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Effects of bali yoga program for athletes (BYP-A) on psychological state related to performance of circus artists

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Abstract

Yoga and the practice of mindfulness have gained popularity as performance psychology interventions, by promoting a relaxed state of focus, increasing body flexibility, and improving awareness during performances. Like professional athletes, circus performers invest a great deal of time, resources, and mental and physical energy in their performances. The present pilot project focuses on the effect of the Bali Yoga Program, adapted for athletes (BYP-A), on the general psychological state, quality of life, performance anxiety, and perceived athletic performance of circus artists studying at the National Circus School in Montreal. Over 8 weeks, student circus artists (n= 18) attended 90-min yoga session. Results showed that following the intervention, participants reported decreased depressive and somatic symptoms, decreased cognitive and somatic performance anxiety and enhanced coping abilities (relaxation, mental distractions). BYP-A has initially shown to provide benefits for circus artists, such as factors related to improved psychological health and mental state related to performance. Future avenues for research should explore yoga intervention more thoroughly and pursue to investigate the differences existing between circus arts and other performance fields.

Keywords: yoga, performance anxiety, quality of life, coping, circus arts, performance

Introduction

Circus performers invest a great deal of time, resources, mental strength, and physical energy in their performances. This clientele must develop multiple skills (dance, music, theater) going beyond the mastery of an athletic discipline. More precisely, they must train the technique of their chosen discipline while perfecting their live stage presence to constantly adapt their expertise to new environments (e.g., various show conditions). There are essential foundations to understanding stage performance psychology, such as balancing the attention required for skill execution, managing the pressure of delivering an outstanding performance, while being sensitive and closely connected with the audience (Filho, Aubertin & Petiot, 2016; Ménard & Hallé, 2014) [22, 57]. These high-level demands can lead to significant psychological health issues such as overtraining, exhaustion, injuries, eating disorders, and performance anxiety. Van Rens & Heritage (2021) [75] found that professional performing artists reported significantly higher rates of mental health disorders and undesirable emotional states than the general population, as well as precarious and low rewards in the work domain, such as remuneration, job security and opportunities for career progression (Donohue *et al.*, 2018; Van Rens *et al.*, 2021; Willis *et al.*, 2019) [17, 75]. Therefore, a major challenge experienced by this population is to maintain a balance between stress and recovery (Kellmann, 2010) [46].

While performance psychology interventions have been shown to contribute greatly to elite athletes' well-being, optimal psychological states, and performances (Mellalieu & Handon, 2015) [56], there is a paucity of literature emphasizing the effect of yoga practice on the psychological health and performance of circus artists and additional rigorous research is needed to further explore the prospective benefits of these interventions. Given the importance of developing mental strategies and techniques to help circus artists maintain and enhance their psychological well-being, the current study explored the impact of regular yoga practice on circus student-artists' psychological states (Filho, Aubertin & Petiot 2016; Tremblay, 2018) [22, 74].

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Mindfulness and Yoga Intervention

Mindfulness is defined as paying attention to the present moment and encouraging individuals to tolerate and change their relationship to internal states (e.g., anxiety), in a nonjudgmental manner (Kabat-Zinn, 1994) [43]. In the last decades, Mindfulness-based interventions have grown in popularity in the athletic domain because of their promising impacts on athletes' psychological states (Anderson, Ferreira, & Ferretti, 2010; Gardner & Moore, 2012) [3, 29]. Kabat-Zinn (1990) [42] suggests that the practice of hatha yoga is one of the most influential to connect to the body through mindful consciousness, by encouraging the acceptance of the body's physical boundaries and psychological state. Yoga practice, a discipline consisting of several possible features and components (e.g., physical postures, breathing exercises, meditation), is intended to enhance and balance the main aspects of health: physical, mental, emotional, and spiritual. Kabat-Zinn noticed that individuals often try to exceed their limits in training, fighting to push further. Contrarily, yoga practice promotes remaining aware of the body's limits, by observing and respecting them in the present moment (Grilli Cadieux, Gemme, & Dupuis, 2021) [33]. By accepting their physical limits, athletes may prevent the distress that typically comes with relentless striving to surpass oneself. Because circus disciplines stretch circus artists' capacity to remain focused on the "here and now" while being highly physically demanding, the practice of yoga appears to be a relevant form of mindfulness practice to ignite wellbeing in this specific population.

Psychological Benefits of Mindfulness and Yoga Intervention

Practicing yoga has revealed multiple benefits on psychological wellbeing. For instance, it has been shown to enhanced mood, alleviate anxiety (Cramer *et al.*, 2018) [15], and reduce perceived stress (Wang & Szabo, 2020) [76]. While anxiety is defined as a natural human reaction to stress described by sensations of tension, apprehensive thoughts and physical changes, that is activated whenever a person perceives a danger or threat (APA, 2021) [1], performance anxiety refers to a propensity to consider performing circumstances as threatening and to react to these situations with specific negative emotions (e.g. feelings of apprehension and tension), associated primarily and directly with performance (Martens, Vealey, & Burton, 1990; Fletcher & Hanton, 2003) [55, 23]. The literature concerned with yoga highlights its benefit in lowering perceived stress, which might indicate an improved capability to manage negative events and explains its association with anxiety reduction (Goodman, Kashdan, Mallard, & Schumann, 2014) [32].

Increased quality of life is another reported benefit of yoga practice (Harner, Hanlon & Garfinkel, 2010; Büsing, Michalsen, Khalsa, Telles, & Sherman, 2012) [40, 14]. Described as people's perceptions of their life position in relation to the culture and value systems in which they live and in relation to their objectives, expectations, norms, and concerns (WHOQOL, 1998) [78], quality of life showed signs of improvement following the practice of yoga, on various health-related outcome measures (e.g., HRV, blood glucose, blood lipids, salivary cortisol, and oxidative stress) in both healthy and ill populations (Ross & Thomas, 2010) [65]. In the athletic domain, through acceptance, athletes learn to listen to their body and mind, and thereby prevent the distress that may result from strenuous efforts (Tierney, 2020) [73].

To circumvent the negative impacts of anxiety and increase

quality of life, the development of coping strategies is key. According to Lazarus & Folkman (1984) [53], coping strategies allow individuals to devote in behavioral and cognitive efforts and direct them to handle particular external and internal demands. Among the numerous coping skills, the capacity to relax and recognize distracting thoughts could be developed through yoga. One component of yoga is conscious relaxation (yoga nidra, savasana), which consists of reestablishing contact with various body parts, cultivating moment-to-moment awareness, accepting physical sensations, and letting go of disruptive thoughts (Kaufman, Glass, & Pineau, 2019; Polsgrove, Haus, & Lockyer, 2019) [31, 61]. These aspects of yoga appear to be efficacious strategies to enhance awareness of the leading stressors that should be managed, and reject less powerful and significant stressors, thereby enabling athletes to better cope with stress (Marinov, Gencheva, Angelcheva, Ignatov, & Dimitrov, 2017; White, Bethell, Charnock, Leckey, & Penpraze, 2021) [54, 77].

Finally, the practice of yoga also impacted positively on performance indicators in various populations. Namely, research has shown that such practice can allow dancers to enhance mind-body awareness, improve their movement abilities, decrease their pain, and learn to tolerate sensations that emerge during trainings. Similarly, yoga also resulted in enhanced athletic performance, through enhancement in flow disposition dimensions such as increased concentration and greater sense of control (Briegel-Jones, Knowles, Eubank, Giannoulatos, & Elliot, 2013) [11]. Yoga was also shown to increase flexibility and agility (Bal & Kaur, 2009) [7], strengthen stability and control (Hart & Tracy, 2008) [41], cardiorespiratory ability, and well-being (Harinath *et al.*, 2004) [39]. Hence, such a practice could facilitate goal attainment for artists.

In light of these findings and yoga's rising recognition as a complementary mental performance intervention, the aim of the present study was to test the effect of yoga practice on anxiety, depression, quality of life, coping, and goal achievement among circus artists, a group for which the effect of yoga has never been studied before. Specifically, given its ecological validity within the motor domain, we focused on Bali Yoga Program for Athletes.

Bali Yoga Program for Athletes

The Bali Yoga Program for Athletes (BYP-A) is a standardized yoga intervention based on Madan Bali's method (Bali, 2015) [8]. Bali is a notorious yoga instructor who has been teaching for almost 60 years now (Blackman, 1973; Thompson, 2012; Gyulai, 2014) [10, 71, 38]. The BYB-A intervention consists of idiosyncratic characteristics, including psychoeducational matter on the psychophysiological features of athletic performance (e.g., reduction of performance anxiety, increasing concentration and mindfulness). Furthermore, through frequent relaxation periods between each posture, this method allows the body to develop its capacity to regulate and rejuvenate. More specifically, the BYP is adapted to athletes/artists needs (Filho *et al.*, 2016; Anestin, Dupuis, Lanctôt, & Bali, 2017; Tremblay, 2018) [22, 4, 74] and designed to provide them with an efficient support program, that can be easily integrated into their training plan and particular reality.

The Present Study

In addition to examining the impacts of an 8-week yoga intervention (BYP-A) on the psychological state (anxiety, performance anxiety, depression, somatic symptoms, quality

of life, mindfulness, and coping skills) as well as the perceived performance of circus artists, the present pilot project explored the *feasibility* of such an intervention in an elite circus school context. It was expected that: (a) the BYP-A program for circus artists was feasible, (b) student-artists who participated in the study reported an improved psychological state (reduced anxiety, depression and somatic symptoms, increased quality of life), an enhanced mental performance state (reduced performance anxiety, increased mindfulness, and coping skills) and an improved perceived athletic performance following the intervention.

Method

Study Design

Led in an ecologically valid setting, this study evaluated variations from longitudinal pre- to post intervention through investigating responses of 18 subjects of the group analysis.

Participants

Participants were 18 adult student artists (9 females, 9 males; M age =19, SD =1.77 of the National Circus School (NCS) in Montréal (Canada). Specialized in various circus disciplines such as acrobatics ($n=7$), dual acts ($n=6$), aerials acts ($n=5$), juggling ($n=3$), and balancing ($n=3$), student artists were predominantly Caucasian ($n=14$). They had a high school ($n=15$) or college ($n=3$) education, and originated from Quebec ($n=6$), other Canadian provinces ($n=2$), or other countries ($n=10$). Eligibility criteria for participation were as follows: 18 years and older, registered at NCS, able to understand French or English, not regularly practicing yoga, and not taking part in any psychotherapy.

Measures

Sociodemographic Questionnaire. This questionnaire assesses basis characteristics (sex, age, ethnicity) and background information (place of origin, housing status, level of education, previous athletic discipline and experience, actual circus specialty) of participants.

Feasibility Measures

Satisfaction Questionnaire: This retrospective questionnaire evaluates the participants' adherence to the yoga program. It focuses on participants' satisfaction and experience, by assessing which aspects of the intervention were found useful, were appreciated or disliked, and how much participants would recommend it to other circus artists. Each item is rated on a 5-point Likert scale ranging from 1 (not at all) to 5 (extremely).

Logbook

This questionnaire assesses the participants' adherence to individual home yoga practice. Subjects reported how many times per day or per week they had practiced yoga (frequency), at what time of the day (morning, afternoon, and evening) and how long it has lasted (duration).

Measures of Effects

Patient Health Questionnaire-Somatic/Anxiety/Depression: (PHQ-SAD; Kroenke, Spitzer, Williams, & Löwe, 2010) [49]. Based on the DSM-IV, this questionnaire is a short screening instrument, developed to detect mental disorders in the primary care settings (Löwe *et al.*, 2004) [53]. Extensively used to evaluate the presence and severity of depressive, anxious, or somatic symptoms, the PHQ-SAD incorporates three scales: the Patient Health Questionnaire-9

(PHQ-9); the Generalized Anxiety Disorder-7 (GAD-7), and the Patient Health Questionnaire-15 Somatic Symptoms (PHQ-15). This questionnaire has been reported to have adequate psychometric properties (Spitzer, Kroenke, Williams, & Löwe, 2006) [70].

Quality of Life Systemic Inventory

(QLSI; Dupuis, Perrault, Lambany, Kennedy, & David, 1989). The QLSI is a self-reported questionnaire which includes 28 items (life domains) divided in 8 dimensions: physical health, emotional and cognitive function, social and family environment, spirituality, hobbies, domestic work. Building on Van Rens *et al.* recommendations (2021) [75], an additional section covering five items intended to capture specific characteristics of student-artists, that were not comprised in the initial questionnaire items, was included: (a) learning efficacy, (b) application of instructions, (c) kindness toward the body, (d) retention of instructions, and (e) ease of movement. For each domain, this scale evaluates the gap existing between one's actual situation and personal objectives. Using a Visual Analogue Scale indicator, this gap is measured by the importance of each life domain and the movement either towards or away from the goals. Then, a Likert scale ranging from 1 (essential to my life) to 7 (completely useless) is used to rate the importance of each item. QLSI has demonstrated strong global consistency ($\alpha = 0.87$). Subscales are relatively independent with no correlations exceeding 0.53. The test-retest reliability is 0.86 ($p < .001$) for the English version and 0.88 for the French version (Dupuis, Taillefer, Martel, Rivard Roberge, & St-Jean, 2004) [19].

Competitive State Anxiety Inventory-2

(CSAI-2; Martens *et al.*, 1990) [55]. The CSAI-2 is used to assess the level of anxiety of student-artists after receiving the intervention. The CSAI-2 contains 16 self-reported items measuring three aspects of the state of anxiety (i.e., cognitive anxiety, somatic anxiety, and self-confidence), including scales for direction, frequency, and intensity of each symptom. The intensity was rated on a 4-point Likert scale from 1 (not at all) to 4 (very much so), the direction was scored on a 7-point scale ranging from -3 to +3, and the frequency was rated from 1 (not at all) to 7 (all the time). Martens *et al.* (1990) [55] reported Cronbach alpha reliability coefficients of 0.81 for cognitive anxiety, 0.82 for somatic anxiety, and 0.88 for self-confidence.

Five Facet Mindfulness Questionnaire-Short Form:

(FFMQ-SF; Bohlmeijer Ten Klooster, Fledderus, Veehof, & Baer, 2011) [12]. The FFMQ-SF measures 24 items, which are split among five subscales of mindfulness: observing the present moment, describing thoughts and feelings, acting with awareness, non-judging of thoughts and feelings, and non-reactivity to inner experience. Items (e.g., "I can easily put my beliefs, opinions and expectations into words") are rated on a 5-point Likert scale ranging from 1 (never or rarely true) to 5 (very often or always true), with higher scores representing higher levels of mindfulness. The FFMQ-SF has shown acceptable model fit, strong correlations to the original FFMQ and good reliability, displaying Cronbach alpha's ranging from 0.75 to 0.87 (Bohlmeijer *et al.*, 2011; Baer *et al.*, 2006) [12, 5].

Coping Inventory for Competitive Sport

(CICS; Gaudreau & Blondin, 2002) [27]. The CICS consists of

39 items examining 10 coping strategies that are divided in three second-order dimensions: (a) task-orientated coping (thought control, mental imagery, relaxation, effort expenditure, logical analysis, and seeking support), (b) distraction-orientated coping (distancing and mental distraction), and (c) disengagement-orientated coping (disengagement/resignation and venting of unpleasant emotions). Subjects rate their coping capacities on a scale ranging from 1 (does not correspond at all) to 5 (corresponds very strongly). This instrument has demonstrated satisfactory reliability, Cronbach's index ranging between 0.67 and 0.87 (Gaudreau *et al.*, 2002) [27].

Attainment of Sport Achievement Goals Scale

(A-SAGS; Gaudreau, Amiot, Blondin, & Blanchard, 2002, [27] as cited in Gaudreau & Blondin, 2004) [28]. This questionnaire measures 12 items describing one of the three dimensions of goal achievement: (a) mastery, (b) self-improvement, and (c) performance. Student artists respond to the different statements according to their performance during the last month of training, on a scale ranging from 1 (does not correspond at all) to 7 (corresponds completely). The A-SAGS has been reported to have good psychometric properties, with composite reliability (Time 1 = 0.90, Time 2 = 0.93) and acceptable validity (Gaudreau & Antl, 2008; Gaudreau *et al.*, 2004) [26, 28].

Procedure

Participants were recruited in coordination with the school's College Program Direction. Prior to the yoga intervention, researchers met with the student artists to introduce them to the program and address any concerns. All students gave written informed consent to voluntarily participate in the research. Student-artists were explicitly advised that all data would be kept confidential and that they could disengage from the investigation at any time. Flowchart of participants at each phase of the study is available in supplemental materials. This research was accepted by the Institutional Ethics Committee for Student Research Project.

One week before the BYP-A, participants were asked to complete questionnaires (sociodemographic and effect measures), through an online survey. Questionnaires required approximately 45 minutes to complete. Subsequently, student artists participated in a weekly 90 min yoga session for 8 weeks. All sessions were carried out in a training studio at the NCS. They were administered by a certified yoga teacher and senior circus artist, and by the first author who led the psychoeducational content, who both received an 8-week training for the BYP-A intervention. A standardized guidebook of the program was provided, with detailed session instructions and description of the topics developed by Dr. Bali and two psychologists.

The BYP-A combines Hatha yoga components: postures, relaxation between postures, breathing techniques, meditation, and visualization. Each session of the BYP-A intervention was conducted as follows: introduction to psychoeducational theme (15 min), sequence of yoga poses and relaxation with breathing exercises (55 min), guided meditation related to the session's theme (10 min), OM chant and final relaxation (10 min). The eight psychoeducational themes were presented in the following order: (a) importance and benefits of yoga, (b) definition and causes of stress and performance anxiety, (c) power of a concentrated and positive mind, (d) self-regulation process, (e) benefits of breathing and relaxation, (f) open consciousness, (g) acceptance, kindness, and self-compassion

philosophy, and (h) importance of daily yoga practice.

During the session, the instructors explored the physiological and psychological aspects of the postures and highlighted the relevance of being attentive to physical sensations. Between each posture, a brief relaxation (breathing and visualization) sequence was executed. Throughout the program, poses were added gradually. By the sixth session, 21 poses were being performed (see supplemental materials). A variety of alternative poses were also suggested to accommodate participants' specific conditions. During sessions, a yoga mattress and supportive blocks were provided to circus artists. Between each yoga sessions, participants were given the recommendation to practice at home using a cue-card with all posture figures and completing the online logbook. For a thorough explanation of the yoga program (postures, psychoeducational themes, etc.) administered in the project, please contact the first author.

In the following week of the yoga program, participants completed the different questionnaires (measure of effect) a second time. The Satisfaction Questionnaire was also completed at the end of the yoga intervention to better understand students-artists' experience.

Data Analysis

To analyze research data, the statistical software Jeffreys's Amazing Statistics Program (JASP) v. 0.13.1 was used. Histograms were inspected to observe distribution aspects of the continuous variables. Normality distribution was examined by asymmetry, kurtosis coefficients, and Shapiro-Wilk test. Absolute and relative frequencies were calculated for categorical variables (e.g., demographic data). Central tendencies (mean) and variability (standard deviation, minimum, and maximum) were also analyzed. To compare participants who completed all questionnaires and the ones who didn't complete parts or all post intervention questionnaires, we conducted ANOVAs on both time measures. To examine the influence of the yoga intervention on the different variables, Wilcoxon' tests were conducted on participant's questionnaires scores ($p < .10$) over the two time points. Given the small sample size and some variables not normally distributed, we choose Wilcoxon test and conducted effect-size estimates using Matched-pairs rank-biserial correlation (Kerby, 2014) [47]. It is interpreted as the proportion of responses in the hypothesis direction minus the proportion of responses against the hypothesis. This coefficient varies from -1 to 1, like Pearson's r .

Considering Winer (1962) [80], Rowell (1989) [66], as well as Rosnow & Rosenthal (1989) [63] reflections on the importance of pondering the cost of alpha and beta errors in choosing alpha level and considering that risks in our study are minor, we decided to use an alpha threshold of 0.1 instead of 0.05, with a Type II error of 0.2 and giving twice as much importance to Type I error than to Type II error. Initially, statistical power was calculated using Gpower for three-time measure (i.e., pretest, posttest, follow-up), with a sample size of 17 subjects, an effect size of $f=.25$ and a time correlation of 0.6, the statistical power reaches 80% at an alpha threshold of 0.1. However, due to the covid-19 pandemic and it's impacts on the circus artists school program, the follow-up wasn't completed by enough participants and couldn't be included in the analysis. Therefore, with the pre-post sample size of 15 subjects, the sensitivity of the study allows to detect an effect size of $d=0.6$ (equivalent to $r=0.33$), with a power of 80% at an alpha threshold of 0.1. In addition, considering our small sample size, results will be described in terms of effect size

(i.e., small, medium, and large) and not only using the p value. It was decided not to use imputation methods for missing data, because of the small sample size, the non-normal distribution of several variables, and the exploratory nature of this pilot project. Nonetheless, results should be interpreted with this consideration.

Results

Feasibility

The feasibility data is presented in Tables 1. The average program adherence is of 93.75%. Three of eighteen participants who completed the program missed one yoga session and two missed three yoga sessions out of the 8-week intervention phase.

Regarding individual yoga practice at home, participants practiced yoga individually on average nearly once a week ($M= 0.92$, $SD=0.28$) for 48 minutes. 52% of home yoga was practiced in the afternoon, 22% in the evening, 20% in the morning and 6% at noon.

As per the subjective perception of the intervention based on the satisfaction and questionnaire, the sense of usefulness related to the various components of the yoga intervention is globally high ($M \geq 2.86$). It should be noted that the guided relaxation is the component considered to be the most useful. Yet, the results show a moderate recommendation rate. Therefore, this BYP-A seems quite feasible both in terms of content and adherence.

Table 1: Program Adherence and Subjective Perception of Participants

Adherence indexes	<i>M</i>	<i>SD</i>
Number of class sessions	7.5	0.96
Number of home sessions	7.36	2.26
Number of AM sessions	2.1	1.45
Number of noon sessions	1	0
Number of PM sessions	4.5	2.061
Number of evening sessions	2.55	1.95
Program Components Evaluation		
Explications of session's theme	3.2	0.85
Guided Relaxation	3.6	1.14
Postures and breathing techniques	3.2	1.22
Guided meditation	2.87	1.63
In class yoga practice	3.2	1.38
Individual home yoga practice	2.53	1.3
Recommendation		
Percentage	57	26.38

Effects on Psychological and Performance Variables

Table 2 presents the detailed statistics results. Following the intervention, participants reported enhanced psychological health, with significant reduction in depression symptoms and somatization symptoms, with large effect sizes. A slight decrease in anxiety symptoms was observed, however not significant, and with a small effect size. Regarding QoL, there was no significant changes from pre to post-tests measures.

As per the performance psychology variables, participants reported significantly less cognitive and somatic performance anxiety levels following the intervention. No statistically significant differences were found for the confidence component. Similarly, no statistically significant differences in the 5 components of mindfulness (i.e., observation, acting

with awareness, non-reaction, description, and non-judgement) were observed. However, medium effect sizes were observed on the non-reaction and non-judgement components. Regarding the coping skills, circus artists reported significant enhancements from pre to post testing on two items: (a) a greater use of relaxation with a near large effect size and (b) a reduction in mental distraction with a medium effect size. No significant differences in the other aspects of coping were observed. However, there are three medium effect size on mental imagery, venting of unpleasant emotions and logistic analysis, as well as two small effect size on thought control and seeking support. Finally, the analysis of the perceived athletic performance revealed no significant statistical improvement. However, the effect size was small.

Table 2: Mean scale scores before and after the intervention

Variable	Scale	Pre <i>M</i> (<i>SD</i>)	Post <i>M</i> (<i>SD</i>)	W(p)	ES Wi	95 % CI	
						LL	UL
Anxiety	GAD7	6.67 (7.09)	5.2 (3.3)	67.5 (0.69)	0.125	-2.500	4.000
Depression	PHQ9	9.87 (5.66)	7.47 (3.56)	90.5(0.09)	0.508***	-4.222	5.000
Somatization	PHQ15	11.6 (8.11)	8.87 (5.54)	79 (0.02)	0.736***	1.000	5.500
Quality of Life	QLSI	6 (2.94)	6.24 (3.42)	19 (0.95)	0.056	-0.618	0.682
Performance Anxiety	CSAI-2						
Cognitive		24.53 (7.62)	21.33(7.47)	86.5 (0.03)	0.648**	4.853e -5	6.000
Somatic		23.13 (5.82)	20 (6.26)	3 (0.099)	0.527***	-0.500	7.000
Confidence		25.6 (7.26)	25.33 (8.7)	34.5 (0.93)	0.045	-2.000	4.000
Mindfulness	FFMQ						
Observation		13.87 (3.25)	13.93 (3.47)	22.5 (1)	0.000	-3.000	4.000
Acting with awareness		17.33 (3.22)	17.6 (2.47)	46.5 (0.73)	-0.114	-4.000	2.500
Non-reaction		14.33 (3.52)	15.47 (4.22)	26.5 (0.35)	-0.321**	-4.000	1.500
Description		17.87 (3.31)	17.13 (3.94)	58.5 (0.38)	0.286	-0.500	2.500
Non-judgement		15.13 (4.12)	16.53 (3.98)	22.5 (0.20)	-0.423**	-4.000	1.000
Coping skills	CICS						
Mental imagery		3.88 (0.7)	3.63 (0.94)	60.5 (0.30)	0.330**	-0.250	0.625
Thought control		3.45 (0.96)	3.38 (0.86)	41.5 (0.47)	0.258*	-0.750	0.750
Relaxation		3.27 (1.07)	2.82 (1.02)	67.5 (0.13)	0.484**	-0.125	1.125
Distanciation		2.58 (0.71)	2.67 (1.05)	45.5 (0.68)	-0.133	-0.585	0.415
Venting of unpleasant emotions		2.23 (1.14)	1.98 (1.12)	59 (0.36)	0.297**	-0.250	1.000
Effort expenditure		4.05 (0.56)	4.04 (0.6)	36 (0.82)	0.091	-0.665	0.505
Seeking support		3.2 (1.01)	2.97 (0.98)	55 (0.53)	0.209*	-0.500	1.000
Disengagement/resignation		2.18 (1.18)	1.98 (0.72)	52 (0.67)	0.143	-0.500	0.625
Mental distraction		2.05 (0.74)	2.88 (0.74)	52 (0.18)	0.429**	-0.125	1.000
Logical analysis		3.2 (0.79)	2.18 (1.18)	65 (0.39)	-0.303**	-0.750	0.250
Athletic performance	A-SAGS	3.97 (1.18)	4.06 (1.16)	23 (0.65)	-0.205*	-0.154	-0.648

M= Mean; SD= standard deviation; W(p)= Wilcoxon p value; ES Wi= Wilcoxon Effect size

Note. For the Wilcoxon test, effect size is given by the matched rank biserial correlation.

*small ES (.15); ** medium ES (.30); *** large ES (.50).

Discussion

The aim of the present study was to explore the effects of the BYP-A on student circus artists’ psychological health, mental state related to performance and athletic performance as well as the feasibility of implementing such a program in a circus school environment. As expected, artists that received BYP-A experienced increased psychological health, with enhanced general mental health. The yoga practice was also positively associated with artists’ psychological state related to performance, with decreased performance anxiety, increased mindfulness, and improved coping skills. These results are discussed thoughtfully next.

The findings of the current study support that implementing a yoga intervention once a week in an elite circus school is feasible. Indeed, the average percentage of frequency adherence throughout the intervention is 92%, which is much higher than the one from Ribeiro, Atchley, & Oken (2018) [62] who considered 76% as strong adherence. Specifically, the satisfaction rates of the different program components emphasize positive and promising viability of this intervention. The guided relaxation is the aspect considered to be the most useful which has been shown by previous studies to allow a healthy stress-recovery balance, especially regarding enhanced general well-being, reduced somatic symptoms, and improved ability to cope with pain (Filho *et al.*, 2016; Willmarth, Davis, & Fitzgerald, 2014) [22]. In

addition, we obtained fairly high average of home practice duration. This tends to suggest that, for some individuals, the practice of yoga can be motivated by sincere pleasure and joyful effort, and therefore by faith in the practice (Guillaume, Béliisle, Jean & Dupuis, 2021; Gyatso, 2010, 2014) [35, 36, 37]. Despite these encouraging results, only 57% of participant reported they would suggest the yoga program to other circus artists. This low percentage might be explained by the fact that student circus artists often have an intensive training and academic program (Kellmann, 2002; Decker, Aubertin, & Kriellaars, 2019) [46, 22]. Thus, this highlights the need to make certain adjustments to circus artists’ schedule, which may benefit from integrating complementary psychological interventions.

The first hypothesis that artists receiving the BYP-A would experience increased psychological health was partially supported. Data analysis demonstrated significant reduction in depressive and somatic symptoms after the yoga-based intervention, indicating its effectiveness as a treatment intervention. These outcomes agree with other research that investigated the impacts of yoga and mindfulness-based interventions on athletes’ psychological health (Aherne, Moran, & Lonsdale, 2011; Bernier, Thienot, Codron, & Fournier, 2009; Thompson, Kaufman, De Petrillo, Glass, & Arnkoff, 2011; Schober, 2018) [2, 6, 72, 68]. Given that student circus artists report significantly greater levels of depression,

fatigue, and isolation than professional circus artists and the general population (Donohue *et al.*, 2018; Van Rens *et al.*, 2021) ^[17, 75], learning to balance stress and recovery through yoga thus appears to be relevant. As per anxiety symptoms, no significant change was observed. It is possible that yoga practice increased these artists' awareness of anxiety. Indeed, the meditation component of yoga involves awareness of present-moment experience, including unpleasant sensations and emotions. This could explain the absence of perceived anxiety reduction in the short term. Nevertheless, by enhancing awareness of uncomfortable feelings like anxiety, without avoiding or trying to suppress them, artists might improve their ability to manage their emotions both within and outside the context of performance (Glass, Spears, Perskaudas, & Kaufman, 2019) ^[31].

Likewise, the effect of yoga practice on student artists' quality of life was not found significant. Different studies have observed enhanced levels of quality of life after yoga in patients with cancer (Lanctôt, Dupuis, Marcaurell, Anestin, & Bali, 2016) ^[52], chronic pain (Patil *et al.*, 2018) ^[59], hypertension (Parikh, Mahida, Vaghela, & Shah, 2021) ^[60], ADHD (Girard-Bériault, 2019) ^[30], anxiety (Kirkwood, Rampes, Tuffrey, Richardson, & Pilkington, 2005; Cramer *et al.* 2018) ^[48, 15], and healthy adults (Büssing *et al.*, 2012) ^[14]. Mindfulness in sport settings has also been shown to have significant positive effects on athlete's global wellbeing and life satisfaction (Baltzell & Summers, 2018; Foster, 2017) ^[9, 24]. Although few studies have reported that yoga can be beneficial for improving athletes' wellbeing (Singh, 2014) ^[69], the current study does not provide sufficient evidence to support the relationship between this type of intervention and quality of life.

As expected, the current study observed reduced level of cognitive and somatic performance anxiety after the yoga-based intervention. These findings are in line with previous research underlining the effects of contemplative techniques on sport anxiety of various athletes (Bühlmayer, Birrer, Röthlin, Faude, & Donath, 2017; Kaufman *et al.*, 2019) ^[13, 31]. For instance, Kusuma and Bin (2017) ^[51] found that yoga treatment reduces cognitive and somatic anxiety of badminton athletes. It has also been observed that yoga is just as effective or more effective than psychological exercises at enhancing distinctive facets of an athlete's mental health, especially with regard to perceived stress and anxiety reduction (Goodman *et al.*, 2014) ^[32]. Because circus artists must deal with the added stress associated with live performance and continuous evaluation (Filho *et al.* 2016, Ménard *et al.*, 2014) ^[22, 57], the results of the current investigation support the integration of yoga practice as a way to reduce cognitive and somatic anxiety related to performance.

While yoga and mindfulness are often associated, the impact of yoga on mindfulness skills are ambiguous. While some results revealed a positive impact (Briegel-Jones *et al.* 2013) ^[11], other authors suggest that self-consciousness developed through yoga practice is not acquired immediately, but may progress properly with the passage of time (Ferreira-Vorkapic & Rangé, 2014; Ferreira-Vorkapic, Feitoza, Dantas, & Bastos, 2017) ^[21, 20]. These results' discrepancies might be explained by the use of inadequate psychometric tools. In the current study, the assessment of mindfulness relies on self-reports (FFMQ). According to Grossman and Van Dam (2011) ^[34], the initial Buddhist concept of mindfulness encompasses a distinctive composition of various interacting factors, that the current methodological approaches often neglect to consider, which may lead to wrong or distorted representations of

mindfulness. Moreover, broadly contrasting working definitions of mindfulness are found in the literature and the absence of external standards to validate measures emphasize this relevant issue.

With regard to coping skills, results suggests that on completion of the yoga intervention student artists reported enhancements in their capacity to relax and to manage mental distractions. While it has been demonstrated that regular yoga practice improves the ability to react efficiently in stressful situations, to concentrate on the problem, and actively cope in the general population (Marinov *et al.*, 2017) ^[54], to our knowledge, this is the first time that enhanced coping strategies are observed in performers following a yoga intervention. In the athletic domain, relaxation skills have been shown to help athletes manage competitive anxiety and encourage recovery. Specifically, while physical relaxation tools (e.g., muscle relaxation) are beneficial to cope with competitive anxiety, mental relaxation strategies (e.g., meditation) are helpful to deal with general anxiety (Kudlackova, Eccles, & Dieffenbach, 2013) ^[50]. Therefore, yoga practice and its multifarious components (e.g., breathing, asanas, meditation) may provide performers with a tool that allows them to choose which aspects of the program they want to integrate in their training routine, according to their current needs.

Despite the positive impact of BYP-A on psychological states and skills, the intervention did not impact subjective athletic performance of circus artists. This contradicts Glass *et al.* (2019) ^[31] randomized controlled trial, who found that Mindful Sport Performance Enhancement training program (including mindful yoga) improve collegiate athletes' self-rated sport performance with regards to physical skills (e.g., agility, mechanics). Performance being a complex and multidimensional phenomenon, many elements must be aligned to enhance it. It is thus challenging to pinpoint the reason why the current intervention failed to benefits circus artist performance without adopting a complex system perspective (Woods, McKeown, Rothwell, Araújo, Robertson, & Davids, 2020; Rudd, Pesce, Strafford, & Davids, 2020) ^[81, 67]. More research aiming at enhancing performance should adopt this type of perspective to better capture the mechanism of performance optimization.

Strengths and Limitations

This research has several qualities. This is the first investigation that empirically studied the impacts of yoga practice on mental health and performance showing promising psychological benefits for circus arts students. The program was adapted to correspond to the circus training environment and specific needs of performers. For example, given that student athletes are often faced with overscheduling concerns, the yoga intervention can be easily integrated within training and performance time, and lastingly incorporated over their training lifespan. It was given by a certified teacher, who is also a circus artist that studied at the NCS, and thus understands the issues, reality and stressors related to circus arts training. Moreover, the 8-week yoga program is a standardized intervention that can be easily adapted and used in high level sport and performance contexts. Finally, thanks to the participation of high-performance circus student artists bringing great ecological validity, the design of this pilot study offers a significant contribution to the developing literature in this field.

Despite promising results, this study presents limitations. First, the small sample size, combined with nonattendance to

yoga sessions due to unexpected events (e.g., injury) and missing data, might have limited the power in testing the hypothesis, lowered generalizability and contributed to the nonsignificant findings. In addition, this study utilized a convenience sample which might have reduced the representativeness of our results. Due to the feasibility and exploratory phase of the BYP-A intervention, this study was conducted using a nonrandomized control design. Since no control comparison group was used to compensate for confounding variables, reliability might not have been ensured. Especially, a historic event (Covid-19 pandemic) occurred at the same time as our post-test, which might have impacted the results. At the onset of the pandemic, NCS closed for an indefinite period, as did the entire circus industry, making this field even more precarious. Consequently, student-artists faced great amount of worry and uncertainty related to their future career potentially leading to changes in psychological health, performance anxiety and performance. This situation might explain the high dropout rates for the follow-up phase of this investigation. Furthermore, the study design did not control for general factors related to the BYP-A other than the passage of time, such as, social desirability, therapeutic expectations, changes in lifestyle of the artists, injuries, and diet, which might have impacted the results.

Implications for Future Research

Future research is necessary to address the lack of studies investigating the influence of yoga-based interventions with athletic populations (e.g., sport, circus, dance settings). Precisely, randomized controlled trials should be conducted in forthcoming investigation to allow stronger reliability regarding outcome effects between active groups. Comparing BYP-A with different psychological skills training programs (e.g., mindfulness-based, relaxation) could also be relevant. These high-quality research designs would help to identify specific mechanisms through which yoga contributes to enhance psychological health or performance related mental state. Future research would also benefit from developing interventions for circus performers who experience difficulties such as reduced psychological wellbeing and emotional state (e.g., high level of anxiety, choking-susceptible, less coping skills). Indeed, previous studies reported that circus artists with low self-efficacy (e.g., fear, self-doubt) would benefit from using interventions that allow them to mentally prepare, visualize their performance, and subsequently receive the protection needed to succeed and reach higher level of flourishing (Ménard *et al.*, 2014; Mesagno & Marchant, 2013; Van Rens *et al.*, 2021) [57, 58, 75]. Finally, research suggests that mental skills training and techniques can be used for discipline-specific performance issues, with unique idiosyncratic performance stressors. For example, aerial acts artists tend to struggle with fear of injury, jugglers with fear of failure, contortionists with pain control, and clowns with social pressure from the audience (Filho *et al.*, 2016; Ross & Shapiro, 2017) [22, 64]. Thus, subsequent studies would contribute to examine the effect of yoga practice with specific circus disciplines according to their related issues.

Conclusion

In summary, this exploratory study offers preliminary support for the feasibility and utility of the BYP-A, with promising impacts on psychological health and mental performance state of circus student artists. The continued study of yoga-based

interventions with high level performers will considerably deepen our actual understanding of psychological health and coping skills in performing arts populations and our capacity to support them in improving their current performance. The collaboration between a clinical psychology student and a yoga practitioner led to a holistic intervention, allowing knowledge building and experiential learning. Researchers and practitioners may benefit from using this type of transdisciplinary approach in the future to better support and optimize human psychological health and performance. On behalf of the co-authors, the corresponding author declares that there is no conflict of interest.

Data availability statement

The data that support the findings of this research are openly accessible in “Figshare” at <http://doi.org/10.6084/m9.figshare.17057819.v1>.

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