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*Article*

# Online Yoga Instruction Improves Resilience in Athletes during the Covid -19 Pandemic

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**Abstract:** The mental and emotional health of an athlete is crucial for their performance and well-being. Sports-related stress can significantly impair that mental health. Yoga of Immortals (YOI) is a unique combination of specific yogic postures, breathing exercises, sound therapy & meditation, which has demonstrated benefit in improving measures of mental health. This study used the Sports Mind Inventory (SMI) to examine whether YOI can improve the resilience of athletes to sports-related stress. Participants were a diverse set of athletes based in Mauritius who routinely engage in a wide range of athletic activities. Participants were randomly assigned to receive four weeks of YOI or no intervention. Both groups completed the SMI questionarie at baseline and again after four weeks. The YOI intervention significantly increased the total mean SMI scores by 14%, indicating improved sports resilience and psychological health. No improvement was observed in the control group. This study demonstrates that YOI is a promising intervention in improving sports related stress.

**Keywords:** Yoga of Immortals (YOI); atheltic performance; Dewan Sport Inventory; Sports resilience

## 1. Introduction

Peak athletic performance depends not simply on physical health, but also on mental and emotional health. Athletic training, whether at the level of a professional or at the level of an amateur juggling multiple responsibilities, inevitably involves a considerable amount of stress. This stress is often more acute for female athletes [1]. Changes to the sporting world wrought by the COVID-19 pandemic, such as cancelled events, loss of compensation, and a change or unavailability in trainers, have exacerbated the stress athletes face [2, 3]. In extreme cases, sustained stress can lead to sleep disruption [4-6] or even precipitate an eating disorder, eroding an athlete's performance and general health [7].

Resilience, the ability to withstand or recover quickly from stress [8], is requisite for successful athletic performance. Highly resiliant athletes better manage stress and even recover more effectively from injury [9]. Female athletes, in particular, may achieve better athletic performance and overall quality of life by improving resilience [3]. A survey developed by Connor and Davidson has become standard for measuring adult resilience [7-9]. The Sports Climate Questionnaire has been used to measure the resilience of semi-professional athletes, consisting of 15 questions to measure athletes' perception about support from their coach [10]. Another study used Richardson's resilience model, which consists of two factors: Homeostatic and Resilient Reintegration [11]. Measures for adolescent resilience have also been developed [12]. However, no tool exists to measure sports resilience, sports mental performance, and general life skills.

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A growing literature on yoga and mindfulness shows that these techniques can improve athletes' performance [13,14]. One meta-analytical review of mindfulness practices in athletes practicing precision sports - shooting and dart throwing - found that mindfulness improves mental skills and performance [14]. Another study showed that yoga could improve the physical fitness, speed, and accuracy of cricketers [13]. Additionally, medatitative practices substantially improve the ability to focus attention [15][18]. Such focus is critical to athletic performace, as concentration improves movement efficiency [19], and inadequate attention can be a predictor of injury [16][20]. Finally, yogic and medatitive practices improve forms of stress that athletes face outside the sporting world, such as social anxiety [17][21], which impacts ~15% of elite athletes [18][22].

Recently, Yoga of Immortals (YOI) app-based interventions were reported to reduce clinical depression and anxiety [19], insomnia [20], and urinary incontinence [21]. YOI is a unique combination of mindful physical, mental, and breathwork exercises designed to improve overall well-being. The practices of YOI can be traced back to ancient yoga traditions, and now the benefits of YOI on the general population are known. However, the effect of YOI on athletes is not explored yet. Therefore, this study evaluates the effectiveness of YOI on athletes, explicitly focusing on sports-related mental health, including resiliance [22][23][3]. To address these questions, we here evaluated the effect of YOI on sports resilience. We used the Sports Mind Inventory (SMI), a new tool to measure sports resilience and sports-related psychological health, to track changes in sports resilience after four weeks in athletes that completed a YOI training vs. those that did not. We found that YOI significantly improved SMI scores, particularly in subscores related to resilience, confidence, and positive mindset. YOI app-based training is therefore a promising intervention to improve resilience to stress in athletes.

## 2. Materials and Methods

### 2.1. Study design and participants

The study was conducted on athletes based in Mauritius from mid-October 2021 to mid-November 2021. An email containing demographics questionnaires and the Sports Mind Inventory (SMI) was sent to prospective participants. Participants who agreed on the consent form and completed the baseline questionaries on time were selected for this study. Participants were randomly assigned into the control and YOI group, and YOI app access was provided to each study participant in the study group. The participants' demographics are shown in **Table 1**. After four weeks, SMI scores were reassessed.

**Table 1.** Demographics of athletes included in this study

| Category | Control Group (N = 14) | YOI Group (N = 26) |
|---|---|---|
| *Gender* | | |
| Female | 8 | 13 |
| Male | 6 | 13 |
| *Age* | | |
| <18-25 | 5 | 10 |
| 26-36 | 2 | 7 |
| 37-47 | 2 | 6 |
| 48-58 | 3 | 1 |
| 59-69 | 2 | 2 |
| *Ethnicity/Race* | | |
| American Indian or Alaska Native | 0 | 1 |
| Asian | 7 | 6 |
| Black or African American | 0 | 3 |
| Native Hawaiian or Other Pacific Islander | 0 | 1 |
| Other | 1 | 13 |
| White | 6 | 2 |

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### 2.2. Study approval

The study was approved by the Institutional Review Board, University of Cincinnati, Cincinnati, Ohio, United States of America (IRB approval number, 2020-0494).

### 2.3. Assessment scales

The SMI is a 24-item self-report survey encompassing multiple domains, including the resilience concept, provided by N. Dewan. The first six questions address both cognitive and emotional responses to adverse situations in sports, such as losing. Both positive and negative response styles are included in this section to mitigate response set bias. The next nine questions address well-established attitudinal, cognitive, and mental skills related to sports performance. The next seven questions capture psychological constructs like social relatedness, positive and flexible thinking style, self-reliance, and higher purpose, that correlate with resilience in day-to-day life. The last two questions attempt to capture the self-perception of the athlete in terms of their sense of physical capacity and skill mastery. The instrument is available as a "coach's version" or a "parents' version" to determine agreement amongst respondents. Responses were recorded on 5-point Likert-type scale, where '1' stands for 'strongly diagree', '2' for 'disagree', '3' for 'neither', '4' for 'agree', and '5' for 'strongly agree'. SMI scoring was regular for most of the questions, excluding questions 1, 2, 5, and 6, which were reverse-scored.

### 2.4. YOI intervention

The app-based YOI program has been described previously [23-25]. The central components consist of breathwork, whole body movements, and postures. In this study, a variant of the YOI program was specifically designed for athletes to provide clear instruction to participants via live streamingk.

### 2.5. Statistical analysis

The data was analyzed with *Microsoft Excel* and *GraphPad Prism 9*. The descriptive statistics are shown as mean (± standard error of mean) and the percentage difference (δ). Wilcoxon matched-pairs signed-rank test was used for both control and YOI groups. The YOI group was expected to get reduced SMI scores, while the control group could have higher or lower scores. Therefore, for the YOI group one-tailed test was applied, and for the control group, a two-tailed test was applied. Percentage changes obtained from matched participants were analysed using an unpaired Mann-Whitney test with 95% confidence interval and one-tailed calculation.

## 3. Results and discussions

The study population encompassed athletes involved in the following activities: badminton, boxing, Brazilian ju jitsu, equestrian sports, football, golf, judo, karate, kun khmer, muay thai, running race, horseback riding, trekking, dancing, gymnastics, and swimming. Some of the participants also reported more than two sports. All participants were from Mauritius with mixed ethnicity and ages (**Table 1**).

After four weeks of YOI, total SMI scores significantly increased in the YOI group ($p = 0.0018$) while scores remained unchanged or non-significantly declined in the control group. (**Table 2 and Figure 1**). The improved score after YOI demonstrates that this intervention improves resilience in athletes, and that the SMI can be used to measure this effect. In the YOI group, scores were significantly higher at week four compared to baseline for the following SMI domains: sports resilience, positive sports mindset, positive & resilient mindset, and sports self-confidence (**Figure 1**). The total mean difference in SMI scores was also significantly higher for YOI compared to the control group ($p = 0.0048$). The mean differences were also significant for the sports resilience ($p = 0.0080$) and positive sports mindset ($p = 0.0103$) domains, while trends were observed in social relatedness ($p = 0.0507$) and positive & resilient mindset ($p = 0.0587$; **Table 2 and Figure 1**). The total mean difference in SMI scores was 14.15 ± 5.45% higher after YOI practices for four weeks, while a -2.24 ± 2.63% reduction was observed in the control group.

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Yoga and related modalities are ancient practices whose mental health benefits have been intuitively understood for millenia. Modern medical science has subsequently demonstrated multiple psychological and health benefits from such practices [ex., 23-25]. However, proper instruction, in a studio from a licensed teacher at a set time, is not feasible in all situations. Self-instruction is possible, but often minimally effective [26]. YOI serves as a scalable instruction tool that can be accessed widely. YOI protocols in this study were explicitly tuned for athletes and directly taught by YOI founders and/or YOI teachers via live video streaming. Four weeks of YOI practice increased SMI scores by ~14%.

A limitation of the study is that it was performed in a single country with a small number of athletes (n=40). Moreover, the YOI effect on the athletes' sports performance was not measured in this study, so whether improvements in SMI scores translate to improvements in athletic performance could not be assessed.

**Table 2.** Mean SMI scores, p-values, and mean difference from baseline for matched participants of the control group (N = 14) and YOI group (N = 26) at week-0 and week-4. Wilcoxon matched-pairs signed-rank test was used to compare week-0, and week-4 mean SMI scores using 95% confidence interval. Unpaired Mann Whitney test compared control vs. YOI mean difference using 95% confidence interval.

| | Mean SMI scores | | | | | | Mean difference from baseline | | |
|---|---|---|---|---|---|---|---|---|---|
| Sports Domain | Week 0 (Control) | Week 4 (Control) | p-value | Week 0 (Pre-YOI) | Week 4 (Post-YOI) | p-value | δ-Control (%) | δ-YOI (%) | p-value |
| Sports resilience | 20.07 ± 1.22 | 20.07 ± 0.97 | 0.828 | 20.23 ± 0.76 | 23.04 ± 0.87 | 0.001 | 1.21 ± 2.26 | 16.19 ± 4.58 | 0.008 |
| Positive sports mindset | 36.43 ± 1.33 | 35.29 ± 1.48 | 0.394 | 34 ± 1.45 | 37.85 ± 1.38 | 0.012 | -2.82 ± 2.68 | 17.72 ± 8.58 | 0.010 |
| Purpose in life | 4.50 ± 0.20 | 4.43 ± 0.20 | >0.999 | 4.12 ± 0.24 | 4.35 ± 0.20 | 0.188 | -0.71 ± 3.66 | 27.18 ± 17.88 | 0.171 |
| Social relatedness | 8.43 ± 0.44 | 7.93 ± 0.68 | 0.684 | 7.50 ± 0.36 | 8.12 ± 0.36 | 0.071 | -5.77 ± 7.79 | 12.65 ± 6.34 | 0.051 |
| Positive & resilient mindset | 16.50 ± 0.80 | 16.00 ± 0.87 | 0.713 | 15.04 ± 0.62 | 16.46 ± 0.60 | 0.043 | -2.03 ± 4.44 | 14.00 ± 6.54 | 0.059 |
| Sports Self confidence | 7.10 ± 0.45 | 6.93 ± 0.66 | >0.999 | 7.077 ± 0.33 | 7.89 ± 0.32 | 0.033 | -2.24 ± 7.86 | 18.41 ± 8.62 | 0.149 |
| Total score for all domains | 93.00 ± 3.83 | 90.64 ± 4.15 | 0.581 | 87.96 ± 3.07 | 97.69 ± 3.20 | 0.002 | -2.24 ± 2.63 | 14.15 ± 5.45 | 0.005 |

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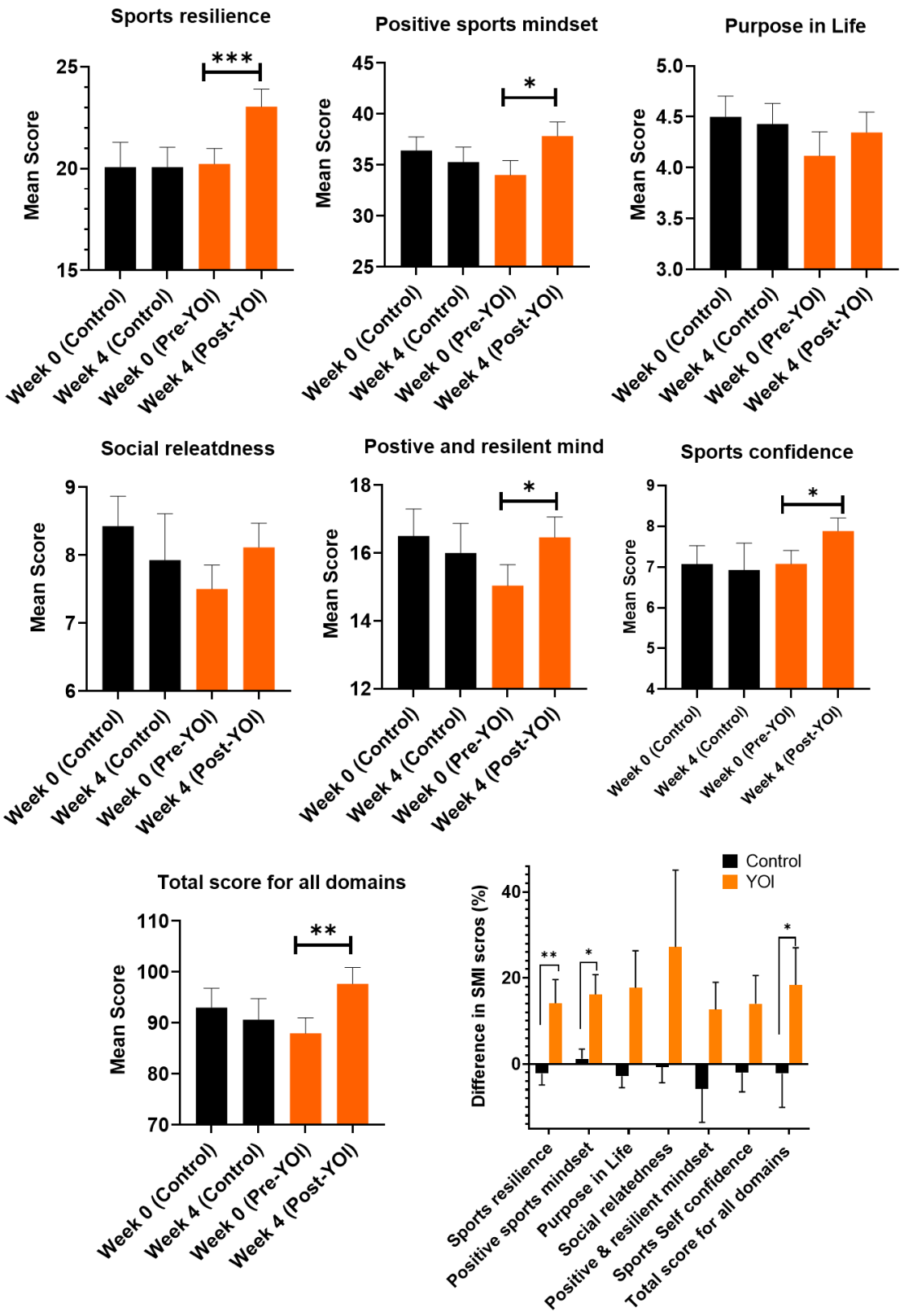


**Figure 1.** SMI score showing the effect of YOI on athlete sports-related mental health for the control group (N = 14) and the YOI group (N = 26) at week 0 and week 4. Wilcoxon matched-pairs signed-rank test was used to compare week 0 and week 4 SMI scores with 95% confidence interval. The bottom right shows difference (%) in SMI score at week 4 from baseline among control and YOI group. Unpaired Mann Whitney test compared control vs YOI with 95% confidence interval. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

## 5. Conclusions

This study is the first report showing the effect of YOI on athletes' sports-related mental health. Based on the SMI score, it was confirmed that YOI positively impacts athletes' mental and emotional health. The present data indicates that YOI is a promising intervention to improve resilience to sports-related stress in athletes.

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**Data Availability Statement:** The data presented in this study are available on request from the corresponding author. The data are not publicly available due to Ethical Concerns.

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**Supplementary Materials:** Sports Mind Inventory

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