



## Original Article

## Yoga and mental health among Brazilian practitioners during COVID-19: An internet-based cross-sectional survey

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## ABSTRACT

This study aimed to describe yoga practice and verify its association with depression, anxiety, and stress during the COVID-19 pandemic among Brazilian practitioners. A cross-sectional anonymous online survey was conducted in all regions of Brazil using a snowball sampling strategy among yoga practitioners. A total of 860 participants (87% female, aged: 19–82 years) completed the survey. Sociodemographic data, lifestyle factors, yoga practice during the pandemic, and the Depression Anxiety and Stress Scale (DASS-21) scores were collected between July 9 and July 15, 2021. Overall, 9.5%, 9.3%, and 5.6% of participants exhibited some traits (mild to severe) of depression, anxiety, and stress, respectively. Hatha yoga (48%) was the most commonly practiced yoga style. In the adjusted analysis, a higher yoga experience (> 5 years) was associated with better anxiety (odds ratio; bootstrap 95% confidence interval: 2.42; 1.32, 4.49) and stress status (1.80; 1.06, 3.00) than beginners (< 1 year). Practitioners who reported higher time and days of yoga practice during the study period were more likely to show normal levels of depression (odds ratio: 2.56–6.49;  $p < 0.05$ ), anxiety (odds ratio: 3.68–8.84;  $p < 0.05$ ), and stress (odds ratio: 2.15–5.21;  $p < 0.05$ ). Moreover, the maintenance of practice frequency during the pandemic was associated with higher odds of normal levels of depression (2.27; 1.39–3.79), anxiety (1.97; 1.25–3.10), and stress (1.97; 1.32–2.96). In conclusion, our findings indicated that a higher level of yoga practice was associated with better mental health levels during the COVID-19 pandemic.

## Introduction

The severe respiratory syndrome (coronavirus disease 19, COVID-19) caused by a newly discovered coronavirus strain has spread worldwide and is posing a severe threat to global public health.<sup>1</sup> Owing to the COVID-19 pandemic, individual actions (e.g., wash hands and use facial masks) and community-level restrictions (e.g., quarantine and temporary partial or complete lockdown) have been enforced to control the spread of the virus infection rate<sup>2–4</sup>; however, the stringent level of these measures and the timeliness of implementation by governments affected the mental health of the population.<sup>5</sup>

Furthermore, excessive exposure to social media/news, contradictory health information, physical symptoms similar to COVID-19 infection, lack of confidence in doctors, previous psychiatric disorders, unemployment, and student status, among others, were factors that considerably increased the levels of anxiety, depression, and stress.<sup>6–9</sup>

During the pandemic, the increase in the prevalence of mental disorders was accompanied by other public health problems, such as obesity

and physical inactivity, which in turn were also factors associated with an increased risk of hospitalization and death from COVID-19.<sup>10,11</sup> Given the impact of COVID-19 on lifestyle and mental health, non-pharmacological strategies, and activities that follow social distancing guidelines (such as internet-based cognitive behavioral therapy and physical activities) are crucial to counteract the challenges to public health.<sup>12,13</sup>

Yoga originated in ancient India as a comprehensive mind-body practice and has gained popularity worldwide as a holistic approach to physical and mental wellbeing.<sup>14,15</sup> Although yoga encompasses several styles, a growing body of evidence has shown that practices such as postures (asanas), breathing techniques (pranayama), and meditation (dhyana) have several therapeutic effects.<sup>16</sup>

The public interest in yoga is increasing as it can be easily performed and as it is adaptable, which could be a strategy during the pandemic to cope with stress and help maintain mental health.<sup>17</sup> Systematic reviews indicated that yoga can be considered a viable and safe ancillary treatment option for individuals with high levels of anxiety and depression.<sup>18–20</sup> However, most studies have been conducted under

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### Abbreviations

BMI	Body Mass Index
CI	Confidence Interval
COVID-19	Coronavirus Disease 2019
DAG	Directed Acyclic Graph
DASS-21	Depression Anxiety and Stress Scale-21
OR	Odds Ratio

clinic conditions and little empirical data are currently available about the level of yoga practice and its possible associations with mental health during the pandemic. Therefore, the current study aimed to describe yoga practice and to verify the association of this practice with depression, anxiety, and stress levels among Brazilian practitioners during the COVID-19 pandemic.

## Methods

### Study design and participants

This cross-sectional study described yoga practice and evaluated mental health using Depression Anxiety Stress Scale-21 (DASS-21) during the COVID-19 pandemic among Brazilian practitioners. For this, we enrolled yoga studios and teachers from Brazilian capitals and municipalities with a population of more than 100,000. An anonymous questionnaire was disseminated on an online platform using a snowball sampling strategy, and the practitioners who received the link were encouraged to pass it to other known practitioners. Data were collected between July 9 and July 15, 2021, and the official number of registered cases and deaths by COVID-19 during this study period in Brazil was 242,019 and 7,254, respectively.<sup>21</sup>

The survey link was directed to a page that included a brief text detailing the research protocol, and the participants who eventually advanced in the questionnaire gave their consent and agreed to participate in the study. The inclusion criteria for participating in the study were age  $\geq 18$  years and being a yoga practitioner with at least six months of experience. Conflicting answers and/or missing information in the survey were excluded. The local Research Ethics Committee approved this study (protocol number: 4.035.382), and all procedures adopted in the research complied with the National Health Council resolution (number 466/12).

### Measures

The first part of the survey was predominantly a multiple-choice questionnaire on parameters such as sociodemographic data, lifestyle factors (age, sex, body mass index [BMI], chronic disease, COVID-19 infection, smoking, other regular practice of physical activity, region of Brazil, employment status, education level, and number of people in the household), and yoga practice (experience, average time of practice per session in the last week, number of practice days in the last week, and maintenance of yoga practice frequency during the pandemic).

The second part of the survey consisted of items of DASS-21 that were adapted and validated for the Brazilian Portuguese language,<sup>22</sup> an instrument widely used by different countries during the COVID-19 pandemic.<sup>23–26</sup> The score referred to the feeling over the last week and was based on a four-point Likert-type scale, ranging from 0 (not applicable to me at all) to 3 (very much applicable to me or applicable most of the time). Questions 3, 5, 10, 13, 16, 17, and 21 formed the depression subscale. Questions 2, 4, 7, 9, 15, 19, and 20 formed the anxiety subscale, and questions 1, 6, 8, 11, 12, 14, and 18 formed the stress subscale. For the final score, the scores from each subscale were added and multiplied by two to correspond to the original scale score (DASS-42). The cutoff

scores for depression were 0–9, 10–13, 14–20, 21–27, and  $\geq 28$ , corresponding to normal, mild, moderate, severe, and extremely severe, respectively. The cutoff scores for normal, mild, moderate, severe, and extremely severe anxiety were 0–7, 8–9, 10–14, 15–19, and  $\geq 20$ , respectively. The cutoff scores for normal, mild, moderate, severe, and extremely severe stress were 0–14, 15–18, 19–25, 26–33, and  $\geq 34$ , respectively.<sup>27</sup> In our study, the internal consistency was considered good (overall = 0.86; if item dropped: depression = 0.80, anxiety = 0.81, and stress = 0.79) according to the Cronbach's alpha coefficient.

### Statistical analysis

All analyses were conducted using R version 4.1.2 (R Foundation for Statistical Computing, Vienna, Austria). Categorical variables were described as absolute and relative frequencies. Continuous data were presented as medians and interquartile ranges (25<sup>th</sup>–75<sup>th</sup> percentile). The association of yoga practice with mental health outcomes was tested by the generalized linear models with a binomial probability distribution, using the normal cutoff scores for depression, anxiety, and stress level as dependent variables. The models were adjusted for potential confounders based on a directed acyclic graph (DAG) using the web-based software DAGitty (Supplementary file).<sup>28</sup> The minimal sufficient adjustment sets considered were: age, chronic disease, education level, employment, and sex. Assumptions and quality of the models such as multicollinearity, outliers, binned residuals plot, and Hosmer-Lemeshow goodness-of-fit test were checked using the 'performance' package (version 0.8.0).<sup>29</sup> Bootstrap (10,000 replicates) 95% confidence interval from exponentiated coefficients and *p*-values were obtained using the case resampling method using 'boot.pval' package (version 0.4).<sup>30</sup> The significance level was set at 0.05.

## Results

Eight respondents were excluded owing to conflicting or missing information. A total of 860 individuals completed the survey and had the data quality checked. The median time to complete the questionnaire was 6.3 (5.0–8.3) min, and respondents who completed the survey were from all Brazilian states (27 federative units), except for Amapá (north region). The characteristics of the study participants are shown in Table 1. The median age of the participants was 43 (35–54) years, ranging from 19 to 82 years. Most of the participants were female (87%), living in the southeast Brazil region (36%), had higher education (90%), lived with three or more residents in the household (47%), had BMI  $< 25$  kg/m<sup>2</sup> (68%), reported no chronic diseases (76%), were employed (82%), regularly performed another physical activity (63%), and were not diagnosed with COVID-19 (82%) during the study period.

Table 2 shows information regarding the characteristics of yoga practices of study participants. Hatha yoga (48%), Vinyasa yoga (10%), and Integral yoga (6%) were the most commonly practiced styles. Most participants had  $> 5$  years of experience (45%), reported a mean time of  $\geq 60$  min per practice session (46%), 1–2 days of yoga practice (38%) in the last week, and maintained the same frequency of practice during the pandemic (70%).

Fig. 1 illustrates the variability and distribution of the DASS-21 scores by violin plots. The median depression score was 2 (0–5; 25<sup>th</sup>–75<sup>th</sup> percentile), ranging between 0 and 21. The median anxiety score was 2 (0–4), ranging between 0 and 20. The median stress score was 5 (2–8), ranging between 0 and 21. Concerning case frequency, 90.5%, 90.7%, and 94.4% of participants had normal depression, anxiety, and stress levels, respectively. Overall, 9.5% of participants exhibited some traits (mild to severe) of depression (mild, 5.3%; moderate, 3.7%; severe, 0.5%), 9.3% exhibited anxiety (mild, 3.3%; moderate, 4.7%; severe, 1.3%; extremely severe, 0.1%), and 5.6% exhibited stress (mild, 4.4%; moderate, 1.2%).

The association of the characteristics of yoga practice with depression, anxiety, and stress indicators is shown in Table 3. Among yoga

**Table 1**  
Characteristics of study participants (n = 860).

Variables	Absolute frequency	Relative frequency (%)
<b>Sex</b>		
Female	748	87
Male	112	13
<b>Age group (years)</b>		
18–29	95	11
30–44	351	41
45–59	298	35
≥ 60	116	13
<b>Country region</b>		
North	63	7
Northeast	204	24
Midwest	84	10
Southeast	308	36
South	201	23
<b>Education level</b>		
Primary	5	1
Secondary	83	10
Further	772	90
<b>Size of household</b>		
Lives alone	140	16
2 people	315	37
≥ 3 people	405	47
<b>BMI group (kg/m<sup>2</sup>)</b>		
< 25	581	68
25–29.9	218	25
≥ 30	61	7
<b>Chronic disease</b>		
Yes	210	24
No	650	76
<b>Employment</b>		
Employed	705	82
Unemployed	61	7
Retired	94	11
<b>Other physical activity</b>		
Yes	542	63
No	318	37
<b>Diagnosed with COVID-19</b>		
Yes	155	18
No	705	82

BMI = body mass index. COVID-19 = coronavirus disease 19.

**Table 2**  
Characteristics of yoga practiced by the respondents.

	Total (n = 860)
<b>Yoga style most practiced</b>	
Hatha	413 (48%)
Vinyasa	85 (10%)
Integral	53 (6%)
Kundalini	47 (5%)
Ashtanga	35 (4%)
Raja	24 (3%)
Iyengar	15 (2%)
SwāSthya	13 (2%)
Others	93 (11%)
Do not know	82 (10%)
<b>Yoga experience</b>	
< 1 year	141 (16%)
1–2 years	126 (15%)
2–5 years	205 (24%)
> 5 years	388 (45%)
<b>Average time of practice per session in the last week</b>	
< 30 min	74 (9%)
30–60 min	334 (39%)
≥ 60 min	399 (46%)
None	53 (6%)
<b>Frequency of practice in the last week</b>	
0 day	50 (6%)
1–2 days	330 (38%)
3–5 days	327 (38%)
> 5 days	153 (18%)
Yes	606 (70%)
No	254 (30%)

practitioners with > 5 years of experience, it was observed higher odds to have normal levels of anxiety ( $OR = 2.42$ ; bootstrap 95% $CI = 1.32, 4.49$ ) and stress ( $OR = 1.80$ ; bootstrap 95% $CI = 1.06, 3.00$ ) than practitioners with < 1 year of experience.

Practitioners with an average duration of yoga practice per session of 30–60 min and > 60 min, were more likely to had normal levels of depression ( $OR_{30-60 \text{ min}} = 3.00$ ; bootstrap 95% $CI = 1.37, 6.64$ ;  $OR_{>60 \text{ min}} = 3.41$ ; bootstrap 95% $CI = 1.51, 7.63$ ), anxiety ( $OR_{30-60 \text{ min}} = 4.11$ ; bootstrap 95% $CI = 2.05, 8.78$ ;  $OR_{>60 \text{ min}} = 5.43$ ; bootstrap 95% $CI = 2.72, 11.75$ ), and stress ( $OR_{30-60 \text{ min}} = 2.56$ ; bootstrap 95% $CI = 1.24, 5.24$ ;  $OR_{>60 \text{ min}} = 3.70$ ; bootstrap 95% $CI = 1.81, 7.65$ ) than practitioners with no practice in the last week.

A dose-response association was observed between the days of practice and higher odds to normal levels of depression ( $OR_{1-2 \text{ days}} = 2.56$ ; bootstrap 95% $CI = 1.15, 5.53$ ;  $OR_{3-5 \text{ days}} = 3.19$ ; bootstrap 95% $CI = 1.38, 7.39$ ;  $OR_{>5 \text{ days}} = 6.49$ ; bootstrap 95% $CI = 2.38, 26.89$ ), anxiety ( $OR_{1-2 \text{ days}} = 3.68$ ; bootstrap 95% $CI = 1.89, 7.61$ ;  $OR_{3-5 \text{ days}} = 5.82$ ; bootstrap 95% $CI = 2.85, 13.08$ ;  $OR_{>5 \text{ days}} = 8.84$ ; bootstrap 95% $CI = 3.85, 27.67$ ), and stress ( $OR_{1-2 \text{ days}} = 2.15$ ; bootstrap 95% $CI = 1.05, 4.43$ ;  $OR_{3-5 \text{ days}} = 3.15$ ; bootstrap 95% $CI = 1.47, 6.70$ ;  $OR_{>5 \text{ days}} = 5.21$ ; bootstrap 95% $CI = 2.27, 13.96$ ) compared to no practice during the study period.

Among practitioners who reported maintaining the frequency of yoga practice during the pandemic, it was observed higher odds to report normal levels of depression ( $OR = 2.27$ ; bootstrap 95% $CI = 1.39, 3.79$ ), anxiety ( $OR = 1.97$ ; bootstrap 95% $CI = 1.25, 3.10$ ), and stress ( $OR = 1.97$ ; bootstrap 95% $CI = 1.32, 2.96$ ) than in those who did not maintain the same frequency.

## Discussion

Our survey of yoga practitioners provided some important findings. Firstly, Hatha was the most practiced yoga style among study participants. Secondly, a higher level of yoga practice was associated with better depression, anxiety, and stress status during the COVID-19 pandemic. In addition, maintaining the frequency of yoga practice was associated with normal levels of DASS-21 scores, reinforcing the importance of mind-body practices in stressful events such as a pandemic.

Brazil has stood out as one of the worst countries to have dealt with the pandemic.<sup>31</sup> In addition, in mid-June 2021, it surpassed the mark of 500,000 official deaths from COVID-19. The present study was restricted to a one-week period (July 9 and 15, 2021) owing to possible fluctuations in the characteristics of the pandemic on the population's mental health indices. During the study period, we were able to gather information from the five regions of Brazil.

Our data indicated that Brazilian yoga practitioners are more likely to be female and have a higher education, unlike Indians, who present a better balance between sex.<sup>32</sup> In contrast, our data aligned with other national surveys conducted in the United States,<sup>33</sup> the United Kingdom,<sup>34</sup> and Germany,<sup>35</sup> which demonstrated that yoga practitioners were predominantly female and white and had a higher education level.

In Western society, yoga practice was popularized via group classes, and various styles were derived from the elements of traditional yoga. In this sense, the vast majority of Brazilian practitioners (48%) reported that Hatha yoga was the most practiced or predominant style in their daily practice. Our data differ from a German survey in which Sivananda (22.4%) was the most practiced yoga style.<sup>35</sup> These differences reflect each country's cultural aspects; however, we cannot rule out the influence of the pandemic in changing the pattern of practice.

Globally, mental disorders (such as anxiety and depression) are recognized as the leading causes of disability,<sup>36</sup> and the psychological impact of the COVID-19 pandemic has made this public health problem even more evident.<sup>37</sup> In our study conducted among Brazilian yoga practitioners, the prevalence of severe and extremely severe depression (0.5%) and anxiety levels (1.4%) was relatively low, while no severe cases of stress were observed based on the cutoff scores.

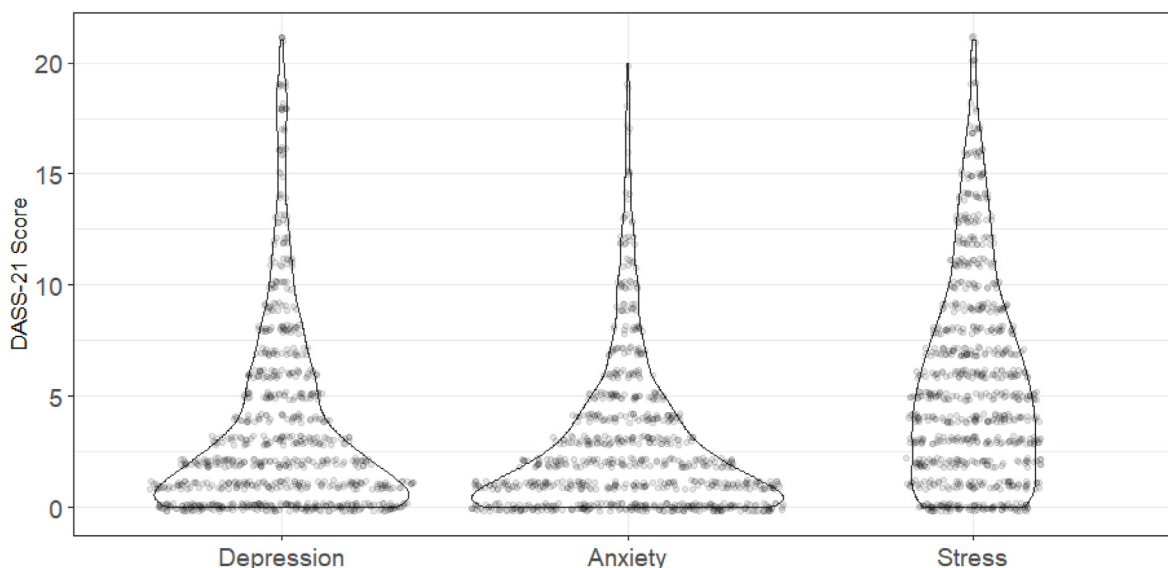


Fig. 1. Violin plots for depression, anxiety, and stress scores from Depression Anxiety and Stress Scale (DASS-21).

Table 3

Association between yoga practice and normal levels for depression, anxiety, and stress ( $n = 860$ ).

	Depression		Anxiety		Stress	
	OR (95%CI)	p-value	OR (95%CI)	p-value	OR (95%CI)	p-value
<b>Yoga-Experience</b>						
< 1 year	ref.		ref.		ref.	
1–2 years	0.68 (0.32 – 1.37)	0.259	1.38 (0.71 – 2.71)	0.332	1.45 (0.77 – 2.76)	0.248
2–5 years	1.30 (0.61 – 2.76)	0.513	1.87 (0.99 – 3.66)	0.054	1.48 (0.84 – 2.60)	0.164
> 5 years	1.45 (0.71 – 2.78)	0.296	2.42 (1.32 – 4.49)	0.008	1.80 (1.06 – 3.00)	0.031
<b>Mean time of practice</b>						
None	ref.		ref.		ref.	
< 30 min	1.46 (0.57 – 4.38)	0.421	1.89 (0.81 – 5.24)	0.134	1.73 (0.72 – 4.35)	0.214
30–60 min	3.00 (1.37 – 6.64)	0.010	4.11 (2.05 – 8.78)	0.001	2.56 (1.24 – 5.24)	0.012
> 60 min	3.41 (1.51 – 7.63)	0.008	5.43 (2.72 – 11.75)	< 0.001	3.70 (1.81 – 7.65)	0.001
<b>Number of practice days</b>						
0 day	ref.		ref.		ref.	
1–2 days	2.56 (1.15 – 5.53)	0.022	3.68 (1.89 – 7.61)	0.001	2.15 (1.05 – 4.43)	0.038
3–5 days	3.19 (1.38 – 7.39)	0.009	5.82 (2.85 – 13.08)	< 0.001	3.15 (1.47 – 6.70)	0.005
> 5 days	6.49 (2.38 – 26.89)	0.001	8.84 (3.85 – 27.67)	< 0.001	5.21 (2.27 – 13.96)	< 0.001
<b>Maintained frequency during the pandemic</b>						
No	ref.		ref.		ref.	
Yes	2.27 (1.39 – 3.79)	0.002	1.97 (1.25 – 3.10)	0.004	1.97 (1.32 – 2.96)	0.002

OR = odds ratio; 95%CI = 95% confidence interval; ref. = reference category. Model adjusted for age, chronic disease, education level, employment, and sex.

The low prevalence of severe cases observed in the current study must be interpreted with caution as individuals vulnerable to mental health issues may not participate in research studies voluntarily (self-selection bias). Another aspect is the stage of the pandemic in each region of the country. In this sense, we conducted a small observational study in the first few months of the pandemic in the southeast region of Brazil (May 19 and 26, 2020).<sup>38</sup> The study indicated higher rates of severe levels of depression (8%), anxiety (12.2%), and stress (12.2%) based on DASS-21 scores among yoga practitioners. During this period, we observed that a higher experience ( $\geq 2$  years) and frequency of practice ( $\geq 5$  days/week) were associated with lower odds of severe stress symptoms.<sup>38</sup>

In our study, yoga experience was associated with normal anxiety and stress levels during the COVID-19 pandemic. Furthermore, yoga practitioners who reported a higher level of practice (average of time practice and weekly frequency) and maintained the same frequency of practice were more likely to report normal levels of depression, anxiety, and stress during the pandemic (Table 3). Our findings are consistent with those of previous cross-sectional studies that demonstrated that yoga practice was

associated with lower anxiety levels<sup>39</sup> and higher mental wellbeing among Indians<sup>40</sup> during COVID-19.

Our study is cross-sectional in nature, and therefore, it is not possible to determine causality. However, intervention studies during the COVID-19 pandemic support the positive evidence of yoga practice on mental health improvements.<sup>20,41,42</sup> For example, Wadhen and Cartwright<sup>20</sup> investigated the impact of a 6-week online yoga class on the stress and wellbeing perception of people working from home during COVID-19 in London (June–July 2020). Compared with the control group, the yoga intervention group had significantly improved perceived stress, mental well-being, and depression (based on DASS-21) scores.<sup>20</sup>

Among the mechanisms that explain the therapeutic effects of yoga on mental health, we can highlight the positive modulation of the hypothalamic-pituitary-adrenal axis, decreasing systemic cortisol concentration,<sup>43,44</sup> and increasing the gamma-aminobutyric acid (an inhibitory neurotransmitter) level in the brain.<sup>45</sup> On the one hand, psychological stress and depression disorders are associated with a pro-inflammatory state.<sup>46</sup> On the other hand, yoga practices could reduce

pro-inflammatory cytokines and increase anti-inflammatory cytokines.<sup>47</sup> These effects reinforce the benefits of daily yoga practice during stressful events, such as in a pandemic; however, future research is required to evaluate the effects of yoga on mental health in COVID-19 survivors.<sup>48</sup>

This study is subject to certain limitations. Firstly, anonymous, online surveys are restricted to participants with internet access, tend to have a biased selection, and may not represent the entire population of interest. Secondly, the diagnosis of any mental disorder before the pandemic and the evolution was not considered. Thirdly, the absence of a control group may be another potential limitation of the study. Therefore, the data used in our study were obtained during a specific period in the pandemic, and the results cannot be extrapolated to non-yoga practitioners.

In conclusion, our study showed that a higher level of yoga practice was associated with better mental health levels during the COVID-19 pandemic in Brazil. Therefore, encouraging the continuation of daily yoga practice can contribute to mental health during the COVID-19 pandemic. Furthermore, we found that the practice was more prevalent among Brazilian women with a higher level of education, and Hatha yoga was the most practiced style during the period.

### Submission statement

We declare that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere including electronically in the same form, in English or in any other language, without the written consent of the copyright-holder.

### Ethical approval statement

This research was approved by the local Research Ethics Committee (protocol number 4.035.382), and all participants gave their consent and agreed to participate in the study.

### Authors' contributions

GMS: recruitment, data curation, and the draft of the manuscript. RV: conceptualization and project administration. AGSVR: recruitment and data curation. CAC: recruitment and data curation. MC: recruitment and data curation. AHC: conceptualization, project administration, and formal analysis. All authors interpreted the data and participated in the critical revision and final approval.

### Conflict of interest

The authors report no conflict of interest.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.smhs.2022.04.005>.

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