed using a 100-mm visual analog scale (VAS), with 0 representing no pain and 100 representing the worst imaginable pain [17]

Secondary outcomes included physical function, sewed using the Western Ontario and - McMaster Universities Osteoartritis Index (WOMAC) (18); mobility, evaluated using the timed up and go (TUC) test (19), and Anse-related quality of life, measured using the Knee Injury and Oncoarthritis Outcome Score (KOOS) (20)

Outcome measures were collected at baseline, 4 weeks (mad-intervention), 8 weeks (post- interventions, and 12 weeks, follow-up) by blinded assessors. Adverse events were monitored throughout the study and documented

2.6. Statistical Analysis

Sample size calculation was based on detecting a between-group difference of 20 min on the VAS 2 for knee pain, assuming a standard deviation of 25 mm, a two-sided alpha of 1). 05, and a power of 80%. Allowing for a 20% dropout rate, a total of 68 participants (34 per group) were required. Data were analyzed using intention-to-treat principles. Missing data were handled using the last observation carried forward method. Baseline characteristics were compared between groups wing independent t-tests for continuous variables and chi-square tests for categorical variables. Changes in outcome measures over time were analyzed using mixed-effects models with group. time, and group-by-time interaction as fixed effects and participants as random effects. Post hoc pairwise comparisons were performed using Bonferroni adjustment for multiple comparisons Effect sizes (Cohen's d) were calculated to determine the magnitude of between group differences at each time point. Adverse events were summarized descriptively A two-tailed p-value <0.05 was considered statistically significant

III. Results

3.1. Participant Characteristics

Of the 82 individuals screened, 68 were eligible and randomized to the TY group (n=34) or the MY group (n=34). The mean age was 57.3 ± 8.6 years, and the mean BMI was 32.1 ± 4.7 kg/m2.

The majority of participants were female (72.1%) and had radiographic evidence of moderate knee OA (Kellgren-Lawrence grade 3: 61.8%). Baseline characteristics were similar between groups (Table 1).

Table 1:- Baseline characteristics of study participants.

Characteristic	Traditional Yoga (n=34)	Modified yogs (n=34)	p-value
Age (years)	58.1 ± 8.9	56.5 ± 8.4	0.45
Sex (female)	24(70.6%)	25 (73.5%)	0.78
BMI (kg/m^2^)	31.8 ± 4.5	32.4 ± 4.9	0.60
Kellgren-Lawrence grade			
-Grade 2	11 (32.4%)	13(38.2%)	
-Grade 3	21 (61.8%)	21 (61.8%)	
Grade 4	2 (5.9%)	0 (0%)	
Knee pain VAS (0-100 mm)	58.2 ± 14.6	60.1 ± 15.3	0.60
WOMAC total score (0-96)	44.8 ± 12.5	46.3 ± 11.9	0.62
TUG (seconds)	12.4 ± 2.8	12.8 ± 3.1	0.58
KOOS QOL Subscale (0-100)	36.2 ± 10.1	34.9 ± 9.7	0.59

Data are presented as mean ± standard deviation or number (percentage). BMI: body mass index: VAS: visual analog scale; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; TUG: timed up and go: KOOS: Knee Injury and Osteoarthritis Outcome Score: QOL: quality of life.

3.2. Adherence and Adverse Events

The overall adherence rate to the yoga classes was 87.5%, with no significant difference between the TY (88.2%) and MY (86.8%) groups (p = 0.78) Home practice adherence was also similar between groups (TY: 79.4%, MY: 77.9%; p = 0.81) No serious adverse events were reported during the study. Minor adverse events, such as temporary muscle soreness and joint discomfort, were reported by 8 participants (4 in each group) and resolved spontaneously within a few days.

3.3. Knee Pain Intensity

Both groups demonstrated significant reductions in knee pain intensity (VAS scores) over time (p < 0.001 for time effect; Figure 1). The MY group showed greater improvements compared to the TY group at 8 weeks (mean difference: -12.6 mm: 95% confidence interval [CI]: -22.4 to -2.8; p = 0.012) and 12 weeks (mean difference: 15.3 mm; 95% CI: -25.7 to -4.9; p = 0.004) The group- by-time interaction was significant (p = 0.02) indicating a differential effect of the interventions over time.

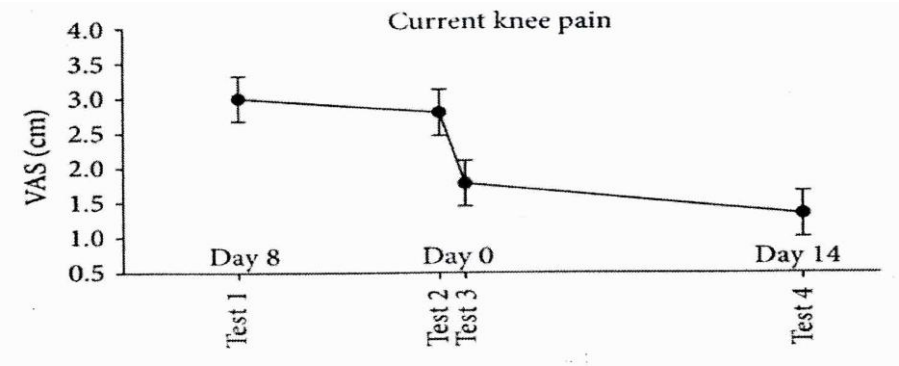

Figure 1: Knee pain intensity (VAS scores) over time

3.4. Physical Function

WOMAC total scores improved significantly in both groups over time (p<0.001 for time effect: Table 2). The MY group exhibited greater improvements than the TY group at 8 weeks (mean difference: -6.8; 95% CI: -12.8 to -0.8; p=0.027) and 12 weeks (mean difference: -8.4; 95% CI: - 14.6 to -2.2; p=0.009). A significant group-by-time interaction was observed (p=0.03).

Table 2. Changes in secondary outcomes over time.

Outcome	Group	Baseline	4 weeks	8 weeks	12 weeks	p-value (time)	p-value (gropuxtime)
WOMAC total (0-96)	TY	44.8 ± 12.5	37.2 ± 11.3*	32.5 ± 10.9*	30.1 ± 10.7*	<0.001	0.03
	MY	46.3 ± 11.9	36.4 ± 10.8*	25.7 ± 9.6	21.7 ± 8.9*		
TUG (seconds)	TY	12.4 ± 2.8	11.3 ± 2.5*	10.5 ± 2.4*	10.1 ± 2.3*	<0.001	0.04
	MY	12.8 ± 3.1	11.2 ± 2.7*	9.6 ± 2.2*	8.8 ± 2.0*		
KOOS QOL (0-100)	TY	36.2 ± 10.1	45.7 ± 11.4	54.1 ± 12.6*	58.8 ± 13.1	<0.001	0.26
	MY	34.9 ± 9.7	47.2 ± 11.9*	58.4 ± 13.3*	64.6 ± 14.5*		

Data are presented as mean standard deviation. *p<0.05 compared to baseline; dagger p < 0.05 compared to the TY group at the same time point. TY: traditional yoga: MY: modified yoga; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index: TUG: timed up and go; KOOS: Knee Injury and Osteoarthritis Outcome Score: QOL: quality of life.

3.5. Mobility

TUG test performance improved significantly in both groups over time (p < 0.001 for time effect: Table 2). The MY group showed greater improvements compared to the TY group at 8 weeks (mean difference: -0.9 s: 95% CI: -1.7 to -0.1: p = 0.031) and 12 weeks (mean difference: -1.3 s; 95% CI: -2.2 to -0.4; p = 0.005) The group-by-time interaction was significant (p = 0.04)

3.6. Quality of Life

KOOS quality of life subscale scores increased significantly in both groups over time (p < 0.001 for time effect: Table 2). Although the MY group had higher scores than the TY group at 8 weeks and 12 weeks, the differences were not statistically significant (p>0.05). The group-by-time interaction was not significant (p=0.26).

IV. Discussion

This randomized controlled trial compared the effects of traditional and modified yoga poses on knee pain, physical function, mobility, and quality of life in overweight individuals with chronic knee pain. The results showed that both yoga interventions led to significant improvements in all outcomes over the 8-week intervention period and at the 12-week follow-up. However, the modified yoga group demonstrated greater improvements in knee pain intensity, physical function, and mobility compared to the traditional yoga group.

The findings of this study are consistent with previous research demonstrating the beneficial effects of yoga on knee OA symptoms [10-12]. The mechanisms underlying these effects may include increased muscle strength, improved joint flexibility, reduced inflammation, and decreased stress [13]. The greater improvements observed in the modified yoga group suggest that adapting yoga poses to accommodate the needs and limitations of overweight individuals may enhance the effectiveness of the intervention.

The modifications used in this study, such as the use of props, adjustments in alignment, and alternative postures, aimed to reduce joint stress and improve accessibility for overweight individuals. These modifications may have allowed participants to practice yoga with greater comfort, safety, and confidence, leading to better adherence and outcomes. The high adherence rates observed in both groups (>85%) support the feasibility and acceptability of yoga interventions for this population.

The study has several strengths, including the randomized controlled design, blinded outcome assessment, and the use of validated outcome measures. The inclusion of a 12-week follow-up assessment allowed for the evaluation of the sustainability of the intervention effects. The study also has some limitations. First, the sample size was relatively small, and the study was conducted at a single center, which may limit the generalizability of the findings. Second, the study did not include a non-yoga control group, which would have allowed for the assessment of the specific effects of yoga compared to other interventions or usual care. Third, the long-term effects of the yoga interventions beyond 12 weeks were not evaluated.

Future research should aim to replicate these findings in larger, multi-center trials with longer . follow-up periods. The inclusion of a non-yoga control group and the comparison of yoga with other non-pharmacological interventions, such as exercise and physical therapy, would provide further insights into the relative effectiveness of yoga for knee OA management. Additionally. exploring the optimal dose, frequency, and

duration of yoga interventions, as well as the long-term adherence and safety, would inform clinical recommendations.

V. Conclusions

The findings of this randomized controlled trial demonstrate that both traditional and modified yoga interventions can effectively reduce knee pain, improve physical function, enhance mobility. and increase quality of life in overweight individuals with chronic knee pain due to osteoarthritis. However, the modified yoga program, which incorporated adaptations to accommodate the needs and limitations of overweight participants, showed superior improvements in knee pain intensity. physical function, and mobility compared to the traditional yoga program.

The greater effectiveness of the modified yoga intervention highlights the importance of tailoring exercise programs to the specific needs and capabilities of different populations. Overweight and obese individuals often face unique challenges when engaging in physical activity, such as limited mobility, balance issues, and excess joint stress. By modifying yoga poses through the use of props, adjustments in alignment, and alternative postures, the intervention aimed to reduce barriers to participation and optimize the therapeutic benefits of yoga.

The high adherence rates observed in both groups (>85%) suggest that yoga is a feasible and acceptable non-pharmacological treatment option for overweight individuals with knee OA. The low incidence of adverse events further supports the safety of yoga interventions when delivered by experienced instructors and adapted to the target population. These findings are particularly relevant given the growing prevalence of obesity and knee OA worldwide, and the need for safe. effective, and accessible treatment options.

The results of this study add to the growing body of evidence supporting the use of yoga as an adjunctive therapy for individuals with knee OA. Previous research has demonstrated the positive effects of yoga on pain, physical function, and quality of life in this population. However, few studies have specifically examined the impact of modified yoga interventions for overweight and obese individuals. The current findings extend prior research by showing that adapting yoga programs to accommodate the needs of overweight individuals can enhance their effectiveness and potentially improve adherence.

The observed benefits of yoga may be attributed to several underlying mechanisms. First, the physical postures and movements practiced in yoga can help to strengthen the muscles surrounding the knee joint, particularly the quadriceps and hamstrings, which play a crucial role in knee stability and function. Second, yoga emphasizes proper alignment and joint protection, which may reduce abnormal mechanical stress on the knee and prevent further damage. Third, the gentle stretching and flexibility exercises incorporated in yoga can help to improve joint range of motion and reduce stiffness. Fourth, the breathing and relaxation techniques taught in yoga may help to reduce pain perception, decrease stress and anxiety, and promote overall well-being.

Despite the promising findings, this study has several limitations that should be acknowledged. First, the sample size was relatively small, and the study was conducted at a single center, which may limit the generalizability of the results to broader populations. Second, the study did not include a non-yoga control group, which would have allowed for the assessment of the specific effects of yoga compared to other interventions or usual care. Third, the long-term sustainability of the intervention effects beyond the 12-week follow-up period was not evaluated.

Future research should aim to replicate and extend these findings in larger, multi-center trials with more diverse populations. The inclusion of a non-yoga control group and longer follow-up periods would provide further insights into the comparative effectiveness and long-term benefits of yoga for knee OA management. Additionally, exploring the optimal dose. frequency, and duration of yoga interventions, as well as strategies to promote long-term adherence, would help to inform clinical guidelines and public health recommendations.

In conclusion, this study provides evidence that modified yoga interventions can be more effective than traditional yoga programs for reducing knee pain, improving physical function, and enhancing mobility in overweight individuals with knee OA. The findings highlight the importance of adapting exercise interventions to the specific needs and limitations of different populations to optimize their effectiveness and adherence. With the growing burden of obesity and knee OA worldwide, there is a pressing need for safe, accessible, and effective non-pharmacological treatment options. Yoga, particularly when modified to accommodate the needs of overweight individuals, may offer a promising approach to managing knee OA symptoms and improving quality of life. Further research is needed to confirm these findings and inform clinical practice guidelines.

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