doi: 10.4085/1062-6050-0214.20

Adding mindfulness practice to exercise therapy for female recreational runners with patellofemoral pain: A randomized controlled trial

Shahabeddin Bagheri, PhD*; Aynollah Naderi, PhD †; Samira Mirali, MSc ‡; Luís Calmeiro, PhD §; Britton W. Brewer, PhD #

* E-mail: ay.naderi@shahroodut.ac.ir.

† E-mail: bagherishahab@yahoo.com.

‡ E-mail: fatimah.shaabani@gmail.com.

§ E-mail: l.calmeiro@abertay.ac.uk.

E-mail: bbrewer@springfieldcollege.edu

* *School of Sport Sciences, Shahrood University of Technology.*

† School of Humanities, University of Nahavand, Hamadan, Nahavand, Iran.

‡ Department of Sport Science, University College of Omran and Tosseeh, Hamadan, Iran.

§ *School of Social and Health Sciences, Abertay University, Dundee, United Kingdom.*

Department of Psychology, Springfield College, Springfield, United States.

Corresponding Author:

Shahabeddin Bagheri, School of Humanities, University of Nahavand, Hamadan, Nahavand, Iran.

E-mail: Sh.Bagheri@naghu.ac.ir

Tel:+989186726462.

P.O.B: 6593134711.

Trial registration: this trial is registered at the university hospital medical information network of Japan (UMIN-CTR) with address https://rctportal.niph.go.jp/en/detail?trial_id=UMIN000035347 and current controlled trials UMIN000035347.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interests: The authors declare that they have no competing interest.

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Abstract

Context: Considering current models that highlight the role of psychological components in pain management, mindfulness practice may be an effective strategy in the management of pain.

Objective: To examine the effects of adding an eight-week mindfulness program to exercise therapy on the perceptions of pain severity, knee function, fear of movement, and pain catastrophizing of female recreational runners with patellofemoral pain (PFP).

Design: Parallel randomized control clinical trial.

Setting: University Lab.

Patients or Other Participants: Thirty female runners (age 28.3±7.08 years) with PFP were randomly assigned to the two intervention groups: exercise group and mindfulness- exercise group.

Intervention(s): The Ex group received 18 weeks (3 sessions per week) of an exercise program for symptoms control and training modifications. The mindfulness-exercise group received an 8-week mindfulness intervention in addition to the exercise program. The mindfulness component started 4 weeks before the exercise component; therefore, the two components overlapped during the first 4 weeks of the intervention.

Main Outcome Measure(s): Usual pain, pain during stepping, and pain during running were assessed through visual analog scales (VAS). Functional limitations of the knee were assessed using the knee outcome survey. Fear of movement, pain catastrophizing, and coping

strategies were measured with the Tampa Scale for Kinesiophobia, the Pain Catastrophizing Scale, and the Coping Strategies Questionnaire, respectively. These outcomes were assessed at baseline, at week 9, and after 18 weeks.

Results: Pain during running, pain during stepping, and functional limitations of the knee were significantly lower for the mindfulness- exercise group than for the exercise group ($p<.05$). mindfulness- exercise participants reported higher perceived treatment effects than exercise group participants ($p<.05$). Pain catastrophizing was lower and coping strategies were more favorable for mindfulness- exercise participants than for exercise participants ($p<.05$).

Conclusions: Mindfulness practice can be an effective adjunct to exercise therapy in the rehabilitation of PFP in recreational female runners.

Trial Registry: Trial was registered with the (**blind**).

Key Words: Sport Rehabilitation, Mindfulness Training, Sport Injuries, Anterior Knee Pain

Abstract word count: 292 words

Body of manuscript word count: 4000 words

Key Points:

- Adding an 8-week mindfulness intervention to an exercise therapy program facilitated a quicker onset of perceived therapeutic effectiveness in the terms of clinical and psychological outcomes in runners with PFP.

- After 18 weeks exercise therapy, participants who received an 8-week mindfulness program showed greater improvements in the clinical and psychological outcomes than those who didn't receive program, indicating better long-term effectiveness.
- Addition of 8-week mindfulness practice to the PFP exercise therapy program led to more long-lasting effects two months after the completion of the interventions.

Introduction

Patellofemoral pain (PFP), which refers to pain around or behind the patella that is exacerbated by activities that exert load to the patellofemoral joint,[1] is a common condition among runners[2] and can have adverse effects on physical and occupational functioning.[1] Although athletic trainers for PFP usually target physical impairments such as muscle weakness, muscle shortness, and poor quality of movement,[3] the relationship between structural malalignment of the patellofemoral joint and pain and disability in patients with PFP is weak.[4] Recently, studies have suggested that psychological characteristics play a role in exacerbating and prolonging the pain and weakening the physical function of athletes with PFP.[5-7] According to the biopsychosocial model, pain and disability are the results of an ongoing interaction among physiological, psychological, and social factors, which leads to a complex pattern of symptoms with potential chronic consequences.[7] Consistent with the tenets of the biopsychosocial model,[5, 6, 8, 9] previous studies have supported the proposed role of psychological factors in affecting disability and pain of PFP. In particular, inverse relationships found between maladaptive cognitions and functional status in patients with PFP[5, 9] suggest that co-interventions that specifically target catastrophic thinking may enhance treatment outcomes.

Framed within a biopsychosocial perspective, the fear-avoidance model has been used to examine the role of cognitive and emotional factors in the chronicization of pain and disability in musculoskeletal conditions.[8] As posited in the fear-avoidance model, pain intensity is associated with negative appraisals of and excessive negative attitudes toward pain (catastrophic thoughts), which lead to fear of re-injury and subsequent maladaptive coping behaviors such as escape, avoidance, and hypervigilance of certain experiences or movements that limit the person's functioning.[8] Almost all of these maladaptive coping

behaviors are present in PFP patients[5-7] and are associated with increased pain intensity, pain chronicization, and disability.[5-8] Such pain may result in psychological distress, reflected in people's fear-avoidance and catastrophizing thoughts concerning their knee pain.[6, 9] Such distress can interfere with involvement in physical activity.[10] A deeper understanding of negative psychological responses in association with PFP may help in relieving pain and improving knee function in individuals with PFP.

Mindfulness is a mental state that involves a deep sensory consciousness of present-moment experiences, without any revealing, responsive, and self-referential judgment to the inner experience.[11] The practice of mindfulness requires deliberate sustained attention to sensory and cognitive processes along with an unconditional acceptance of the inner experience.[11] This practice requires a conscious effort to inhibit learned responses and create greater acceptance of, detachment from, and objectivity regarding each experience.[11] Mindfulness practice makes it possible for participants to truly experience what is happening in the here-and-now through attention to and awareness of emotional states.[12] As part of an injury rehabilitation program, mindfulness can be an effective means of achieving physical and mental relaxation,[13] facilitating individuals' communication with their minds and bodies,[12] and recognizing and accepting their condition as injured athletes,[13] thereby allowing them to focus more effectively on their rehabilitation.[13] Mindfulness can also change several aspects of the pain-related fear-avoidance cycle, such as catastrophizing, anxiety, arousal, and avoidance behaviors,[11, 14-16] which may reduce physical pain and disability associated with sport injuries. Further, mindfulness can facilitate pain relief through detachment from sensory aspects of pain and changes in cognitive-appraisals of and affective-motivational reactions to pain.[14, 15]

The goal of the current study was to assess the impact of adding a mindfulness program to exercise program on pain intensity, knee-related function, perceived treatment effect, fear of re-injury, and pain catastrophizing in female recreational runners with PFP. Based on the extant literature, we hypothesized that compared with a control group, runners with PFP who received mindfulness training in addition to the exercise treatment program would experience: (a) lower pain intensity, fear of re-injury, and pain catastrophizing; and (b) better knee function and more frequent use of coping strategies to manage pain.

METHODS

Design

This study was an 18-week single-blinded, parallel-group randomized controlled trial conducted at the laboratory of the University College XXX and XXX. Participants were assessed at baseline, week 9 after completion of the mindfulness sessions (mid-intervention), week 18 (end of the exercise intervention), and 2 months after the end of the intervention (follow-up) (Figure 1).

Participants

Based on a prior study with a standard deviation of 25 mm pain intensity measured on a 100-mm visual analog scale (VAS), [17] 15 participants in each group were deemed necessary to detect a 20-mm between-group difference in pain intensity, considering a 2-tailed significance level (α) of 0.05 and desired power (1-β) of 0.90.

A group of 98 female recreational runners suspected to suffer from PFP were screened and 30 met the inclusion criteria. It is well-documented that females are more likely than males to sustain PFPS [18]. To be included in the study, recreational runners had to: (a) be a female between the ages of 18 and 40 years; (b) report running ≥2 times per week for >45 min and/or a minimum weekly running distance of 10 km; (c) presents a history of insidious onset

of signs and symptoms of PFP that was unrelated to trauma in one or both knees for at least 3 months before assessment; (d) score less than 85/100 on the Activities of Daily Living Scale of the Knee Outcome Survey (KOS-ADLS); and (e) report anterior or retropatellar knee pain of 3 or greater on the 10-cm visual analog scale (VAS) during at least 3 of the following tasks: (1) manual compression of the patella against the femur at rest; (2) an isometric knee extensor contraction; (3) palpation of the posteromedial and postero-lateral borders of the patella, 4) resisted knee extension, (5) running, jumping, squatting, kneeling, ascending/descending stairs, or prolonged sitting.[2]

Prospective participants were excluded if they had intra-articular pathology, coexisting lower limb injuries, history of patellar dislocation or knee surgery, pain from the patellar tendon or menisci, Osgood-Schlatter or Sinding- Larsen-Johansson syndrome, knee joint effusion, or hip pain, or if palpation of the patellar tendon, iliotibial band, or pes anserinus tendons induced pain. All assessments were conducted by a licensed physiotherapist at a university-based lab. If participants had bilateral knee pain, the most painful knee (as indicated on the VAS scale) was selected for testing. Participants were recruited through flyers and pamphlets posted in physiotherapy clinics and public places and through emails to faculty and staff of University College XXX and XXX in January and February 2019. All participants signed an informed consent form approved by Ethics Committee for Research on Human Subjects of University College XXX and XXX and trial was registered with the XXX (#XXX).

Randomization and blinding

Participants were enrolled by an independent physiotherapist who was blinded to the allocation of participants to experimental conditions. A computer-generated (Random Allocation Software 2.0) random allocation sequence was used to block-randomise

147 participants (block size of 2, 4, 6 allocation ratio 1:1) to the exercise group or mindfulness-
148 exercise group.
149 To control for selection bias, group allocations were hidden from the researchers enrolling
150 and assessing participants in sequentially numbered, opaque, sealed envelopes. The
151 envelopes were numbered and recorded on an official trial form by an independent
152 researcher. Corresponding envelopes were opened by research assistant (AAA) after enrolled
153 participants completed all baseline assessments and it was time to allocate the intervention.
154 All clinical assessments were performed by a laboratory specialist who was not directly
155 involved in the study and was blinded to the interventions that the patient received. Data
156 analyst was blinded to group allocation. Precautions were taken to ensure participants were
157 unaware of the interventions of the other groups. Participants were requested not to disclose
158 the content of their program to the laboratory specialist.
159
160 Outcome measures
161 Pain intensity was measured on a 100-mm VAS ranging from 0 (no pain) to 100 (worst
162 possible pain).[19] Participants rated their current, best, and worst level of pain during the last
163 24 hours. The average of the three ratings was used to estimate usual pain intensity. Pain
164 during running and stepping was also measured.
165 Knee symptoms and function during daily living and sport was assessed with the Knee
166 Outcome Survey (KOS), consisting of two subscales: the KOS-Activities of Daily Living Scale
167 (KOS-ADLS) and the KOS-Sports Activities Scale (KOS-SAS). The KOS-ADLS has 14-items that
168 evaluate knee injury-related symptoms and functional limitations during daily living. The KOS-
169 SAS includes 11 items related to symptoms and functional limitations during sport activities.
170 Responses are given on a six-point Likert scale from 0 (unable to perform) to 5 (no difficulty).

Scores are calculated by summing the item scores for each subscale and normalizing them to a 0-to-100 score, with 0 indicating extreme knee problems and 100 indicating no knee problems.[20]

Perceived treatment effect was measured using the global rating of change (GRC) scale.[21] Participants rated the perceived effect of treatment on a 15-point, single-item scale ranging from -7 (a very great deal worse) to +7 (a very great deal better), with 0 representing about the same. Participants' scores and the frequency of participants who scored +4 (moderately better) or higher, indicating successful treatment, are reported.[17]

Fear of movement and re-injury was assessed using the Tampa Scale for Kinesiophobia (TSK). TSK is a 17-item questionnaire, on which participants rate their agreement with each item (e.g., I'm afraid that I might injure myself if I exercise) on a four-point Likert scale (1, strongly disagree, to 4, strongly agree). A total sum is calculated and high scores reflect more pain-related fear.[22]

Pain catastrophizing was assessed using the Pain Catastrophizing Scale (PCS), which consists of 13 items describing the pain experience (e.g., If I am in pain, I am afraid the pain will get worse). The PCS measures three dimensions of catastrophizing: rumination, magnification, and helplessness. Rumination refers to patients' incapacity to stop thinking of attending to the pain. Magnification represents an exaggerated appraisal of pain as a threat. Helplessness represents a state of despair that is brought about by the perception that one is incapable of exerting any control over the experience of pain. Participants rate their agreement with each item using a five-point Likert scale from 0 (not at all) to 4 (always). Higher total and subscale scores indicate more frequent pain catastrophizing.[23]

Coping strategies. The frequency of participants' use of pain coping strategies was assessed with the 27-item Coping Strategies Questionnaire (CSQ). Coping strategies are categorized

195 into six domains: distraction (5 items), catastrophizing (6 items), ignoring pain sensations (5
196 items), distancing from pain (4 items), coping self-statements (4 items), and praying and
197 hoping (3 items). Each domain is scored separately, with higher scores indicating greater use
198 of strategies.[24] Respondents rate how often they use each strategy to cope with pain on a
199 Likert scale ranging from 0 (Never do that) to 6 (Always do that).[24]
200 A survey was used to gather information on age, weight, height, medication use, and running
201 habits.

202 Interventions

203 **Exercise intervention.** Participants in both groups received an exercise protocol that consisted
204 of 13 exercises (5 stretching exercises, 7 strength and balance exercises) for 18 weeks, 3
205 sessions per week with a duration of 60 to 90 minutes per session.[17, 25] The exercise protocol
206 was proceeded with a 10-min warm-up and ended with 10-min cool- down; including jogging
207 and general/dynamic exercises.Rest intervals between sets and exercises were 30 and 90
208 seconds, respectively. The initial intensity of most strength training exercises was set to 10
209 repetitions maximum (10RM),, which produced VAS pain ratings of less than 3. 10RM,
210 approximately 75% of a maximal repetition, was determined according to the Baechle and
211 Earle guidelines for strength training[26]. If participants did all the exercises without (1)
212 aggravated knee pain, (2) excessive fatigue, and (3) local muscle pain 48 hours after the
213 previous training session, the training load was increased (Supplement 1).
214 Participants were also given instructions on how to manage their training load and modify
215 their running according to their symptoms. They were first asked to increase their weekly
216 exercise frequency and to reduce the duration and speed of each training session. Because
217 some participants had difficulties running downstairs and downhill, they were advised to
218 avoid such activities and engage in run-walk intervals instead. It was recommended to keep

the PFP intensity no higher than 3 out of 10 on the VAS while running. If the pain did not return to pre-exercise levels within 60 minutes after exercise or if symptoms were increased the following morning, the training load and intensity of the running program were modified. Runners were advised against increasing the step rate by more than 7.5%-10% [27] per week and using a non-rearfoot strike pattern.[28]

At the end of each week, the participants had a 10-minute treadmill session and received feedback from the physiotherapist on running technique. Each participant received an individually-tailored weekly program designed by a physiotherapist that was continuously modified depending on the evaluation of the runners' symptoms. All exercises were supervised by a researcher and a physiotherapist. None of the participants received any other training programs during the study and was asked not to attempt physical activities that would induce knee pain.

Mindfulness training. In the eight-week of mindfulness-based stress reduction (MBSR),[29] mindfulness- exercise participants received instruction on mindfulness meditation practices such as breathing meditation, body scan meditation, gentle yoga, sitting meditation, and walking meditation. Instructions were expected to increase awareness of thoughts, bodily sensations, and emotions, with an attitude of curiosity, openness, and acceptance [12, 14] (Supplement 2).

The mindfulness-exercise group received an 8-week mindfulness intervention in addition to the exercise program. The mindfulness component started 4 weeks before the exercise component; therefore, these components overlapped during the first 4 weeks of the exercise intervention. To optimize skill learning, mindfulness sessions were delivered in two sessions with seven and eight participants, respectively, and were conducted by a trained sport psychologist. We did not administer one-on-one training sessions, but when a participant had

243 difficulty in learning any topics, the sport psychologist spent more time with that participant
244 at the end the session, as needed. Participants were requested to practice the skills at home
245 for up to 45 minutes daily. This regimen was recorded on a pre-printed form that was used to
246 monitor participants' adherence. Researchers provided training manuals and CDs with
247 instructions for practice during the intervention and follow-up periods.

248 ## Attendance

249 Attendance rates for the exercise component of the programs for the exercise group and
250 mindfulness- exercise group were 87.7% (range 81.5–100%) and 92.3% (range 85.2–100%),
251 respectively. Time limitations, family problems, fatigue, and disease were the main reasons
252 cited for non-attendance. The attendance rate for the mindfulness component was 100%.

253 ## Safety

254 Participants were asked to report any adverse events experienced during the study
255 regardless of perceived severity (e.g., mild pain). An adverse event was defined as any
256 unfavorable or unintended medical occurrence (i.e., abnormal laboratory findings,
257 symptoms, or diseases) temporally associated with the study, whether related to
258 interventions or not. Participants were referred to an independent physician for clinical
259 assessment and initiation of appropriate course of action. Five participants (16.7%; three
260 from the exercise group and two from mindfulness- exercise group) reported at least one
261 adverse event, but no serious adverse events were identified. The adverse events involved
262 temporary pain and were resolved within 12 to 48 hours after the end of the exercise training
263 session.

264 ## Data analysis

265 Descriptive statistics were computed for all variables. Normality and homogeneity of
266 variances were tested with Shapiro-Wilk and Levene tests, respectively. A series of 2 (exercise

group, mindfulness- exercise group) x 4 (baseline, week 9, week 18, follow-up) mixed ANOVAs was used to test the main and interaction effects of group (independent factor) and time (repeated-measures factor) on the dependent variables. For significant interactions, pairwise comparisons were performed with Bonferroni's correction, for which multiplicity-adjusted p-values are reported. The effect size of Cohen's d (ES) was calculated for all continuous variables. Values are presented as mean ± SD and 95% confidence intervals (CIs). All statistical analyses were conducted with an alpha level of .05 using SPSS statistical software (Version 18.0, SPSS Inc., Chicago, IL).

Results

At baseline, the mindfulness- exercise group was similar to the exercise group in terms of demographic and pain characteristics ($p > 0.05$). The session, duration, and distance of running were similar for both groups ($p > 0.05$). Fourteen participants (5 from the mindfulness- exercise group and 9 from the exercise group) reported using medication for pain during the study (Table 1).

(Table 1 about here)

Pain intensity

Results showed significant time × treatment interaction effects for usual pain, pain during running, and pain during stepping ($p < 0.01$) (Table 2). Usual pain ($p < 0.001$, ES=1.14), pain during running ($p < 0.001$, ES = 2.12), and pain during stepping ($p < 0.001$, ES = 1.16) decreased significantly from baseline to week 9 for the mindfulness- exercise group. Pain during stepping decreased more for participants in the mindfulness- exercise group than for those in the exercise group at week 9 ($p = .03$; Dif = 13.1%; 95% CI, 7.3% to 18.9%), week 18 ($p < .01$; Dif = 12.3%; 95% CI, 2.9% to 21.7%), and follow-up ($p < .01$; Dif = 17%; 95% CI, 8.2% to 25.8%). Pain during running decreased more for participants in the mindfulness- exercise

group than for those in the exercise group at week 18 (p < .01; Dif =15.8%; 95% CI, 11.0% to 20.6%) and follow-up (p < .01; Dif = 21.2%; 95% CI, 14.6% to 27.8%). In addition, usual pain decreased more for participants in the mindfulness- exercise group than for those in the exercise group at follow-up (p < .01; Dif = 21.9%; 95% CI, 14.1% to 29.7%).

Our results show a significant positive relationship between pain intensity before the interventions and the amount of pain reduction after the 18-week interventions for usual pain (r= 0.54, *p < 0.001*), *pain during running (*r= 0.63, *p < 0.001), and pain during stepping* (r= 0.43, *p < 0.001*). These results suggest that pain reduction was greater for participants who reported higher levels of pain after the interventions.

Knee related function

Significant time × treatment interaction effect was found for knee function (p < .01) (Table 2). Knee function for the mindfulness- exercise and exercise groups improved significantly from baseline to week 9 (p < .001, ES = 1.28, and p < .001, ES = 1.40, respectively). This improvement was similar for both groups at week 9 (p > .05), but knee function improved more for the mindfulness- exercise group than for the exercise group at week 18 (p < .01; Dif = 8.2 %; 95% CI, 3.3% to 13.1%) and follow-up (p < .01; Dif = 14.8 %; 95% CI, 6.6% to 23.0%).

Perceived treatment effect

Significant time and treatment effects were found for perceived treatment effect (p < .01) (Table 2). Follow-up comparisons showed that perceived treatment effect improved more for the mindfulness- exercise group than for the exercise group at week 9 (p < .01; Dif = 28.5%) and week 18 (p < .01; Dif = 20.8%), but not at follow-up (p > .05). By week 9, 60% of the mindfulness- exercise group reported that treatment was successful compared to 27% of the exercise group (χ^2 = 6.42, p=.02). By week 18, 73% of the mindfulness- exercise group and 60% of the exercise group reported treatment was successful, whereas, at follow-up, these

315 numbers were 67% for the mindfulness- exercise group and 60% for the exercise group; none
316 of these differences was significant (χ^2=2.73, p=.21, and χ^2= 0.23, p=.57; respectively).

317 Fear of movement

318 Significant time × treatment interaction effect was found for fear of movement (p < 0.01)
319 (Table 2). Fear of movement decreased significantly from baseline to week 9 for participants
320 in the mindfulness- exercise group (p < .001, ES = 2.76), but not for participants in the
321 exercise group (p > 0.05). Fear of movement decreased more in the mindfulness- exercise
322 group than in the exercise group at the week 9 (p < .001; Dif = 20.6%; 95% CI, 13.0% to
323 28.2%), week 18 (p = .001; Dif = 22.1%; 95% CI, 14.6% to 29.6%), and follow-up (p < .01; Dif =
324 23.4%; 95% CI, 11.9% to 34.9%).

325 Pain catastrophizing

326 Significant time × treatment interaction effect was found for pain catastrophizing (p < 0.01)
327 (Table 3). Pain catastrophizing decreased significantly in the mindfulness- exercise group
328 from baseline to week 9 (p < .01, ES = 0.80), but not in the exercise group (p > 0.05). Pain
329 catastrophizing decreased more in the mindfulness- exercise group than in the exercise
330 group at week 9 (p < .01; Dif = 30.8%; 95% CI, 21.8% to 39.8%), week 18 (p = .01; Dif = 40.9%;
331 95% CI, 29.6% to 52.2%), and follow-up (p < .02; Dif = 28.4%; 95% CI, 18.7% to 38.1%).

332 Coping strategies

333 Significant time × treatment interaction effects were found for ignoring pain sensations and
334 distancing from pain (p < 0.01) (Table 4). Both strategies increased significantly in the
335 mindfulness- exercise group from baseline to week 9 (p < .001, ES = 0.73, and p < .001, ES =
336 1.1, respectively), but not in the exercise group (p > .05). Moreover, both strategies were
337 more in the mindfulness- exercise group than in the exercise group at week 9 (p < .001; Dif =
338 18.4%; 95% CI, 8.3% to 28.5%, and p < .001; Dif = 32.3%; 95% CI, 17.9% to 46.7%,

respectively), week 18 ($p < .001$; Dif = 39.7; 95% CI, 30.1% to 49.3% and $p < .01$; Dif = 30.7; 95% CI, 23.4% to 38.0%, respectively), and follow-up ($p < .001$; Dif = 30.6%; 95% CI, 24.7% to 36.5% and $p < .001$; Dif = 27.4%; 95% CI, 22.5% to 32.3%, respectively).

Discussion

Overall, the results indicate that adding an eight-week mindfulness intervention to exercise therapy led to decreased pain intensity, fear of re-injury, and pain catastrophizing and increased knee function and coping to manage knee pain in recreational runners with PFP. These findings are consistent with research showing that mindfulness training can enhance responses to non-pharmacological interventions for knee osteoarthritis.[30] Mindfulness practice modified pain-associated cognitions (i.e., pain fear and pain catastrophizing), so that runners who participated in the mindfulness program were less fearful of re-injury when performing rehabilitation movements and reported lower pain catastrophizing thoughts. These results augment previous research in which adding cognitive-behavioral treatment to routine biomedical therapy for chronic low back pain was associated with a decreased fear of movement beliefs[29] and alterations in fear-avoidance beliefs about physical activity were the strongest predictor of functional improvement and post-rehabilitation pain reduction in patients with anterior knee pain. [9] Other studies have also shown that changes in catastrophizing and kinesiophobia after exercise therapy treatment can predict changes in disability and pain intensity in patients with anterior knee pain.[5, 6] The precise mechanisms through which catastrophizing can affect pain and disability are not well understood. It appears that catastrophizing-prone people have difficulty removing their focus from painful or threatening stimuli, exacerbating pain-related fear.[31] Catastrophizing is also associated with excessive emotional evaluation of pain, which facilitates pain perception.[31, 32] In the present study, mindfulness may have disrupted the fear-avoidance cycle by

attenuating pain catastrophizing. In other words, mindfulness may act as a moderator of the relationship between pain intensity and pain catastrophizing.[16]

According to the fear-avoidance model of pain[32], pain-related fear leads to avoidance behaviors; therefore, informing runners of the negative impact of ruminative thinking concerning their pain may lead to less fear of pain. In turn, less avoidant behavior can reduce the risk of functional disability after PFP. Overall, our results suggest that reductions in pain catastrophizing and pain fear mediate the effects of mindfulness on pain and rehabilitation outcomes.

Mindfulness may help runners experience pain relief by enabling them to detach themselves from the sensory dimension of pain.[14, 15] Such detachment can lead to a decrease in the primary sensory component of pain through descending inhibitory signals.[15] Higher scores in ignoring pain sensations and distancing from pain dimensions of coping strategies in the mindfulness- exercise group compared to the exercise group observed in our study may represent this detachment from the sensory dimension of pain. Mindfulness is associated with shifting attention from ruminative thoughts to the present moment.[12] This can lead to a lower level of negative affect, detachment from the sensory dimension of pain, and less cognitive disruption during the therapeutic exercise program, all of which could help improve performance outcomes of runners with PFP.

Our study has several limitations. Because participants were exclusively recreational female runners with PFP, the results cannot be generalized to other populations or sport activities. In addition, we focused only on chronic PFP. Nevertheless, our participants had similar characteristics to patients who typically seek clinical care. Although we reported medication use, we did not directly measure medication use before and during the study. In future studies, researchers should control for medication use because it may affect study outcomes.

Indeed, there is evidence that patients who suffer from depression and anxiety report more intense pain and that these relationships are bi-directional[33, 34]. Patients with depression and anxiety have the tendency to engage in catastrophizing. Pain-based catastrophizing has prospectively predicted pain, while pain acceptance has predicted low pain-related distress, and engagement in activity predicted low depression[35]. Therefore, an exercise therapy programme that integrates mindfulness acceptance is likely to impact catastrophizing and pain perception and patients' mental health needs to be considered for a more effective recovery. At the beginning of the study, none of the study participants reported receiving regular meditation or yoga training at that time. We did not, however, request information about the participants' history of engagement in such programs. It is recommended that researchers consider the history of participation in meditation and yoga in future studies as an inclusion/exclusion criterion. According to the report of the sport psychologist, almost all participants were satisfied and eager to participate in mindfulness training. Because we did not directly measure participants' satisfaction with the class, however, this issue should be addressed in future research. A previous study[36] suggests that as the amount of contact and/or social support available from health professionals and/or other exercise participants in a group-based intervention increases, so does the beneficial effects of the intervention. Accordingly, in our study, both interventions (i.e., exercise training and mindfulness training) were administered in a group setting. Therefore, participants in both experimental groups received social support. Nevertheless, while one group received only one intervention, the other group received both interventions. Therefore, the extent to which participants received different amounts of social support might have influenced the results; hence, future study can overcome this limitation by selecting a placebo intervention with group approach. Another limitation of the current study is that the exercise sessions

were long and therefore not easily applied to most clinical practice settings that treat injuries in recreational runners. Thus, programs that are more easily translated into practice settings should be considered in future studies. In the study, a high number of potential volunteers (n=98) was screened out, potentially raising concerns about selection bias in this sample of participants. Such concerns, however, are attenuated by the fact that participants were screened and enrolled by an independent physiotherapist who was blinded to the allocation of participants to experimental conditions and research goals.

Conclusions

Adding mindfulness practice to exercise therapy may reduce knee pain intensity, fear of movement, and pain catastrophizing and improve knee function of runners with PFP. Moreover, it may result in pain relief, quicker onset of therapeutic effects, and longer-lasting effects than exercise therapy alone without the harmful side effects associated with current pharmacological treatments. Therefore, it is suggested that mindfulness practice should be used as an adjunct to exercise therapy in PFP rehabilitation programs.

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Table 1. Baseline Statistics of Demographic Characteristics, Biomedical Information, and Sport Function of Participants by Treatment Groups

Variables	Mind- Ex Group (n=15) Mean ± SD	Ex Group (n=14) Mean ± SD	Mean difference (95%CI)	p-value
Age (y)	27.9 ± 7.5	28.8 ± 6.8	-0.9 (-6.12 to 4.65)	0.78
BMI (m/kg^2)	23.7 ± 2.3	23.2 ± 2.6	0.5 (-1.30 to 2.39)	0.55
Affected knee, n (left/right/bilateral)[#]	1/8/6	0/6/9		0.77
Target knee, (n) (dominant /non- dominant) [#]	13/2	13/2		-
Injury history (week)	27.9 ± 12.7	24.1 ± 10.7	3.8 (-5.10 to 12.55)	0.4
Sessions run per week (n)	3.5 ± 1.1	3.7 ± 0.8	-0.2 (-0.93 to 0.53)	0.6
Duration run per week (Min)	101.0 ± 31.2	97.5 ± 22.5	3.5 (-16.67 to 24.01)	0.7
Distance run per week (km)	13.4 ± 3.3	14.4 ± 2.6	-1.0 (-3.27 to 1.14)	0.3
Any medication intake (n) [#]	5 (33%)	9 (60%)		0.14

Abbreviations. Mind- Ex; Mindfulness- exercise, Ex; Exercise, 95%CI; 95%confidence interval.

Note: [#], chi square test

Table 2. Statistical Results of Pain and Disability by Treatment Groups

Variables	Mind- Ex Group (n=15)	Ex Group (n=14)	Mean difference (95%CI)	Time		Group		Time ×group interaction	
Usual pain				*p*	η_p^2	*P*	η_p^2	*p*	η_p^2
Baseline	32.9 ± 8.2[#$&]	32.5 ± 8.8[$&]	0.4 (-5.9 to 6.7)	0.001	0.94	0.23	0.05	0.001	0.34
Week 9	29.9 ± 7.6	31.2 ± 7.3	-1.3 (-7.1 to 4.5)						
Week 18	11.6 ± 5.4	15.8 ± 5.1	-4.2 (-8.1 to -0.3)						
Follow up	12.9 ± 5.8	19.4 ± 5.9	-6.5 (-10.9 to -2.1)*						
Pain during running									
Baseline	46.9 ± 11.0[#$&]	45.1 ± 11.4[$&]	1.8 (-6.57 to 10.17)	0.001	0.92	0.32	0.04	0.01	0.20
Week 9	39.1 ± 10.1	43.1 ± 10.9	-4.0 (-11.85 to 3.85)						
Week 18	18.3 ± 6.4	23.7 ± 9.9	-5.4 (-11.7 to 0.9)*						
Follow up	21.3 ± 7.2	27.1 ± 10.0	-5.8 (-12.7 to 0.8)*						
Pain during stepping									
Baseline	50.1 ± 13.5[#$&]	49.7 ± 12.1[$&]	0.4 (-9.2 to 9.9)	0.001	0.94	0.20	0.06	0.004	0.25
Week 9	40.5 ± 10.2	46.3 ± 9.6	-6.2 (-16.4 to 4.0)*						
Week 18	20.1 ± 8.0	26.0 ± 7.7	-5.9 (-11.8 to -0.1)*						
Follow up	21.9 ± 10.3	30.1 ± 11.0	-8.2 (-16.2 to -0.3)*						
Knee related function									
Baseline	64.9 ± 9.1[#$&]	62.6 ± 11.2[#$&]	2.3 (-5.4 to 9.9)	0.001	0.88	0.02	0.17	0.007	0.23
Week 9	71.2 ± 9.2	68.8 ± 9.9	2.4 (-4.8 to 9.6)						
Week 18	90.2 ± 8.1	81.8 ± 4.7	8.4 (3.4 to 13.4) *						
Follow up	84.9 ± 8.2	71.9 ± 5.9	13.0 (7.7 to 18.3) *						
Perceived treatment effect									
Week 9	3.5 ± 3.18[#$&]	1.5 ± 2.41[#$&]	2.0 (-0.1 to 4.1) *	0.001	0.44	0.04	0.13	0.41	0.03
Week 18	5.4 ± 1.76	3.9 ± 1.94	1.5 (-0.08 to 2.9) *						
Follow up	4.4 ± 1.94	3.3 ± 2.02	1.1 (-0.4 to 2.6)						
Fear of movement									
Baseline	45.7 ± 6.7[#$&]	46.5 ± 5.8[#$]	-0.8 (-5.5 to 3.8)	0.001	0.75	0.001	0.33	0.001	0.37
Week 9	32.5 ± 5.7	40.4 ± 4.4	-7.9 (-11.6 to -4.1)*						
Week 18	27.5 ± 5.5	38.3 ± 6.9	-10.8 (-15.4 to -6.1)*						
Follow up	30.9 ± 4.9	42.3 ± 7.8	-11.4 (-16.3 to -6.5)*						

Abbreviations. Mind- Ex; Mindfulness- exercise, Ex; Exercise, 95%CI; 95%confidence interval.

Note:*, Between group significant different; [#], within group significant different between *baseline with* week 9; *$,* within group significant different between b*aseline with* week 18; [&], within group significant different between *baseline with follow up.*

Table 3. Statistical Results of Pain Catastrophizing Variables by Treatment Groups

Variables	Mind-Ex Group (n=15)	Ex Group (n=14)	Mean difference (95%CI)	Time		Group		Time ×group interaction	
Pain catastrophizing				*P*	η_p^2	*p*	η_p^2	*p*	η_p^2
Baseline	21.2 ± 4.4[#$&]	22.1 ± 4.9[#$]	-0.9 (-3.7 to 1.9)	0.001	0.77	0.001	0.49	0.001	0.45
Week 9	10.5 ± 2.0	17.8 ± 3.5	-7.3 (-9.1 to -5.5)*						
Week 18	9.3 ± 2.1	18.4 ± 3.3	-9.1 (-11.1 to -7.1)*						
Follow up	12.4 ± 2.2	19.2 ± 5.1	-6.8 (-9.7 to -3.9)*						
Rumination									
Baseline	9.5 ± 3.3[#$&]	8.0 ± 3.6[$]	1.5 (-1.0 to 4.1)	0.001	0.76	0.14	0.08	0.001	0.44
Week 9	3.7 ± 1.5	6.1 ± 2.7	-2.4 (-4.0 to -0.8)*						
Week 18	3.3 ± 1.4	5.9 ± 2.6	-2.6 (-4.1 to -1.1)*						
Follow up	4.4 ± 1.7	6.2 ± 2.8	-1.8 (-3.4 to -0.2)*						
Magnification									
Baseline	5.7 ± 3.5[#$&]	7.3 ± 1.7[#$]	-1.6 (-3.7 to 0.5)	0.001	0.45	0.002	0.29	0.06	0.10
Week 9	3.5 ± 1.6	5.7 ± 1.8	-2.2 (-3.4 to -1.0)*						
Week 18	2.9 ± 1.3	5.9 ± 1.7	-3.0 (-4.2 to -1.8)*						
Follow up	4.2 ± 1.9	6.5 ± 1.8	-2.3 (-3.7 to -0.9)*						
Hopelessness									
Baseline	5.9 ± 2.5[#$&]	6.8 ± 2.3	-0.9 (-2.9 to 1.1)	0.001	0.33	0.003	0.27	0.01	0.12
Week 9	3.4 ± 1.7	6.1 ± 2.2	-2.7 (-4.2 to -1.2)*						
Week 18	3.1 ± 1.8	5.8 ± 2.0	-2.7 (-4.1 to -1.3)*						
Follow up	3.8 ± 1.6	6.5 ± 3.0	-2.7 (-4.5 to -0.9)*						

Abbreviations. Mind- Ex; Mindfulness- exercise, Ex; Exercise, 95%CI; 95%confidence interval.

Note:*, Between group significant different; [#], within group significant different between *baseline with* week 9*; $,* within group significant different between b*aseline with* week 18*;* [&], within group significant different between *baseline with follow up.*

Table 4. Statistical Results of Coping Strategies by Treatments Group

Variables	Mind- Ex Group (n=15)	Ex Group (n=14)	Mean difference (95%CI)	Time		Group		Time ×group interaction	
				p	η_p^2	*p*	η_p^2	*P*	η_p^2
Distraction									
Baseline	17.1 ± 5.9[#$&]	17.2 ± 5.3	-0.1 (-4.3 to 4.1)	0.001	0.31	0.36	0.03	0.08	0.09
Week 9	20.1 ± 6.1	18.5 ± 6.1	1.6 (-3.0 to 6.2)						
Week 18	22.3 ± 5.8	19.1 ± 5.1	3.2 (-0.9 to 7.3)*						
Follow up	20.4 ± 4.8	18.3 ± 4.6	2.1 (-1.4 to 5.6)						
Catastrophizing									
Baseline	18.4 ± 6.9[#$&]	19.5 ± 7.4	-1.1 (-4.3 to 6.5)	0.001	0.31	0.08	0.11	0.02	0.14
Week 9	14.4 ± 5.2	18.3 ± 5.1	-3.9 (-7.8 to -0.1)*						
Week 18	13.2 ± 4.2	17.5 ± 4.8	-4.3 (-7.7 to -0.9)*						
Follow up	13.9 ± 4.5	17.8 ± 4.7	-3.9 (-7.3 to -0.5)*						
Ignoring pain sensations									
Baseline	15.7 ± 5.9[#$&]	16.6 ± 6.4	-0.9 (-5.5 to 3.8)	0.001	0.68	.17	0.07	0.001	0.57
Week 9	20.0 ± 5.4	17.3 ± 6.4	2.7 (-1.7 to 7.1)*						
Week 18	22.4 ± 5.7	17.2 ± 5.9	5.2 (0.9 to 9.5)*						
Follow up	21.0 ± 4.8	17.1 ± 6.1	3.9 (-0.2 to 8.0)*						
Distancing from pain									
Baseline	14.1 ± 4.9[#$&]	15.6 ± 5.9	-1.5 (-5.6 to 2.6)	0.001	0.46	0.36	0.03	0.001	0.23
Week 9	19.1 ± 4.4	16.1 ± 6.1	3.0 (1.0 to 7.0)*						
Week 18	20.5 ± 5.3	17.9 ± 5.2	2.6 (-1.3 to 6.5)*						
Follow up	19.1 ± 4.3	16.7 ± 5.3	2.4 (-1.2 to 6.0)*						
Coping self-statement									
Baseline	14.3 ± 3.9[#$]	14.5 ±3.9	-0.2 (-2.7 to 3.1)	0.06	0.09	0.41	0.02	0.13	0.06
Week 9	16.1 ± 4.9	14.2 ± 4.9	1.9 (-1.8 to 5.6)						
Week 18	17.1 ± 4.8	14.8 ± 4.7	2.3 (-1.3 to 5.8)*						
Follow up	15.8 ± 3.9	14.9 ± 4.8	0.9 (-2.4 to 4.2)						
Praying and hoping									
Baseline	7.4 ± 2.9[$&]	8.8 ± 2.1	-1.4 (-3.3 to 0.5)	0.16	0.06	0.09	0.01	0.12	0.07
Week 9	8.2 ± 3.4	8.5 ± 3.2	-0.3 (-2.8 to 2.2)						
Week 18	9.8 ± 2.4	8.7 ± 2.2	1.1 (-0.6 to 2.8)						
Follow up	9.1 ± 2.1	8.1 ± 2.1	1.0 (-1.3 to 3.3)						

Abbreviations. Mind- Ex; Mindfulness- exercise, Ex; Exercise, 95%CI; 95%confidence interval.

Note:*, Between group significant different; [#], within group significant different between *baseline with* week 9*; $,* within group significant different between b*aseline with* week 18*;* [&], within group significant different between *baseline with follow up.*

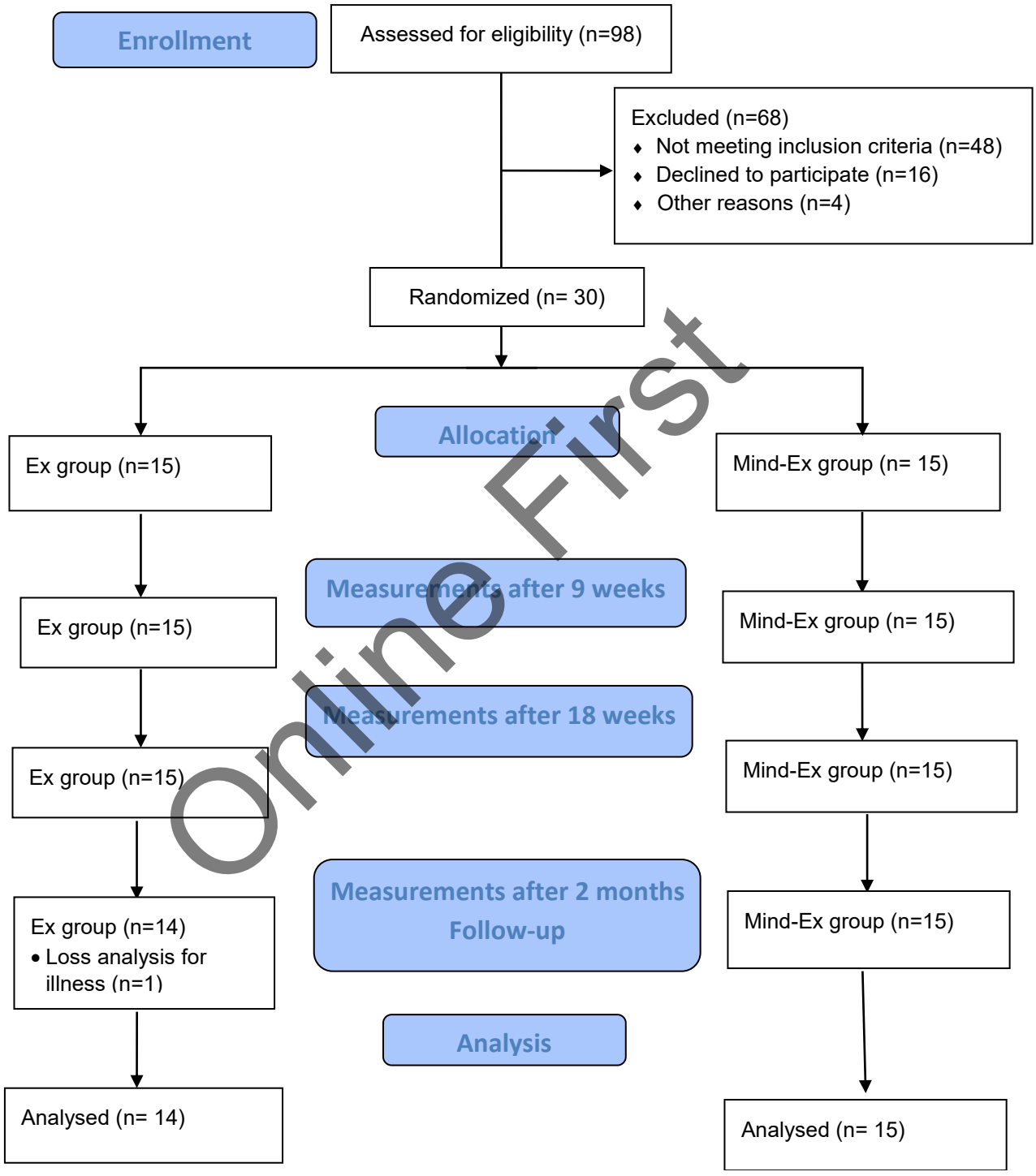

Figure 1. Flow of participants during the course of the study.

Supplementary 1. Exercise protocol

Exercise	Progression	Description
Quadriceps and lateral retinaculum stretches	Week 1- 18	3 sets ×30 sec Stretch to the point feel tension or mild pain
Hamstrings, soleus, gastrocnemius, and iliotibial band stretches	Week 1- 18	3 sets ×15-20 sec Stretch to the point feel tension or mild pain
	Week 1- 18	3 sets ×20-30 sec Stretch to the point feel tension or mild pain
Straight leg raise in supine	Week 1- 4	2 sets ×20 rep Resistance: ankle weight Initial load: 50 % of 10RM
	Week 5- 9	3 sets ×15 rep Resistance: ankle weight Initial load: 75 % of 10RM
	Week 10-14	The same as week 5-9
	Week 15-18	3 sets ×10 rep Resistance: ankle weight Initial load: 100 % of 10RM
Side plank	Week 1- 4	5 sets ×10 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant can use either knee or feet as a support point
	Week 5- 9	5 sets ×20 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use knee as a support point
	Week 10-14	5 sets ×35 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use feet as a support point
	Week 15-18	5 sets ×50 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use either knee or feet as a support point
Prone Plank	Week 1- 4	5 sets ×10 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant can use either knee or feet as a support point
	Week 5- 9	5 sets ×20 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use knee as a support point
	Week 10-14	5 sets ×35 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use feet as a support point
	Week 15-18	5 sets ×50 sec Resistance: body weight Weekly progression: increase 3- sec hold

		Participant use either knee or feet as a support point
Back plank	Week 1- 4	5 sets ×10 sec Resistance: body weight Weekly progression: increase 3- sec hold Perform on both leg if it done on one leg.
	Week 5- 9	5 sets ×20 sec Resistance: body weight Weekly progression: increase 3- sec hold Perform on both legs if it has done on one leg.
	Week 10-14	5 sets ×35 sec Resistance: body weight Weekly progression: increase 3- sec hold Perform on both legs if it has done on one leg..
	Week 15-18	5 sets ×50 sec Resistance: body weight Weekly progression: increase 3- sec hold Perform on both legs if it has done on one leg.
Step exercise on a 20-cm step	Week 1- 4	3 sets ×15 rep Resistance: body and free weight Initial load: 10 % of body weight Weekly progression: 5% of body weight Using a mirror to maintain good control for knee on top of foot and pelvis level.
	Week 5- 9	Perform the same as weeks 1-4, while use elastic band to pulling your knee inwards and increase difficulty.
One leg jump from a 20 –cm step	Week 10-14	3 sets ×15 rep Using a mirror to maintain good control for knee on top of foot and pelvis level during squat position landing.
	Week 15-18	4 sets ×15 rep Using a mirror to maintain good control for knee on top of foot and pelvis level during squat position landing. Using elastic band to pulling your knee inwards and increase difficulty
Single leg stance on unstable platform	Week 13-15	3 sets ×15 rep Eye open
	Week 16-18	3 sets ×15 rep Eye close

Supplementary 2. Description of the topics and contents of mindfulness practice sessions.

Sessions	Content
Week 1	• Understanding stress, how to identify it and how to change how we react to it • Discussion about connections between stress and pain • Reacting and responding to the stress • Exploration of coping strategies with life's difficulties
Week 2	• Discussing how we can get unstuck in old patterns • Offering ways to detach from our habitual patterns of thinking, action, and reaction • Learning effective and ineffective ways to respond to difficult situations, people, or sensations.
Week 3	• Concept of being present and living in the present • The pleasure and power of being present • Abdominal breathing instruction • Mindfulness birthing practice. • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 4	• Introduction to body scan • Meaning and requirements of body scan • How to use the body scan when I am in pain • Abdominal berthing during body scan • Body scan instruction and practice • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 5	• Introduction to sitting mediation • Basic instructions for practicing the sitting meditation • Sitting meditation with the breath, sound, and feelings • Practice of sitting meditation with breath • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 6	• Introduction to walking meditation • Basic information to explore relationship motion and emotions • Practice of walking meditation • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 7	• Introduction to yoga meditation • Instructions about mindful yoga postures and stretches • Practice of yoga meditation • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 8	• Review mindfulness techniques • Integrating the learning from the techniques • Practical ways to bring mindfulness into daily life • Practice of an integrating meditation • Encouraged to practice the mindfulness daily for up to 45 minutes

Supplementary 1. Exercise protocol

Exercise	Progression	Description
Quadriceps and lateral retinaculum stretches	Week 1- 18	3 sets ×30 sec Stretch to the point feel tension or mild pain
Hamstrings, soleus, gastrocnemius, and iliotibial band stretches	Week 1- 18	3 sets ×15-20 sec Stretch to the point feel tension or mild pain
	Week 1- 18	3 sets ×20-30 sec Stretch to the point feel tension or mild pain
Straight leg raise in supine	Week 1- 4	2 sets ×20 rep Resistance: ankle weight Initial load: 50 % of 10RM
	Week 5- 9	3 sets ×15 rep Resistance: ankle weight Initial load: 75 % of 10RM
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	Week 15-18	3 sets ×10 rep Resistance: ankle weight Initial load: 100 % of 10RM
Side plank	Week 1- 4	5 sets ×10 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant can use either knee or feet as a support point
	Week 5- 9	5 sets ×20 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use knee as a support point
	Week 10-14	5 sets ×35 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use feet as a support point
	Week 15-18	5 sets ×50 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use either knee or feet as a support point
Prone Plank	Week 1- 4	5 sets ×10 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant can use either knee or feet as a support point
	Week 5- 9	5 sets ×20 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use knee as a support point
	Week 10-14	5 sets ×35 sec Resistance: body weight Weekly progression: increase 3- sec hold Participant use feet as a support point
	Week 15-18	5 sets ×50 sec Resistance: body weight Weekly progression: increase 3- sec hold

		Participant use either knee or feet as a support point
Back plank	Week 1- 4	5 sets ×10 sec Resistance: body weight Weekly progression: increase 3- sec hold Perform on both leg if it done on one leg.
	Week 5- 9	5 sets ×20 sec Resistance: body weight Weekly progression: increase 3- sec hold Perform on both legs if it has done on one leg.
	Week 10-14	5 sets ×35 sec Resistance: body weight Weekly progression: increase 3- sec hold Perform on both legs if it has done on one leg..
	Week 15-18	5 sets ×50 sec Resistance: body weight Weekly progression: increase 3- sec hold Perform on both legs if it has done on one leg.
Step exercise on a 20-cm step	Week 1- 4	3 sets ×15 rep Resistance: body and free weight Initial load: 10 % of body weight Weekly progression: 5% of body weight Using a mirror to maintain good control for knee on top of foot and pelvis level.
	Week 5- 9	Perform the same as weeks 1-4, while use elastic band to pulling your knee inwards and increase difficulty.
One leg jump from a 20 –cm step	Week 10-14	3 sets ×15 rep Using a mirror to maintain good control for knee on top of foot and pelvis level during squat position landing.
	Week 15-18	4 sets ×15 rep Using a mirror to maintain good control for knee on top of foot and pelvis level during squat position landing. Using elastic band to pulling your knee inwards and increase difficulty
Single leg stance on unstable platform	Week 13-15	3 sets ×15 rep Eye open
	Week 16-18	3 sets ×15 rep Eye close

Supplementary 2. Description of the topics and contents of mindfulness practice sessions.

Sessions	Content
Week 1	• Understanding stress, how to identify it and how to change how we react to it • Discussion about connections between stress and pain • Reacting and responding to the stress • Exploration of coping strategies with life's difficulties
Week 2	• Discussing how we can get unstuck in old patterns • Offering ways to detach from our habitual patterns of thinking, action, and reaction • Learning effective and ineffective ways to respond to difficult situations, people, or sensations.
Week 3	• Concept of being present and living in the present • The pleasure and power of being present • Abdominal breathing instruction • Mindfulness birthing practice. • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 4	• Introduction to body scan • Meaning and requirements of body scan • How to use the body scan when I am in pain • Abdominal berthing during body scan • Body scan instruction and practice • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 5	• Introduction to sitting mediation • Basic instructions for practicing the sitting meditation • Sitting meditation with the breath, sound, and feelings • Practice of sitting meditation with breath • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 6	• Introduction to walking meditation • Basic information to explore relationship motion and emotions • Practice of walking meditation • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 7	• Introduction to yoga meditation • Instructions about mindful yoga postures and stretches • Practice of yoga meditation • Encouraged to practice this session informally based on training manual and CD (45 min in day)
Week 8	• Review mindfulness techniques • Integrating the learning from the techniques • Practical ways to bring mindfulness into daily life • Practice of an integrating meditation • Encouraged to practice the mindfulness daily for up to 45 minutes