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Original Article

Effectiveness of a Mindfulness-Based Intervention in the Management of Musculoskeletal Pain in Nursing Workers

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ABSTRACT

Background: Chronic pain is a prevalent disorder in nursing workers worldwide. Several studies have proposed measures to mitigate this critical scenario. Mindfulness-based interventions (MBI) have been found to have promising results in the treatment of this disorder.
Aims: To quantify the effectiveness of an adapted mindfulness program (AMP) in the management of musculoskeletal pain (MSP) in nursing technicians of a Brazilian university hospital.
Design: This study was a clinical, prospective, open, repeated measures trial, with data collection between January and July 2015.
Settings: Brazilian university hospital.
Participants/Subjects: Sixty-four female nursing technicians with a mean age of 47.01 years (standard deviation = 9.50) with chronic pain symptoms.
Methods: Sixty-four female nursing technicians with a mean age of 47.01 years (standard deviation = 9.50) and MSP participated in this prospective study. Before the intervention (T0), scores of anxiety, depression, mindfulness, musculoskeletal complaints, pain catastrophizing, self-compassion, and perception of quality of life were quantified. These scores were reevaluated after 8 weeks (T1) and 12 weeks (T2) of weekly AMP sessions (60 minutes each). The variables were evaluated by analysis of variance for repeated measures, followed by the Bonferroni test.
Results: AMP reduced the scores of musculoskeletal symptoms, anxiety, depression, and pain catastrophizing ($p < .001$). A significant increase was identified in self-compassion scores and perception of quality of life in the physical, psychological, and overall assessment ($p \leq .04$). Positive effects of AMP occurred at T1 and remained unchanged at T2.
Conclusion: AMP contributed to a reduction in painful symptoms and improved the quality of life of nursing workers, with a lasting effect until the 20th week of follow-up, indicating utility as an effective strategy for the management of MSP in the group studied.

Pain is defined as an unpleasant sensory and emotional experience (International Association for the Study of Pain), associated with actual or potential tissue damage (Merskey & Bogduk, 1994). Pain is the most prevalent symptom in individuals with musculoskeletal complaints caused by excessive and recurrent exertion. In Europe, musculoskeletal disorders are the main causes of absenteeism at work and account for up to 60% of permanent disabilities (Mininel et al., 2013).

Musculoskeletal pain (MSP) symptoms are common among health professionals worldwide and are highly prevalent in the nursing worker category (D'Agostin & Negro, 2016). In these professionals, the symptoms are related to the high physical and psychosocial demands of the work process, together with inadequate individual physical conditioning (Bernal et al., 2015; Davis & Kotowski, 2015; Long, Bogossian, & Johnston, 2013; Mininel et al., 2013).

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In a multicenter study involving approximately 12,000 professionals from different areas, the nursing staff was the group that presented the highest prevalence of MSP (Coggon et al., 2012). In Brazil, the prevalence of MSP among nursing professionals is estimated to be between 43% and 93% (Gurgueira, Alexandre, & Corrêa Filho, 2003).

Mindfulness-based interventions (MBIs) have been found to be a useful complementary tool in the treatment of chronic pain, based on the principle of self-regulation of attention to the present experience (Kabat-Zinn, 1990, 2003). It also has a positive impact on the physical and psychological state of the individual (Bishop et al., 2004; Bonadonna, 2003; Cullen, 2011; Grecucci, Pappaianni, Siugzdaite, Theuninck, & Job, 2015; Kabat-Zinn, 1990; Khoury et al., 2013).

The program called Mindfulness-Based Pain Management, structured for the management of chronic pain, uses practices that stimulate the awareness of actions and reactions of body and mind. It can help to break the vicious cycle of emotional symptoms that intensify pain and vice-versa (Burch & Penman, 2013; Kabat-Zinn, 1990; Chiesa & Serretti, 2009; Irving, Dobkin, & Park, 2009).

MBI practices are self-directed and regulated and, when incorporated into daily life, may modify lifestyle, with beneficial effects on overall health. By giving a new meaning to the symptom of chronic pain, benefits accrue to the MBI practitioner. The individual begins to cope with pain through more focused attention to his or her reactions, with a conscious response (Bush & Kohlrieser, 2013; Demarzo & Campayo, 2015). The person converts stress to a challenge, no longer perceiving it as a threat. This posture can break the cycle of pain—muscle contraction— more pain.

Evidence indicates that meditation involves multiple brain mechanisms that alter the construction of the subjective pain experience from afferent information (Zeidan et al., 2011). Noxious stimuli trigger a series of neurophysiologic changes, which are highly malleable and subject to change. Meditation and pain alter the sensory, cognitive, and affective dimensions of our subjective experience (Cahn & Polich, 2006; Koyama, McHaffie, Laurienti, & Coghill, 2005).

Cognitive control is improved after training (Zeidan, Johnson, Diamond, David, & Goolkasian, 2010), which allows participants to focus more effectively on breathing. This attentional set may reduce harmful effects (Pessoa, McKenna, & Gutierrez, 2002). Additionally, reducing expectations of imminent noxious stimuli promotes pain modulation (Koyama et al., 2005). In meditation training, one learns to reduce anticipation of future events, which may lead individuals to reduce anticipatory responses to noxious stimuli (Brown & Jones, 2010).

The experience of intense or lasting pain, by establishing a pernicious perception, may reduce physical activity. It also can result in a catastrophic sensation of incapacity, helplessness, and lack of confidence in symptom management or coping, which contributes to the development of depression or anxiety (Fernandez et al., 2017).

Wachholtz and Pearce (2009) indicated that social and spiritual support promotes, among other beneficial effects, relaxation through neurophysiologic modifications, such as alterations of neurotransmitter levels, changes in conduction, and differences in the threshold for the recognition of signs of pain as well as through reduced activity of the hypothalamic—pituitary—adrenal axis. The final effect is in the perception of pain, increasing or decreasing sensitivity and tolerance.

Seligman (2002) suggests that the ability to control an aversive event, such as pain, may reduce anxiety. Hofmann, Sawyer, Witt, and Oh (2010) reported that mindfulness was capable of reducing anxiety, depression, and pain.

Hölzel et al. (2011a) analyzed brain magnetic resonance imaging of a group of participants undergoing regular meditation practice at two time points (2 weeks before and after 8 weeks) and compared the findings with those of a control group. The images showed greater density of gray matter in the hippocampus, known to be important for learning and memory, and in structures associated with self-awareness, compassion, and introspection (posterior cingulate gyrus, temporoparietal junction, and cerebellum). Reduced density was identified in the amygdala, an important structure in the pathophysiology of anxiety and stress. In a meta-analysis, Khoury, Sharma, Rush, and Fournier (2015) concluded that mindfulness is moderately effective in reducing stress, depression, anxiety, and distress and in improving the quality of life of healthy individuals. Despite previous results, Bawa et al. (2015) have found limited evidence regarding MBI's efficacy in the control of chronic pain.

Our study aimed to evaluate the effectiveness of a mindfulness adapted program (AMP) as a complementary strategy for managing musculoskeletal pain in nursing technicians of a Brazilian university hospital. The following hypotheses were tested: (1) Does AMP reduce scores of musculoskeletal symptoms, anxiety, pain catastrophizing, and depressive thoughts? (2) Does AMP increase scores of self-compassion, attentional aspects, and perception of quality of life?

Materials and Methods

This study was a clinical, prospective, open, repeated measures trial, with data collection between January and July 2015, in a Brazilian university hospital. The research was approved by the institution's Ethics Committee (number 12357). Two copies of the informed consent were signed for each participant and researcher before the participation in the study. One of the copies was kept with each participant and the other one with the researcher. All the data forms were locked in a specific private and confidential place according to the Brazilian research ethical rules.

The inclusion criteria were age greater than 18 years, having an employment relationship with the institution, complaints of chronic pain for more than 6 months, and 20 minutes' daily meditation between face-to-face meetings. The exclusion criteria were the absence of chronic pain for 6 months or more, acute psychiatric disorders, abuse of alcohol or illicit drugs, and being a regular practitioner of yoga and/or meditation.

Instruments

All the instruments used were validated to Brazilian Portuguese. Musculoskeletal symptoms were evaluated through the Nordic Musculoskeletal Questionnaire, considering the presence or absence of symptoms in the last 7 days (Pinheiro, Tróccoli, & Carvalho, 2002). The pain-catastrophizing scores were quantified by the Pain-Catastrophizing Scale, whose results may vary from 0 to 5 points (Jamir et al., 2008).

To quantify anxiety symptoms, the Spielberger State-Trait Anxiety Inventory was used, whose final score allows the classification of anxiety into mild ($\leq$33 points), moderate (34-48 points), and severe ($\geq$49 points) (Fioravanti, Santos, Maissonette, Cruz, & Landeira-Fernandez, 2006). The intensity of depressive symptoms was evaluated by the Beck Depression Inventory, whose final sum of scores defines the symptoms as absent or mild (0-11 points), moderate (12-19 points), moderate to severe (20-35 points), and severe (36-63 points) (Gomes-Oliveira, Goresntein, Neto, Andrade, & Wang, 2011).

The Mindful Attention Awareness Scale (MAAS) evaluated the characteristics of predisposition to mindful awareness and attention. Higher scores reflect higher levels of mindful awareness and attention (Barros, Kozasa, Souza, & Ronzani, 2015; Brown & Ryan, 2003).

Self-compassion scores were quantified by the Self-Compassion Scale, which permits analysis through subscales (self-kindness, self-judgment, common humanity, isolation, mindfulness, and overidentification) or the integration of the whole (Neff, 2003b). In

the present study, we opted for the integrated result, in which the higher the score, the higher the level of self-compassion (Neff, 2003a).

For the perception of quality of life, we used the abbreviated form of the Quality of Life scale of the World Health Organization (WHOQOL-BREF), whose items are grouped into five domains: physical, psychological, social relationships, environment, and global quality of life. The higher the scores, the better the indicator in each domain (Fleck et al., 2000).

Adapted Mindfulness Program

In our study, AMP was adapted from the Mindfulness-Based Stress Reduction (MBSR) (Kabat-Zinn, 1990) and Mindfulness-Based Pain and Illness Management programs (Burch & Penman, 2013), structured by weekly sessions of 60 minutes each for a period of 8 consecutive weeks. Each session consisted of up to seven participants. In addition to face-to-face practice at the institution, all participants were guided toward daily and individual practice at home, using instructions in the form of standardized audio, made available by researchers to guarantee greater adherence to home meditation with a recommended practice time of 20 minutes (Carmody & Baer, 2009; Klatt, Buckworth, & Malarkey, 2009). They were also encouraged to cultivate present moment awareness while performing their daily routines and activities as an informal practice.

Participants were randomly selected. In each face-to-face meeting, the AMP exercises focused on pain management, breathing techniques, body scanning, mindfulness walking, conscious movements with light body postures, sitting, lying down, and compassion meditation (Kabat-Zinn, 1990). The evaluation instruments were applied at three different periods: pre-intervention (T0) and after 8 weeks (T1) and 12 weeks (T2) of intervention. The diagram of the study is illustrated in Figure 1.

Statistical Analysis

We used SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY) for the statistical analysis. Initially, a descriptive analysis of the studied variables was performed. The analysis of variance for repeated measurements was used to compare the evolution of the variables (among T0, T1, and T2), followed by the Bonferroni test to measure differences found among the outcomes. For statistical significance and considering $\alpha = .05$, error $\beta = .20$, and a 95% confidence interval, the estimated sample size was 62 individuals.

Results

A total of 84 individuals were included at the beginning of the study, of whom 64 completed the study. Table 1 provides the sociodemographic profile of the 64 participants.

The results indicated a significant reduction in musculoskeletal symptoms, levels of anxiety, depression, and pain catastrophizing ($p < .001$). Increased self-compassion and perception of quality of life scores were found in the physical, psychological, and global assessment domains ($p \leq .04$). For all these variables, the positive effects were identified after 8 weeks (T1) and remained unchanged until the 12th week of follow-up (T2).

In contrast, no significant variation was identified in the MAAS scores or in the social relationships and environment domains of the WHOQOL-BREF. The results are detailed in Table 2.

The moderate and intense anxiety symptom scores were significantly reduced after the eighth week of intervention; consequently, a higher percentage of participants presented mild anxiety symptoms in the two subsequent evaluations (T1 and T2). The same effect was identified for depression, with a significant reduction in the percentage of participants with moderate to severe symptoms and an equal increase in absent or minimal symptoms.

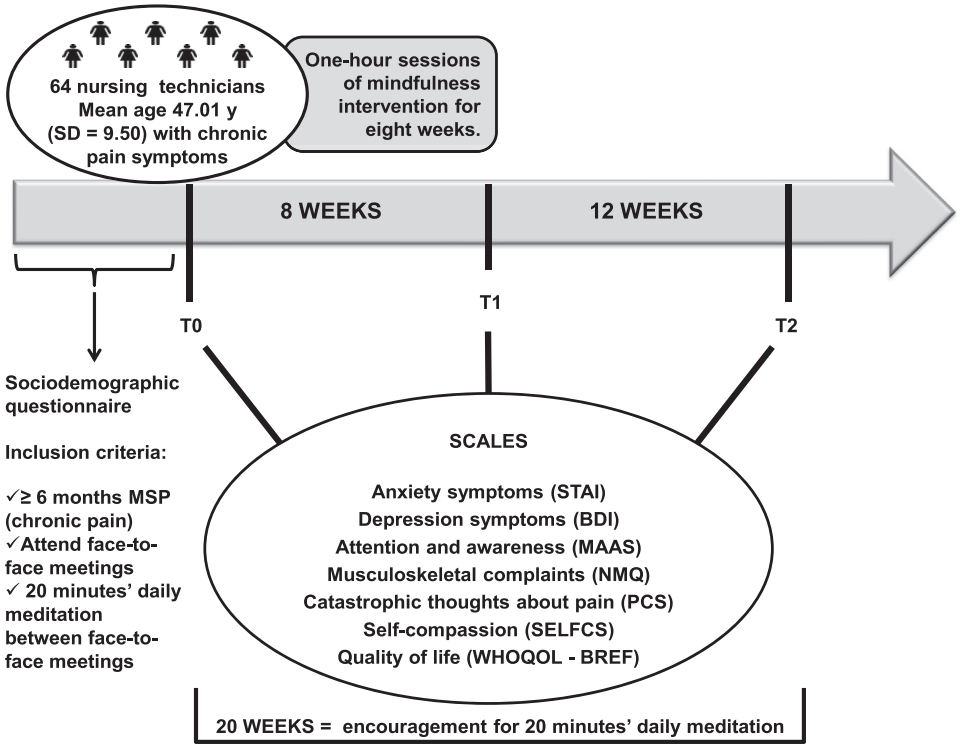

Figure 1. Study diagram. SD = standard deviation; MSP = musculoskeletal pain.

Table 1
Profile of Female Nursing Technicians Who Participated in the Study

Sex	100% females
Age	Mean = 47.01 years (SD = 9.50 years) Minimum = 25 years Maximum = 68 years
Marital status	43.7% married 29.7% divorced 25% single 1.6% widowed
Education	79.7% technical level 20.3% higher level
Working time at the institution	Mean = 14 years
Work day at the institution	40 hours per week 32.8% morning (7:00 a.m.-1:00 p.m.) 34.4% afternoon (1:00 p.m.-7:00 p.m.) 32.8% night (7:00 p.m.-7:00 a.m.)
Time spent going from home to work	Mean = 90 minutes
Religion	56.2% Catholic 25% Evangelical 15.6% Spiritism 3.2% other religious practices
Medications in use*	76.6% analgesics 23.4% nonsteroidal anti-inflammatory drugs 18.8% antidepressants

SD = standard deviation.
* Possibility of using more than one medication class.

Also, the statistical results indicated a very significant finding related to the decrease of pain levels. These results are shown in Figure 2.

Discussion

The objective of this study was to evaluate the effectiveness of AMP as a strategy for the management of musculoskeletal pain in nursing technicians. The results indicated a significant reduction in scores related to pain catastrophizing, depression, anxiety, and musculoskeletal pain symptoms. Additionally, the positive impact of the results was maintained after 12 weeks of intervention, indicating a sustained effect.

These results are consistent with those of Grossman, Niemann, Schmidt, and Walach (2004), which indicated the efficacy of MBI in patients with chronic diseases, regardless of the profession. Promising results were also evidenced by Irving et al. (2009), who studied the effect of mindfulness on groups of resident physicians and medical students.

One of the challenges of incorporating mindfulness' proposal into people's routine is time. To optimize AMP, adapting it to the reality of our service, the duration of supervised practices was reduced by 50% to eight sequential 60-minute meetings. Moreover, we requested the incorporation of some strategies in the daily life of each participant, with shorter daily duration (20 minutes) during the 20 weeks, which were performed in the last 12 weeks without face-to-face meetings. The reduction in practice time did not affect the results, as indicated in the research of Carmody and Baer (2009). These authors studied the effect of reduced practice time on groups of healthy adults and patients with various clinical disorders (cancer, organ transplant patients, fibromyalgia, anxiety, chronic pain, substance abuse, and HIV) and found a positive effect on outcomes and greater adherence to the practices.

Zeidan et al. (2010) reported that some of the beneficial effects of meditation might be obtained after only 4 days (20 min/day) of training and may serve as an adjuvant therapy, effective in acute clinical situations. Pain alteration occurs with a restructuring of the contextual evaluation of nociceptive information through the constellation of interactions among expectations, emotions, and cognitive evaluations intrinsic to the construction of sensory experience. Pain can be regulated by the metacognitive ability of sustaining attention, without judging, with focus on the present moment (Zeidan et al., 2011).

The regular practice of AMP among nursing technicians in the present study appears to have increased tolerance and reduced perceptual sensitivity to chronic musculoskeletal pain through relaxation, as cited by Wachholtz and Pearce (2009), reducing symptoms of anxiety and depression. Researchers have reported the modulation of pain over depressive and anxious symptoms and vice versa (Goyal et al., 2014). In the present study, all participants reported chronic pain and troubling scores for anxiety and depression at baseline. After the AMP intervention, the aforementioned symptoms were reduced.

In testing a second hypothesis, our study found that AMP can induce an increase in self-compassion scores, attentional aspects, and perception of quality of life. Costa and Pinto-Gouveia (2011) compared acceptance of pain and self-compassion. The low-acceptance subgroup reported more self-judgment, isolation, and overidentification. The highest score in self-compassion was also associated with lower rates of anxiety, depression, and stress. Increasing self-compassion asserts the principles of mindfulness.

According to the proposal developed, we believe that the results of this study support the benefits of AMP as a singular method to elevate self-compassion and aid pain and emotional control. Self-compassion is a strong predictor of mental health and well-being,

Table 2
Score Results: Mean (M) ± Standard Deviation (SD) of Scores at T0 and after 8 Weeks (T1) and 12 Weeks (T2) of Intervention

	T0 M (SD)	T1 M (SD)	T2 M (SD)	F	*p*	η^2	Post Hoc
STAI	44.59 (9.28)	38.78 (10.21)	38.76 (8.77)	15.50	.000*	.198	T0 > T1 = T2
BDI	12.69 (6.58)	7.92 (6.71)	7.28 (5.42)	20.36	.000*	.244	T0 > T1 = T2
NMQ	3.75 (2.27)	2.28 (2.15)	2.35 (2.18)	15.79	.000*	.200	T0 > T1 = T2
MAAS	59.26 (13.80)	61.15 (13.68)	62.40 (15.82)	1.39	.252	.022	T0 = T1 = T2
PCS	2.17 (1.25)	1.46 (1.18)	1.26 (1.16)	16.01	.000*	.203	T0 > T1 = T2
SELFCS	78.10 (12.30)	90.44 (16.11)	91 (14.45)	17.44	.000*	.217	T0 < T1 = T2
WHOQOL-BREF Total	3.08 (0.50)	3.41 (0.50)	3.37 (0.50)	8.03	.001*	.112	T0 < T1 = T2
Physical	3.00 (0.60)	3.47 (0.59)	3.46 (0.61)	12.54	.000*	.224	T0 < TI = T2
Psychological	3.34 (0.73)	3.76 (0.57)	3.64 (0.64)	5.22	.001*	.169	T0 < T1 = T2
Social Relationships	3.48 (0.73)	3.64 (0.87)	3.62 (0.78)	0.78	.460	.027	T0 = T1 = T2
Environment	2.83 (0.52)	3.02 (0.55)	2.97 (0.53)	2.05	.130	.054	T0 = T1 = T2
Global	3.09 (0.72)	3.48 (0.67)	3.41 (0.71)	5.75	.040*	.128	T0 < T1 = T2

F = critical factor; STAI = Spielberger State-Trait Anxiety Inventory; BDI = Beck Depression Inventory; NMQ = Nordic Musculoskeletal Questionnaire; MAAS = Mindful Attention Awareness Scale; PCS = Pain-Catastrophizing Scale; SELFCS = Self-Compassion Scale; WHOQOL-Bref = abbreviated World Health Organization Quality of Life scale.
* $p \leq .05$, η^2 = effect size (.01; .06; .14 to indicate small, medium, or large, respectively).

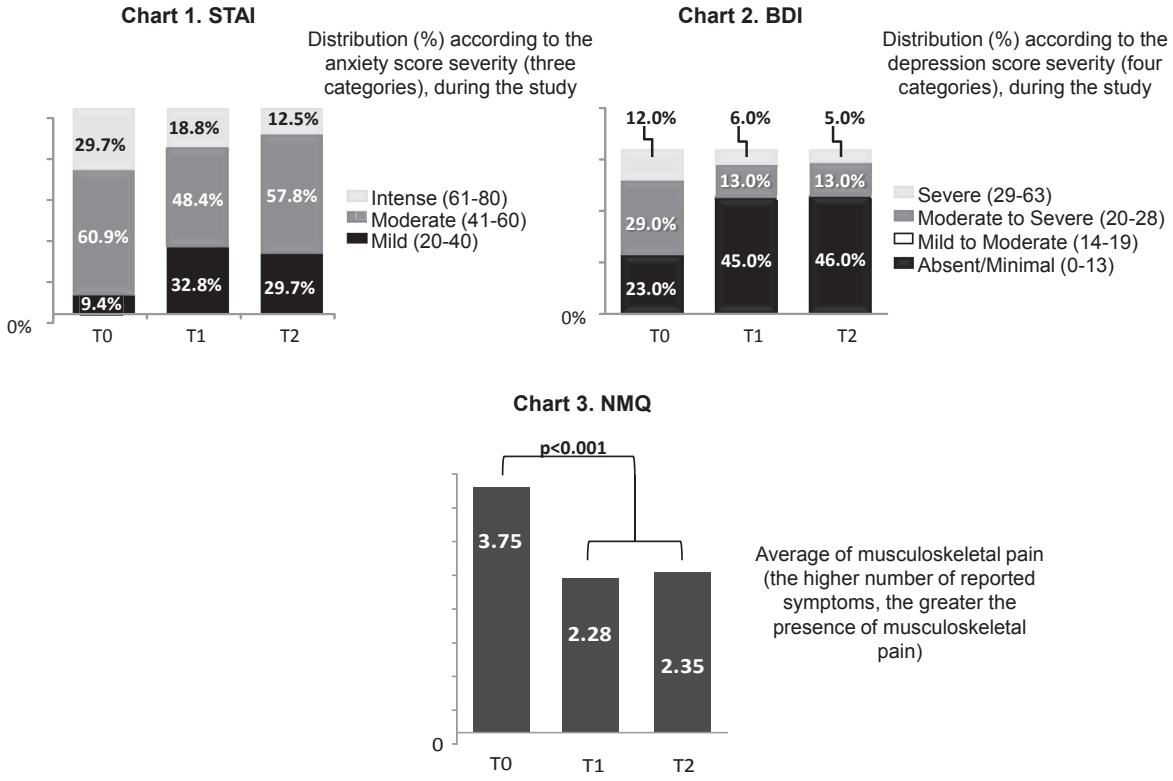

Figure 2. Distribution according to the degree of severity of the anxiety score (Chart 1), depression (Chart 2), and level of musculoskeletal pain symptoms (Chart 3). STAI = Spielberger State-Trait Anxiety Inventory; BDI = Beck Depression Inventory; NMQ = Nordic Musculoskeletal Questionnaire.

positively relating to life satisfaction along with wisdom and personal initiative, optimism, awareness, caring, kindness, and a positive and warm attitude in the face of unpleasant aspects, such as the sensation of pain (Neff, 2003a; Neves, 2011).

Pires, Nunes, Demarzo, and Nunes (2015) had reported that high scores on the MAAS scale reflect a greater capacity for mindfulness. Using the MAAS scale, Barros et al. (2015) found no significant difference between groups that meditate and those that do not meditate. These results suggest that the scale does not adequately assess attention levels of mindfulness among those who meditate.

MacKillop and Anderson (2007) obtained similar results, finding no significant categorical differences between individuals with and without meditation experience and no significant continuous association evident in the overall sample or in individuals reporting experience with meditation. In their original validation study, Brown and Ryan (2003) examined middle-aged Zen Buddhist practitioners who were recruited directly from a Zen monastery, finding significant categorical and continuous relationship between MAAS and experience with meditation. In the present study, participants meditated for no more than 20 weeks and MAAS score did not increase. The researcher's opinion is that the MAAS scale may not be able to discriminate groups in these circumstances—that is, the MAAS scale does not appear to differentiate novice meditators from those without meditation experience.

Van Dam, Sheppard, Forsyth, and Earleywine (2010) concluded that the self-compassion scale presents a better predictive capacity for emotional symptoms and quality of life. In the same study, MAAS presented a low predictive capacity in relation to both topics.

Table 2 reveals that quality of life had a significant and lasting improvement in global score and physical and psychological domains, noted as T0 < T1 = T2 ($p \leq .001$). No change was identified in the environment and social relationships domains. In a controlled study using the WHOQOL-BREF, Nyklíček and Kuijpers (2008) reported that quality of life seems less sensitivite to change than measures of psychological distress and positive affect. In another study, Nyklíček, Dijksman, Lenders, Fonteijn, and Koolen (2012) concluded that mindfulness intervenes primarily through the psychological benefits on anxiety and depression as the main ingredient of increased quality of life. A study using the WHOQOL-BREF scale in nursing professionals (nurses, technicians, and nursing auxiliaries) in Brazil revealed a significant increase only in the postintervention physical and psychological domains, which was maintained in the follow-up (dos Santos et al., 2016).

Hölzel et al. (2011b) advocated that meditation regulates attention, body awareness, and emotions, leading to reappraisal, extinction, and reconsolidation, with a change in perspective on the self. In agreement with the observations of that study, the present results point to internal changes of the participants, without variations occurring in the environment in which they lived and worked or in social relationships.

The two initial hypotheses of in this study were supported. Improved pain symptoms, anxiety and depression, global quality of life, and self-compassion were identified, without significant change in the attention scale (MAAS) and in the environment and social relationship of quality of life domains.

The main limiting factors include the design of the present study, which did not include a control group. Other limiting factors are the lack of assessment of the impact of the improvement of the parameters studied on the performance of the professionals in the care of patients and the nonquantitative reevaluation of the use of analgesic and anti-inflammatory drugs after AMP.

In conclusion, AMP was found to be an effective strategy for the management of musculoskeletal pain among nursing technicians working in a hospital setting.

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