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Article

Music, ballet, mindfulness, and psychological inflexibility

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Abstract

Both music and dance training can be conceptualised as mindfulness-like practices due to their focus on the present moment. Mindfulness and music are associated with mental health. However, evidence from dance practice, especially among ballet students, shows an association with mental health problems. Psychological inflexibility involves cognitive fusion, which is an excessive involvement with internal events, leading to experiential avoidance. Since studies analysing these concepts are scarce in music and dance practice, we intended to examine their effects in young music and ballet students. This study involved 113 participants (9 to 16 years old), 64.4% girls, 34.5% with musical training, 29.2% with ballet training, and 36.3% with no training. All participants completed the Child and Adolescent Mindfulness Measure (CAMM) and the Avoidance and Fusion Questionnaire for Youth (AFQ-Y). AFQ-Y scores correlated with months of ballet training. Ballet students had greater psychological inflexibility than music students and students without any training. CAMM scores did not correlate with months of any practice, and did not distinguish between groups of practitioners. These data confirm prior findings that practice of ballet can have a potential impact on mental health by showing that young ballet students exhibit greater psychological inflexibility.

Keywords

ballet, cognitive fusion, experiential avoidance, mindfulness, music, psychological inflexibility

Music training during childhood has been associated mainly with cognitive benefits, including improvements in memory (e.g., Chandrasekaran & Kraus, 2010; Forgeard, Winner, Norton, & Schlaug, 2008; Roden, 2012), language (e.g., Brandt, Gebrian, & Slevc, 2012; Forgeard et al., 2008), nonverbal reasoning (Forgeard et al., 2008; Portowitz, Lichtenstein, Egorova, & Brand, 2009), general measures of intelligence performance (e.g., Schellenberg, 2004, 2006), and ~~in~~ attention (e.g., Roden et al., 2014; Tervaniemi et al., 2009).

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Not surprisingly, learning to play an instrument is connected to brain maturation benefits. Playing an instrument requires the interaction between multiple motor and ~~sensory-motor~~ areas of the brain, and music perception, which involves several pathways emerging from the auditory cortex (see Zatorre, Chen, & Penhune, 2007 for a review). So, as has been evidenced by some investigations with children, music training is associated with changes in regions of the frontal and temporal lobes and the parieto-occipital sulcus (Hyde et al., 2009); motor, auditory, somatosensory, and visual–spatial brain regions (Gaser & Schlaug, 2003); and brain networks involved in selective auditory attention (Strait & Kraus, 2011).

A related activity, also involving motor expertise and attention ability is dance (Bläsing et al., 2012). Like music, dance is also connected to some skills non-exclusive to dance. Some studies reported specific effects of dance training on configurational learning (Hüfner et al., 2011), movement related memory (see Sevdalis & Keller, 2011 for a review), and interpersonal memory (Woolhouse, Tidhar, & Cross, 2016). Dance, like other complex sensorimotor activities, results from the integration of body coordination, spatial cognition, rhythm, and synchronisation to external stimuli (Bläsing et al., 2012; Brown, Martinez, & Parsons, 2006; Hänggi, Koeneke, Bezzola, & Jäncke, 2010). Consistent with the complex sensorimotor coordination implicated in dance, brain structures involved in spatial cognition, movement control, and coordination are activated. The increased activity takes place in motor, premotor (frontal, cingulate, basal ganglia, and cerebellum regions), and somatosensory areas (parietal and superior temporal regions; Brown et al., 2006). Moreover, dance practice is connected to changes in cerebellum (Nigmatullina, Hellyer, Nachev, Sharp, & Seemungal, 2015), premotor cortex, supplementary motor area, putamen, internal capsule, and corpus callosum (Hänggi et al., 2010).

From a different perspective, there is another point in common. Music practice (Diaz, 2013; Steinfeld & Brewer, 2015) and dance practice (Pinniger, Brown, Thorsteinsson, & McKinley, 2012) can be conceptualised as ways of achieving mindfulness. As a psychological process, *mindfulness* is a state of mind where every moment is appreciated, and full attention is bestowed (Kabat-Zinn, 1982). In this sense, mindfulness is a regulation process of enhanced attention to the immediate experience and awareness. This awareness is characterised by curiosity, openness, and acceptance of the present moment (Bishop et al., 2004). Mindfulness is also considered to be an intense awareness of an experience with acceptance of painful/unpleasant thoughts and feelings (Hayes, Strosahl, & Wilson, 1999). Mindfulness involves skills such as sustained attention and flexibility of attention (Bishop et al., 2004). Other skills are observation of present-moment experience, awareness of current behaviours, and non-judgment of cognitions, emotions, and body sensations (Baer, Smith, & Allen, 2004; Greco, Baer, & Smith, 2011). Research has increasingly shown that mindfulness is connected with mental health (e.g., Baer et al., 2004; Greco et al., 2011).

The reconceptualisation of music and dance practices as mindfulness practices is strengthened by investigations that show the importance of focusing of attention on the performance of motor skills involved in music (Duke, Cash, & Allen, 2011; Hallam et al., 2012) and dance (Denardi & Corrêa, 2013; van Vugt, 2014). Moreover, prior findings suggest that music and dance are similar to mindfulness, because they require focus on the present moment (Diaz, 2013; Pinniger et al., 2012; Steinfeld & Brewer, 2015). This idea is also reinforced by the fact that mindfulness is related to brain areas (Farb, Segal, & Anderson, 2013; Goldin & Gross, 2010; Marchand, 2014; Taylor et al., 2011) similar to those areas found in music and dance training (Hänggi et al., 2010; Li et al., 2014).

Nonetheless, sometimes being alert to the here and now can be a challenging task when psychological inflexibility takes place, jeopardising access to information from the present moment, biasing the quality of the experience itself. This bias happens because two processes

are interacting, which are *cognitive fusion* and *experiential avoidance* (Bond et al., 2011; Gaudiano, 2009).

Cognitive fusion is a bias of perception of external events due to an inadequate and excessive regulation of behaviour by verbal and cognitive private events (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). In other words, cognitive fusion is an excessive involvement with the content of internal events, instead of being present and noticing the ongoing psychological processes (Greco, Lambert, & Baer, 2008). Therefore, a complete contact with reality is prevented when cognitive fusion occurs. This is due to internal events (e.g., emotions, thoughts, memories) that bias the way the present moment is experienced, leading to the experiential avoidance of that moment (Greco et al., 2008, 2011; Luoma & Hayes, 2003).

Recently, cognitive fusion and experiential avoidance were shown to be significantly associated (Gillanders et al., 2014). Experiential avoidance is a reluctance to experience internal events that are appraised negatively, and involvement in behaviours that temporarily decrease the discomfort raised by those internal events (Luoma & Hayes, 2003). For example, an adolescent may feel nervous about performing in public, thinking "I am going to make mistakes and everybody will notice", and then act to reduce anxiety, such as by avoiding attending public recitals. Children and adolescents who are more cognitively flexible deal with situations one at a time and contextually. These children tend to be more flexible in the attributions they make for events, and less prone to avoid uncomfortable private events (Greco et al., 2008). Recent evidence (Cunha & Santos, 2011; Greco et al., 2011) showed that flexible cognitive styles are related to mindfulness skills in children and adolescents. Both concepts are conceptualised as adaptive regulation reflecting psychological health (Chambers, Gullone, & Allen, 2009; Kashdan & Rottenberg, 2010).

Psychological inflexibility and experiential avoidance have been shown to be associated with increased test anxiety in adolescents (Cunha & Paiva, 2012), and with more social comparison, anxiety, and depressive symptoms ~~also~~ in adolescents (Cunha & Santos, 2011).

When we compare dance and music training regarding mental health, some aspects come to light. Some studies show beneficial effects of music training on self-esteem (Costa-Giomi, 1999, 2004; Harland et al., 2000; **[AQ: 1]** Rickard et al., 2013). In contrast, Portowitz et al. (2009) found no effect of music training on self-esteem with ~~seven to nine year olds~~ who had taken two years of music lessons or no lessons. This inconsistency, nevertheless, could be explained by the durations of music training (Rickard et al., 2013). Lower levels of self-efficacy, in another study, were found among students at higher grades, but they could be explicated by the increased awareness of their phase of development (McCormick & McPherson, 2003). Other investigations have shown connection with emotional processing (Pinheiro, Vasconcelos, Dias, Arrais, & Gonçalves, 2015; Thompson, Schellenberg, & Husain, 2004) and self-regulatory processes (McPherson & Renwick, 2010).

Moreover, participating in music lessons seems to be associated with a faster maturation of brain areas connected to emotion regulation (Hudziak et al., 2014). Decreased levels of aggression have been reported (Choi, Lee, & Lee, 2010; Roden, Zepf, Kreutz, Grube, & Bongard, 2016) along with an improvement in a broad range of socio-emotional dimensions assessed by different questionnaires (Ho, Tsao, Bloch, & Zeltzer, 2011). Music training in itself does not seem to be the source of mental health issues, but having to perform publicly could be associated with higher levels of anxiety (Osborne & Franklin, 2011), especially in situations of solo recitals (Cox & Kenardy, 2002).

Conversely, besides dance therapy (Anderson, Kennedy, DeWitt, Anderson, & Wamboldt, 2014; Couper, 1981), there is limited research showing that dance practice brings mental health benefits in childhood and adolescence. The noteworthy exceptions are a study with

pre-schoolers (Lobo & Winsler, 2006) and another with adolescents (Monteiro, Novaes, Santos, & Fernandes, 2014[AQ: 2]). The potential associations with psychological problems are far better studied than associations with psychological advantages, especially among ballet practitioners. Problems include bulimic behaviours later in adulthood (ballet and other dance students; Ackard, Henderson, & Wonderlich, 2004) and a higher risk of developing eating disorders (ballet students; Neumärker, Bettle, Neumärker, & Bettle, 2000). Other issues described are body-related concerns and perfectionism in dance students (Cumming & Duda, 2012) and among ballet students (Cumming & Duda, 2012; Nordin-Bates & Cumming, 2011; Toro, Guerrero, Sentis, Castro, & Puértolas, 2009; Zoletic & Duraković-Belko, 2009). Self-esteem issues (Bettle, Bettle, Neumärker, & Neumärker, 2001) and psychopathological symptoms (Ravaldi et al., 2006) have also been described in ballet students.

Despite prior findings on connections between mindfulness, music and dance practice, to date little is known about whether psychological flexibility and mindfulness are relevant concepts through which to understand the psychological functioning of ballet and music students. So, we centred the main goal of our study on the evaluation and comparison of mindfulness skills and psychological inflexibility in Portuguese children and adolescents who had musical training, dance training (in this case, ballet), and children and adolescents who did not have any kind of structured musical/ballet training outside of their basic school activities. It was hypothesised that mindfulness skills would be higher among music and ballet practitioners when compared with non-practitioners. Accordingly, cognitive inflexibility should be lower among music and ballet practitioners when compared with non-practitioners. Given associations between ballet practice and mental health problems, it was also hypothesised that ballet dancers would have higher levels of cognitive inflexibility and lower levels of mindfulness than music practitioners.

Method

Design

The present study had a cross-sectional design. Dependent variables were (a) mindfulness and (b) cognitive inflexibility (cognitive fusion and experiential avoidance).

Participants

The total sample consisted of 113 Portuguese children and adolescents, 35.4% boys and 64.6% girls. These young people were aged between 9 and 16 years old (mean age = 11.68, *SD* = 1.92), with a mean of 6.16 years of education (*SD* = 1.66).

The sample was divided into three groups: musical training group (MTG: n = 39; 34.51%; n_{female} = 24; once a week formal training; 28 mean months of training; mean age of beginning of training = 10.36 ± 2.94 years); ballet dancers training group (BTG: n = 33; 29.20%; n_{female} = 32; twice a week training, audition once a year; 46 mean months of ballet dancing training; mean age of beginning of training = 9.40 ± 2.80 years), and group of children/adolescents whose only practical and theoretical contact with music was in public school classes, designated the no-training group (NTG: n = 41; 36.28%; n_{female} = 17). In Portuguese public schools, musical education takes place in fifth and sixth grades with some basic musical concepts as well as basic flute playing. Six of the children included in the ballet group had had some musical training in the past, which they later replaced with ballet practicing.

Consistent with data indicating that young ballet dancers/students are more commonly female (e.g., Hänggi et al., 2010; Neumärker et al., 2000), the BTG was predominantly female.

Measures

Child and Adolescent Mindfulness Measure (CAMM; Greco et al., 2011). In our study, we employed the validated and translated version of CAMM for the Portuguese population (Cunha, Galhardo, & Pinto-Gouveia, 2013). This self-report measure contains a total of ten items in a Likert scale with five answer possibilities, ranging from 0 (*never true*) to 4 (*always true*), which are then reverse scored. The total score varies between 0 and 40 points, in which the higher score corresponds to higher mindfulness skills. The CAMM assesses awareness of the present moment, the non-judgmental attention that is provided to it, and non-avoidance responses to thoughts and feelings towards that moment through questions like "At school, I walk from class to class without noticing what I'm doing", "I push away thoughts that I don't like", or "I stop myself from having feelings that I don't like" (Greco et al., 2011).

In the original version, an adequate internal consistency was demonstrated (Cronbach's $\alpha = 0.81$; Greco et al., 2011). The same was demonstrated in the Portuguese version (Cronbach's $\alpha = 0.80$; Cunha et al., 2013); however, in the present study the internal consistency was weak (Cronbach's $\alpha = 0.63$). Since the alpha coefficient depends on the sample size and on the number of items of a scale (Rouquette & Falissard, 2011), and because our sample was smaller than the samples of Greco et al. (2011) and Cunha et al. (2013), we performed a bootstrap analysis (Yuan, Guarnaccia, & Hayslip, 2003). Based on 2000 bootstrap samples, the bootstrapped 95% confidence interval had a lower limit of 0.73 and an upper limit of 0.89, suggesting that we could use CAMM in our study.

Avoidance and Fusion Questionnaire for Youth (AFQ-Y; Greco et al., 2008). The AFQ-Y is a self-report measure that is composed of 17 items that assess cognitive fusion and experiential avoidance (Greco et al., 2008). In the present study, we used the translated and validated version for the Portuguese population by Cunha and Santos (2011). Responses are scored on a five-point Likert scale, ranging from 0 (*not at all true*) to 4 (*very true*), with the total varying between 0 and 68 points. A higher total score indicates higher psychological inflexibility (higher experiential avoidance and cognitive fusion). The AFQ-Y contains questions like "My thoughts and feelings mess up my life", "I push away thoughts and feelings that I don't like", and "I can't be a good friend when I feel upset". This type of content simplifies its comprehension, making it very accessible even to younger children.

An adequate internal consistency ($\alpha = 0.90$) was achieved in the original version (Greco et al., 2008), as well as in the validated Portuguese version ($\alpha = 0.82$; Cunha & Santos, 2011). The present study obtained an equally consistent value ($\alpha = 0.85$; CI 95% = [0.80; 0.89]).

Procedures

We contacted Portuguese music and ballet schools with similar ballet/music class schedules and learning methods in Marinha Grande, Leiria, and Coimbra (region of Beira Litoral). We also contacted public schools to collect data for music/dance non-practitioners. After the initial contact, most school coordinators answered positively (33% did not answer). As a confidentiality guarantee, we explicitly expressed that the data would only be used for research. We also stated that any doubt would be clarified, anonymity would be protected, and results would be returned after data analysis. After collecting the authorisations for the study, some assessment questionnaires were answered in the classroom context in the presence of the researcher ($n = 47$; 41.60%), others were responded to in students' homes ($n = 66$; 58.40%). Statistical analysis showed that these students did not differ from those assessed in the classroom context on any of the variables under study, and hence they all were included in the study.

Statistical procedure

For data analysis, we used the IBM Statistical Package Social Sciences (22.0 version), for Microsoft Windows 8.1. We computed appropriated descriptive statistics for all sociodemographic variables, examining their differences between the MTG, BTG, and NTG, using univariate analyses of variance (ANOVA) for continuous variables, and chi-square tests for categorical ones.

Student's *t*-tests, Spearman correlations, and appropriated effect sizes (ES) were computed to test the possible influence of contextual and sociodemographic variables on CAMM and AFQ-Y scores regarding the whole sample.

Means and standard deviations of CAMM and AFQ-Y scores were calculated for the three groups, followed by an ANOVA to test for differences between group means. We used Gabriel's post hoc tests for all pairwise comparisons, applying Bonferroni correction, setting *p*-value at a 0.0167 level. Furthermore, we made a univariate analysis of covariance (ANCOVA), with the group as the independent variable, to contrast CAMM and AFQ-Y scores after controlling the potential confounding role of amount of training.

To better understand to true nature of the differences encountered, we proceed to Spearman correlations between months of musical/ballet training and CAMM and AFQ-Y scores.

Results

Sociodemographic and academic variables

We used ANOVA and chi-square analysis to test whether the groups were similar (Table 1). The three groups had significant age differences [$F(110) = 10.45$; $p < 0.001$; $\eta^2 = 0.15$] with the MTG being older. The same occurred with the education level [$F(110) = 12.99$; $p < 0.001$; $\eta^2 = 0.19$], with the MTG having a higher educational level. Finally, the chi-square test revealed that there was an association between sex and the group type [$\chi^2(1, n = 113) = 24.88$; $p < 0.001$; $\varphi = 0.47$], with the BTG having more girls.

Amount of training, regardless the type of training (musical or ballet), was significantly different [$t(70) = 2.92$; $p < 0.01$; Cohen's $d = 0.68$], with BTG having had more training months ($M \pm SD = 45.97 \pm 30.43$) than MTG ($M \pm SD = 28.00 \pm 21.55$).

Influence of the contextual and sociodemographic variables on CAMM and AFQ-Y

Completing the questionnaires at school or at home had a trivial influence on CAMM scores [$t(111) = 0.85$; $p = 0.395$; $d = 0.17$] and AFQ-Y scores [$t(111) = 0.71$; $p = 0.480$; $d = 0.14$].

Because the sample was convenient and the groups were dissimilar, we analysed whether sociodemographic variables had an influence on our dependent variables (Table 1). Age and educational level were not correlated with either CAMM or AFQ-Y. Boys had slightly worse scores on CAMM ($p = 0.056$) and AFQ-Y ($p = 0.680$), but the differences were not significant, and the effect size was small for CAMM (Cohen's $d = 0.36$) and trivial for AFQ-Y (Cohen's $d = 0.08$).

Comparison of CAMM and AFQ-Y between groups

As can be observed in Table 1, analysis of variance showed no significant differences for the CAMM scores between the groups [$F(110) = 0.41$; $p = 0.67$; $\eta^2 = 0.01$].

The ANOVA revealed a significant group effect on the AFQ-Y scores [$F(110) = 3.14$; $p = 0.047$; $\eta^2 = 0.05$]. Although Gabriel's post hoc test revealed that there were no significant

Table 1. Means, *SD*s, *r*-values, *t*-values, and *F*-values for CAMM and AFQ-Y regarding demographic variables and music/ballet training groups or no-training group.

	CAMM				AFQ-Y			
	r		*ES r*		*r*		*ES r*	
Age (years)	−0.02		0.04%		−0.17		2.9%	
Education level (years)	−0.03		0%		−0.15		2.3%	
	M	*SD*	*t*/*F*	*d*/η²	*M*	*SD*	*t*/*F*	*d*/η²
Boys (*n* = 40)	22.68	4.42	1.93	0.36	35.15	10.67	0.41	0.08
Girls (*n* = 73)	24.59	6.00			36.14	12.87		
MTG (*n* = 39)	24.56	5.70	0.41	0.01	33.67	11.03	3.14*	0.05
BTG (*n* = 33)	23.58	6.02			40.17	14.27		
NTG (*n* = 41)	23.56	5.07			34.32	10.45		

Note. *SD* = standard deviation; *r* = Pearson correlation; *ES r* = effect size for correlation; *t* = Student's *t*-test; *F* = ANOVA; *p* = significance level; *d* = Cohen's *d* effect size; η² = Eta square effect size; *M* = mean; CAMM = Child and Adolescent Mindfulness Measure; AFQ-Y = Avoidance and Fusion Questionnaire for Youth; MTG = musical training group; BTG = ballet training group; NTG = no-training group.
*$p < 0.05$.

differences in pairwise comparisons ($p > 0.0167$), the effect sizes were moderate in the BTG–MTG (Cohen's $d = 0.51$) and BTG–NTG comparisons (Cohen's $d = 0.47$).

Because the amount of training time between groups was dissimilar, we investigated whether MTG and BTG differences on AFQ-Y remained after controlling for the amount of training time. Therefore, we conducted an ANCOVA with the group as the independent variable, AFQ-Y scores as the dependent variable, and training months as co-variable. Preconditions for conducting ANCOVA were tested (normality, linearity, and homogeneity of regression slopes) and were met in both groups. The ANCOVA was significant [$F(1,69) = 5.47$; $p < 0.05$]; pairwise post hoc tests revealed that the findings were consistent with earlier analyses in which the BTG scored statistically significantly higher than MTG ($p < 0.05$).

Associations between dependent variables and training time

We observed no significant Spearman correlations between either musical ($r_s = -0.08$; $p = 0.355$) or ballet training ($r_s = 0.04$; $p = 0.678$) and CAMM scores.

Regarding the AFQ-Y results, there was no correlation with musical training months ($r_s = -0.05$; $p = 0.335$), but there was a weak, positive correlation with ballet training months ($r_s = 0.28$; $p = 0.003$; *ES r* = 7.8%).

An additional association was also noted: there was a positive and strong correlation between AFQ-Y and CAMM ($r_s = 0.64$; $p < 0.001$; *ES* = 41.0%).

Conclusion

Discussion

To our knowledge, this is the first study to compare adaptive regulatory psychological processes between young students of music and ballet, and non-practitioners. Brain imaging and behavioural evidence led us to conjecture that mindfulness should be different when comparing

musicians and dancers with non-practitioners. Because those with higher mindfulness skills have lower psychological inflexibility, we also supposed that musicians, dancers, and non-dancers/non-musicians should be different in this adaptive regulation process. Finally, mental health evidence led us to predict that young ballet students would have higher levels of cognitive fusion than music students.

The results of this study only support the last prediction. Ballet students were found to have moderately higher levels of psychological inflexibility (cognitive fusion and experiential avoidance) than music students and non-music/ballet practitioners. These results are not explained by the amount of training. Additionally, more months of ballet training are associated with higher levels of psychological inflexibility.

Since this is the first study analysing this construct among ballet students, caution in interpreting these findings is necessary, and replication in other samples is needed to generalise these results. Nevertheless, given the connection between psychological inflexibility and psychopathology (Cunha & Santos, 2011; Venta, Sharp, & Hart, 2012), ~~that~~ finding is consistent with other research linking ballet with psychopathological symptoms (Ravaldi et al., 2006). Also, because of the association between experiential avoidance and maladaptive perfectionism (Santanello & Gardner, 2007), our finding is consistent with existing literature connecting ballet with perfectionism (Cumming & Duda, 2012; Nordin-Bates & Cumming, 2011; Toro et al., 2009; Zoletic & Duraković-Belko, 2009). Nevertheless, the lack of longitudinal studies does not allow one to ascertain whether perfectionism is a personality trait that developed during ballet training or before it (Zoletic & Duraković-Belko, 2009).

The levels of psychological inflexibility could be explained by some characteristics of ballet training. Similar to many sports, ballet involves discipline and physical demands, competitiveness, highly critical and perfectionist attitudes of trainers, and acceptance of emotional and physical suffering (Mainwaring & Krasnow, 2001; McEwen & Young, 2011; Pickard, 2012; Tajet-Foxell & Rose, 1995; Thomas & Tarr, 2009). Moreover, the discipline, perfectionism, and physical excellence of ballet are connected to feelings of pressure to maintain a low body weight (Abraham, 1996; Goodwin, Arcelus, Marshall, Wicks, & Meyer, 2013; Thomas, Keel, & Heatherton, 2011; Toro et al., 2009) and to a higher risk of developing an eating disorder (Abraham, 1996; Ackard et al., 2004; Arcelus, Witcomb, & Mitchell, 2013; Neumärker et al., 2000; Thomas, Keel, & Heatherton, 2005, 2011; Zoletic & Duraković-Belko, 2009). Other associated issues reported were body image distortion or dissatisfaction (Haas, Garcia, & Bertoletti, 2010; Mainwaring & Krasnow, 2001; Nordin-Bates & Cumming, 2011; Pickard, 2012; Zoletic & Durakovic-Belko, 2009), and self-esteem problems (Bettle et al., 2001).

Despite ballet students having higher psychological inflexibility, it is a somewhat surprising finding that they do not have accordingly lower levels of mindfulness skills, since those variables are correlated (Cunha & Santos, 2011; Greco et al., 2011). As we mentioned above, there were no differences in mindfulness skills between ballet students and non-practitioners. Additionally, there was no relationship between mindfulness and ballet practice. These results were not expected due to the way dance is connected to music (Christensen, Gaigg, Gomila, Oke, & Calvo-Merino, 2014), and focused attention (Denardi & Corrêa, 2013). Maybe, the focus on the present moment (Diaz, 2013; Pinniger et al., 2012; Steinfeld & Brewer, 2015) and attention ability (Bläsing et al., 2012; Denardi & Corrêa, 2013) required by ballet explain that finding.

Music students had similar levels of psychological inflexibility as non-music/ballet participants, and amount of musical training did not correlate with psychological inflexibility. Adding to this, despite the relation of mindfulness skills to psychological flexibility, none of the students distinguished themselves in these skills. Knowing that music training affects

brain morphology (Li et al., 2014), and that mindfulness is related to the same brain regions (Farb et al., 2013; Goldin & Gross, 2010; Marchand, 2014; Taylor et al., 2011) led us to expect a different result. Another reason we expected a different result is due to studies showing that music training is associated with emotion regulation (Hudziak et al., 2014), and focused attention (Duke et al., 2011; Hallam et al., 2012). The lack of distinction between groups in mindfulness skills and the non-association between mindfulness and amount of musical training may reflect few years of training. This interpretation derives from the previously demonstrated association between age/years of playing with cortical thickness in various brain regions (Hudziak et al., 2014). Another possible explanation is related to the age at the beginning of formal musical training. Hyde et al. (2009) showed that structural brain changes occur after only 15 months of musical training in early childhood; however, our participants began later on. These reasons could also be invoked for the lack of distinction between ballet students and non-practitioners mentioned above, since our participants had few years of ballet training and started at young teens.

Although the analysis of the influence of the sociodemographic variables on mindfulness skills and psychological inflexibility was not the focus of this study, it is worth noting. Given previous literature (Cunha et al., 2013; Cunha & Santos, 2011; de Bruin, Zijlstra, & Bögels, 2013; Greco et al., 2008, 2011), it is not a surprising set of findings that psychological inflexibility and mindfulness skills are independent of sociodemographic variables. There were exceptions, with de Bruin et al. (2013) verifying higher mindfulness skills in boys compared to girls, and Venta et al. (2012) finding lower psychological inflexibility in boys. However, the lack of association of these variables with sex may be a result of the imbalance of the sample size within the groups due to the unavoidable feature of the sampling context, especially concerning the ballet group.

Limitations

The current study faces some potential limitations that should be addressed. First, this study is performed on a convenience sample, having a potential for self-selection bias of participants. Therefore, generalisation of the results is not advisable until other studies support the main finding.

Another limitation concerns one of our instruments, CAMM, which manifested a questionable internal consistency. However, bootstrap analysis showed that the consistency was probably representative of a small sample for a small number of items. Nevertheless, the positive and strong correlation between CAMM and AFQ-Y gives strength to the use of that instrument in this population. In addition, the study made use of only two measures of psychological functioning. Thus, in view of previous investigations, future research should include psychopathological measures along with measures of mindfulness and psychological inflexibility. Given the review of literature on ballet, other measures could address competitiveness, critical and perfectionist attitudes of trainers, perfectionism, feelings of pressure to maintain a low body weight, body image, and eating behaviours.

Study design could also be considered an issue, since our study was cross-sectional. Care is therefore required in the extrapolation of our findings to developmental processes. Nonetheless, the potential importance of early psychological inflexibility in the development of later psychopathology suggests that future investigation should analyse this adaptive regulation process longitudinally in ballet students.

Another potential limitation is related to generalisability of some results. We found no differences between girls and boys in psychological inflexibility and mindfulness skills, but caution is

required since the number of boys in our study was limited. Although it is common to find gender imbalance among young ballet students, future studies in larger, balanced samples could test for the presence of possible differences.

Despite these limitations, to our knowledge, this is the first study to date investigating psychological (in)flexibility and mindfulness skills in music and ballet students.

Concluding remarks

In summary, this study showed that ballet students present greater psychological inflexibility, with a potential impact on mental health. This investigation on the role of psychological (in) flexibility is a new area of study with ballet students, with a particular interest to teachers/trainers. Teachers and trainers should consider the need to instruct using different cognitive and behavioural techniques for students in order for them to cope in a more adaptive manner in their struggle for high objectives.

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