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The Effect of Internally versus Externally Focused Balance Training on Mindfulness

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The purpose of this study was to determine how alternative types of instruction provided during a 6-week balance exercise program affect mindfulness. A sample of 63 college students was recruited for the study. Group 1 (N = 33) received a 6-week balance exercise intervention instructed with an internal focus of attention (IFA). Group 2 (N = 30) received the same intervention, but exercises were instructed with an external focus of attention (EFA). Mindfulness was measured at baseline and at 6 weeks using the Freiburg Mindfulness Inventory (FMI). Baseline FMI scores between groups were similar (Group 1: 41.6; Group 2: 41.3), however, the difference in gain scores at six weeks was statistically significantly different (Group 1: 17.5; Group 2: 1.7; z = - 4.74, p = .0000, r = .55). The results suggest that internally focused instruction was more effective at increasing mindfulness than externally focused instruction during a 6-week balance exercise program and might be an alternative to meditation as a means of improving mindfulness.

Keywords: ***mindfulness, balance, focus of attention, Freiburg Mindfulness Inventory***

"I have heard that someone asked Sasaki Joshu Roshi, 'What of Zen practice is necessary to preserve?' He replied 'Posture and the breathing.' I think I might say simply, 'Posture'" (Aitken, 1982, p. 14). Several lines of evidence suggest that there might be a relationship between mindfulness and postural balance. In 1977, Ikegami published research on the effect of Zen meditation on posture. Ikegami designed a circular platform resting at three equidistant scales. By comparing the distribution of weight across the three scales it was possible to locate the center of gravity of someone sitting on the platform. The study found that Zen priests exhibited much greater stability when compared to lay persons; that is, they had smaller fluctuations in their center of gravity (Ikegami, 1977).

Mindfulness is a central teaching of Buddhism and Zen priests practice a form of mindfulness meditation (Hanh, 1975). Mindfulness can be defined as "keeping one's consciousness alive to the present moment" (Hahn, 1975, p. 11) or "clear and single-minded awareness of what actually happens *to* us and *in* us, at the successive moments of perception" (Nyanaponika, 1970, p. 30). Mindfulness can be thought of as a state, a "special mode of perception" (Gunaratana, 2011, p. 27) induced by meditation practice or a trait that individuals carry across situations. Indeed, the goal of meditation practice is to cultivate mindfulness at all times (Hahn, 1975).

A growing of body of evidence suggests that mindfulness may be linked to a number of relevant balance outcomes, including improved attention visual-spatial processing, and reduced fatigue (Zeidan, Johnson, Diamond, David, & Goolkasian, 2010). Balance and postural control require the complex integration of afferent information in the central nervous system received from the somatosensory, visual, and vestibular systems, including mechanoreceptors located in ligaments, joint capsules, and musculotendinous tissues (Horak, Nashner, & Diener, 1990). Under normal conditions, the brain selectively processes sensory information and makes adjustments provided by feedback, resulting in desired coordinated musculoskeletal responses. Balance and postural control are essential for performing activities of daily living and sports activities. Although it is known that corrective responses to errors in balance can depend on one's muscle strength, flexibility, and endurance, complete understanding of the cognitive processes involved in balance is limited and requires further investigation. Some cognitive tasks have been shown to improve balance, while others are thought to interfere with mastering balance tasks (Shumway-Cook, Woollacott, Kerns, & Baldwin, 1997; Swan, Otani, Loubert, Sheffert, & Dunbar, 2004). In addition, *difficult balance tasks* have been shown to interfere with cognitive performance (Andersson, Hagman, Talianzaheh, Svedberg, & Larsen, 2002). Interestingly, a study by Fiori, David, and Aglioti (2014) found that yoga practitioners favor internal, vestibular, and proprioceptive information over exteroceptive information during training. The finding suggests that there may be ties between cognitive-sensory systems that support balance and yoga training.

There is at least one study in the literature that found that mindfulness training improves balance (Kee, Chatzisarantis, Kong, Chow, & Chen, 2012). Our study asks the opposite question: *can balance training affect mindfulness?* There are strategies for inducing mindfulness that do not involve meditation. For example, Kabat-Zinn (1990) developed an exercise that involves mindfully eating single raisins and Kee and colleagues (2012) induced mindfulness by having participants focus on a task that involved running the hand back and forth in a basin of water.

Other movement interventions such as, yoga, tai chi chuan, pilates, and GYROKINESIS® have been shown to increase scores on a mindfulness inventories (Caldwell et al., 2010; Carmody & Baer, 2007). Hanh (2008) created a series of ten exercises called “mindful movements” that were designed to increase mindfulness. Balance is an important component of all these approaches. This study differs, however, in that it focuses on two interventions solely designed to improve balance in a young collegiate population.

Static and dynamic balance requires coordinating motor action with perception and is affected by multiple senses including vision, proprioception, vestibular function and cognitive ability (Shumway-Cook & Woollacott, 1995). The motor learning literature suggests that acquiring motor skills, including balance, may be affected by the type of attentional focus that is received when they are learning and performing motor tasks (Wulf, 2013; Wulf, McConnel, Gartner & Schwarz, 2002; Wulf, Mercer, McNevin & Guadagnoli, 2004; Park, Yi, Shin & Ryu, 2015). It is widely purported that focusing attention on the environment to produce a motor action, known as an *external focus of attention* (EFA), rather the position of the body in space or body movement, known as an *internal focus of attention* (IFA), leads to more effective learning of the task because it facilitates more automatic information processing and less need for conscious control. (Jackson & Holmes, 2011; McNevin, Wulf, & Carlson, 2000; Peh, Jia, & Davids, 2011). The question has been raised, however, that the most beneficial type of attentional focus to use during motor learning may actually depend on the many variables related to the task itself, as well as to aspects related to the learner. Different characteristics of a performed task, such as difficulty of the task, the developmental stage the learner is in, the age of the learner, and method of instruction, training, and methods used to assess outcomes may affect the desired outcome.

For example, Perkins-Ceccato, Passmore, & Lee (2003) found that the benefits of attentional focus actually depend on a person’s skill level. The authors found that novice golfers performed better when they were given internally focused instructions, while expert players performed better with externally focused instructions. In a report that studied frail elderly adults, attentional focus did not have an effect on learning balance skills (de Bruin, 2009). Other authors have argued that external focus of attention instruction may be appropriate when goal-directed movement is desired (i.e., a golf swing or dart throwing) but may be less effective for movements or exercises that do not require a target (Kakebeeke, Knols, & de Bruin, 2013). In this case, the learner’s focus is more on physical form than achieving a goal or end result of movement. The belief that an external focus of attention is a preferred method of motor learning has not been sufficiently substantiated by evidence and transference of the theory to different patient populations, as well as to healthy individuals, may not apply (Kakebeeke et al., 2013). In addition, many studies' results are based on one-time instruction of a task rather than on-going instruction which may focus more on task performance than motor learning and can result in different outcomes.

To our knowledge there is no previous published work that has compared an externally vs. internally focused instruction during a 6-week balance training program and measured mindfulness pre- and post-balance training in a population of young collegiate athletes.

Study

The purpose of this study was to determine how alternative types of instruction provided during 6-week balance exercise program affect mindfulness in a population of young, active, and healthy adults.

Method

A convenience sample of 63 physically active college students, having no history of musculoskeletal injury in the last year and no musculoskeletal surgeries in the last 5 years, was recruited for the study. The study was approved by a University Institutional Review Board and written informed consent to participate in the study was obtained from each subject. Group 1 ($N = 33$, mean age 24.8 ± 3.2, 24 female, 9 male) underwent a balance exercise intervention that consisted of eight progressive static and dynamic balance exercises instructed with an internal focus of attention (IFA). Examples of internal focus of attention cues included "keep your feet balanced and level on the rocker board," and "bend your knees and lower your body into a squat by placing your body weight back on your heels."

Group 2 (N = 30, mean age 24 ± 3.8, 17 female, 13 male) received the same balance exercise intervention, except verbal instruction incorporated the use of an external focus of attention (EFA). Cues for the external focus of attention group consisted of: "keep the markers on the rocker board level," and "touch the back of your shorts/pants to the chair behind you (squat)." Subjects were required to attend the exercise sessions two times a week for 6 weeks and 100% compliance was met in this regard. Six weeks was chosen as the length of time for the intervention because motor learning and coordination during this time is due to neural adaptation rather than changes in muscle strength and endurance, which would be a confounding variable for the balance tasks chosen (Shumway-Cook & Woollacott, 1995). The sessions consisted of eight exercise stations in which the subjects randomly rotated around until they completed all stations. Subjects remained at each station for a 1 ½ minute period for the first 3 weeks and time was increased to 2 minutes per station for the subsequent 3 weeks. In addition, the level of difficulty of each exercise was increased every 2 weeks by adding more weight, moving from double-leg to single-leg support, or increasing time for holding the position on one leg. Each exercise station was monitored by an exercise facilitator who was trained in providing the appropriate type of verbal cueing for both the IFA and EFA groups.

Other than the type of instruction received during the exercise sessions (EFA vs. IFA), the balance programs were delivered in a standardized manner for all participants. The nine exercise facilitators who assisted in providing cues at each exercise station and during each exercise session were trained by the principal investigator (PI) prior to the start of the study so that the facilitators would deliver specific and uniform verbal instructions throughout the entire study. The PI is a physical therapist with over 30 years of clinical and teaching experience. Exercise facilitators additionally received index cards which contained the typewritten instructions for each task that was appropriate for the experimental group being trained to ensure consistency and uniformity of instruction during the 6-week intervention. All study participants were blinded to the study's purpose, the assignment of their experimental group and to any expectations or anticipated outcomes of the study.

The exercises included in the balance training program were specifically chosen to increase postural control (static balance) and dynamic balance by including components of balance such as sensory information, joint range of motion, core strength and lower extremity muscular strength (Palmieri et al., 2002). The two static balance exercises included a Warrior 3 pose (alternating legs), and pelvic bridging with a static hold on a BOSU ball). The dynamic exercises included balancing on a rocker-board, first with both feet, then in a single-leg position, double-leg to single-leg balance on a BOSU ball in kneeling while catching a ball, single-leg hopping in a clockwise and counterclockwise direction, a squat-curtsey dynamic movement, and single-leg abduction/adduction exercise with increasing weights, and a Warrior 3 position with the body repeatedly bobbing from this position to the floor and back.

The assessment of balance pre and post-training consisted of the following outcome measures: the Balance Error Scoring System (BESS test), described by Riemann et al. (1999) and the Y-balance test, a modified version of the Star-Excursion Balance Test (SEBT) described by Plisky et al. (2009). The outcome measures collected during this study provided comparative data with regard to quantitative parameters of balance between the two subject groups and therefore will be published in a separate manuscript.

Freiburg Mindfulness Inventory

Mindfulness was measured using the Freiburg Mindfulness Inventory (FMI; Walach, Buchheld, Buttenmuller, & Schmidt, 2006). The FMI is a 14-item instrument that has demonstrated good psychometric properties in previous research. Items include "I am open to the experience of the present moment" and "I watch my feelings without getting lost in them." Items are rated "rarely," "occasionally," "fairly often," or "almost always." The FMI was chosen because it was easy to administer and has been used in a number of studies to measure the effect of experimental procedures on mindfulness (Zeidan et al., 2011; Zeidan, Martucci, Kraft, Mchaffie, & Coghill, 2013). For example, Bussing et al. (2012), administered the FMI as a pretest, at 3 months, and at 6 months to assess changes in mindfulness as a consequence of participation in a yoga training program.

There has been controversy concerning the factor structure of the FMI (Strohle, 2006). A factor analysis by Kohls, Sauer, and Walach (2009) proposed a reduced two-factor structure with four items loading on a presence factor and four items loading on an acceptance factor. The authors found, however, "that both the one-dimensional and the two-factor solution of the FMI-14 show acceptable, but suboptimal fit indices" (p. 229) and that for most practical purposes, mindfulness, as measured by the FMI, could be treated as a single one-dimensional construct. Based on this conclusion, we chose to employ this approach with the data from our study.

Statistical Analysis

A gain score analysis procedure was used for statistical analysis (Campbell, Stanley, & Gage, 1963; Knapp & Schafer, 2009). For each group, the FMI score at baseline was subtracted from the FMI score at six weeks. The resulting gain scores were then compared using a nonparametric two-tailed Wilcoxon test. A non-parametric approach was used because it relies on fewer assumptions and is more appropriate when working with small sample sizes (Leech & Onwuegbuzie, 2002). The statistical analysis was conducted in R (R Core Team, 2013) and Simstat (Peladeau, 1996).

Results

All administrations of the FMI had acceptable levels of reliability, with alpha levels ranging from .66 to .81. Descriptive statistics are shown in Table 1. Baseline FMI scores between Group 1 (IFA) and Group 2 (EFA) were similar (41.6; 41.3). However, the difference in gain scores at six weeks was statistically significantly different. The average gain for the Group 1 (IFA) was 17.5, while the average gain for Group 2 (EFA) was 1.7 (z = -4.74, *p* = .0000, r = .55). A limitation of this study was the lack of a no-intervention control group, however, given the magnitude and nature of the effect, the results found here, while exploratory, are important.

Discussion

The aim of this study was to determine whether the type of verbal instruction provided during a balance exercise program affects mindfulness in healthy college-aged students. Being mindful is thought to promote an enhanced state of well-being as it describes a quality of consciousness characterized by heightened clarity, and increasing one's awareness to the present moment (Brown & Ryan, 2003). Increased mindfulness is purported to improve function, such as walking speed, visual-spatial processing, intention-behavior relationships (i.e. intention with physical activity), positive emotional states, and may reduce fatigue, stress, and mood disturbances in certain populations (Zeidan et al., 2010; Djikic, Langer, & Stapleton, 2008; Chatzisarantis & Hagger, 2007; Brown & Ryan, 2003). Taking into account the benefits that can be derived from being mindful, it is important to understand the most effective measures that can be used to improve mindfulness.

This study found that in a population of healthy college-age students, balance training administered over a six-week period generally improved mindfulness. Improvement in mindfulness, however, was most evident when subjects were instructed to direct their attention to their body position and movement during training (IFA), rather than focusing on the goal or outcome of the movement (EFA). This finding raises an interesting point as it suggests that IFA training may be superior to EFA training when used to increase mindfulness. Perhaps this finding is not so surprising because IFA training focuses on present moment awareness of the

Table 1. Description of FMI scores for the 2 groups of subjects at baseline and after completion of a 6-week balance exercise program.

Time	Group	Median FMI** Scores	Mean FMI** Scores	SD
Baseline	Internal FOA*	41.0	41.6	4.4
	External FOA*	42.0	41.3	5.8
Six Weeks	Internal FOA*	58.0	59.1	11.3
	External FOA*	42.0	43.0	6.2

*Focus of Attention

**Freiburg Mindfulness Inventory (Walach et al., 2006) body and body movements, which would be more likely to facilitate mindfulness. Extant theorists in the field of motor learning suggest, however, that IFA instruction may not be as beneficial when learning motor skills or to improve movement efficiency. Current theory contends that IFA instruction involves conscious control of one's movement which constrains automatic control processes (Wulf, McNevin, & Shea, 2001), whereas EFA instruction allows the body to regulate relevant body movements automatically by focusing on the effects or outcomes of movement on the environment (Wulf et al., 2002). The findings of this research study support the fact that an external focus of attention strategy may be not as effective an internal focus of attention strategy for improving mindfulness over time because it requires the projection of a future goal and is less concerned with sustaining present moment focus. Our results also suggest that current theory about EFA instruction yielding better outcomes may not always hold true across all populations and conditions, to which more recent evidence has alluded (Kakebeeke et al., 2013). Although it is not known whether our results generalize to populations other than the one currently studied, there is a strong indication that a 6-week balance training program that incorporates IFA instruction is more effective method in improving mindfulness than balance training that uses EFA instruction.

Mehling and colleagues (2011) proposed that the construct *body awareness* might be the common element in such mind-body interventions as yoga, Tai Chi, and mindfulness based therapies. Body awareness is defined "an attentional focus on internal body sensation" (p. 1) and "the core-awareness of sensation from inside the body excluding exteroceptive channels" (p. 2). Other researchers have shown that mindfulness-based stress reduction changes the representation of introceptive attention in the cortex. (Farb, Segal, & Anderson, 2013; Lazar et al., 2005).

Conclusions

The results of this investigation suggest that IFA balance training may be an effective technique for improving mindfulness. Increasing mindfulness via balance training may require more body awareness and conscious control and this may explain why IFA instruction was more effective than EFA instruction. Replication and more research are needed to elucidate the relationship between balance, mindfulness, motor learning, interoception and exteroception, and attentional focus strategies.

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