








EFFECT OF TAI CHI ON ADULT MENTAL HEALTH DURING THE PANDEMIC AND FACTORS ASSOCIATED: A CROSS-SECTIONAL STUDY

Laís Renata Almeida CEZÁRIO¹ , Gláucia Maria Bovi AMBROSANO¹ , Guilherme Bovi AMBROSANO² ,
Anderson TAÍRA³ , Rosana de Fátima POSSOBON¹ , Marcelo de Castro MENEZES¹ ,
Karine Laura CORTELLAZZI¹ 

¹ Department of Health Sciences and Children's Dentistry, Piracicaba Dental School, Universidade Estadual de Campinas, Piracicaba, São Paulo, Brazil.

² Department of Genetics at Luiz de Queiroz College of Agriculture, Universidade de São Paulo, São Paulo, São Paulo, Brazil.

³ Sociedade Brasileira de Tai Chi Chuan e Cultura Oriental, Piracicaba, São Paulo, Brazil.

Corresponding author:

Laís Renata Almeida Cezário
laysrenata.almeida@gmail.com

How to cite: CEZÁRIO, L.R.A., et al. Effect of Tai Chi on adult mental health during the pandemic and factors associated: a cross-sectional study. *Bioscience Journal*. 2024, **40**, e40031. <https://doi.org/10.14393/BJ-v40n0a2024-66942>

Abstract

This cross-sectional study aimed to assess whether levels of anxiety, perceived stress, and self-perception of happiness during the Covid-19 pandemic were lower among Tai Chi (TC) practitioners. An online questionnaire was applied from September 2020 to November 2021 through email list and instant messaging application "WhatsApp". In total 368 individuals, 341 of whom did not practice TC, coming from a university and sports academies and 27 TC practitioners from the Brazilian Society of TC and Oriental Culture were included. Sociodemographic, mental health, habits related to physical activity and the State Anxiety Inventory (STAI), Perceived Stress Scale (PSS14) and the Andrews Faces Scale were collected to assess level of state-anxiety, perceived-stress, and self-perception of happiness, respectively. Each independent variable with the outcome variables (severe anxiety level, severe stress level, moderate/severe stress level and self-perception of happiness) were analyzed for simple and multiple logistic regression model. Individuals who do not practice TC are more likely to have a severe level of anxiety (OR=3.55; CI95%CI: 1.37-9.20) and a moderate/severe level of stress (OR=2.60; 95%CI: 1.07-6.35), $p < 0.05$. TC practitioners are more likely to perceive themselves as happy than non-practitioners (OR=3.18; 95%CI: 1.16-8.71), $p < 0.05$. Do not practice regular physical activity (OR=2.88; 95%CI:1.50-4.34); (OR=1.7; 95%CI: 95%: 1.09-2.74) and being young were associated with high levels of stress, $p < 0.05$. The TC practice during the pandemic promoted lower level of perceived stress, state anxiety and greater self-perception of happiness, showing the importance of TC practice and maintaining the frequency of physical activity during the pandemic.

Keywords: Anxiety. COVID-19. Perception. Psychological stress. Tai Chi.

1. Introduction

The COVID-19 pandemic has harmed the physical and psychological well-being of the world population (Kola et al. 2021; Zaninotto et al. 2022). Since the onset of the pandemic, people have experienced anguish and fear caused by the risk of illness, uncertainty about the future, excessive information, routine changes, interruption of plans, and financial concerns (Ho et al. 2020; Varma et al.

2021). Furthermore, the strategies of health organizations to contain the spread of the virus, such as lockdowns, social isolation, and quarantine, contributed to sedentary lifestyles and negative feelings (Xu et al. 2021).

These factors have not only caused symptoms of anxiety and perceived stress in healthy people but worsened these symptoms in individuals with pre-existing psychological problems (Ho et al. 2020; Shigemura et al. 2020; Wang et al. 2020; Varma et al. 2021). These two conditions have been related to a higher susceptibility of individuals to the onset of diseases, harming their quality of life and wellness (Ray et al. 2017; Zheng et al. 2018; Kandola et al. 2018).

Prolonged exposure to stressors may trigger anxiety disorders, described as a psychophysiological sign of stress, i.e. long-term anxiety in anticipation of adverse events (Ray et al. 2017; Koutsimani et al. 2019; Martins et al. 2019). Problems with cognition, learning, and social skills, decreased productivity at work, unemployment, and physical symptoms related to the immune, cardiovascular, and gastrointestinal systems are consequences of these conditions (Yaribeygi et al. 2017; Kandola et al. 2018).

Despite the extensive use of the pharmacological approach for controlling anxiety and stress, non-pharmacological strategies, such as regularly practicing physical activities, are essential for promoting mental health, reducing stress and anxiety levels, and improving self-esteem, self-perception, personal satisfaction, and cognitive and physiological functions (Saeed et al. 2010; Zou et al. 2018; Souza et al. 2021). Besides conventional exercises, alternative practices, such as Yoga and Tai Chi, have also improved the health of people with stress and anxiety (Zou et al. 2018). Tai Chi Chuan is a martial art developed in China and practiced worldwide today, promoting mind-body cultivation and harmony. This practice is a low-to-moderate impact exercise (Xu et al. 2021), combining breathing and meditation techniques with slow and gentle [body] movements that promote balance and relaxation. It includes people of any age or health condition (Wang et al. 2014; Zheng et al. 2018; Kong et al. 2019).

The tested hypothesis was that individuals who practiced Tai Chi during the pandemic would present lower anxiety and stress levels and a higher perception of happiness than non-practitioners. This study is relevant because only a few published articles have evaluated the impact of Tai Chi on practitioners' psychological health during the pandemic (Solianik et al. 2021), and no study on this topic has been conducted on the Brazilian population. Therefore, we assessed whether the levels of anxiety, perceived stress, and self-perception of happiness during the COVID-19 pandemic were lower among Tai Chi practitioners, identifying other factors associated with stress and anxiety symptoms and happiness during the pandemic.

2. Material and Methods

It was a prospective cross-sectional study conducted in Brazil from September 2020 to November 2021. The research included students enrolled in 66 undergraduate courses and 153 postgraduate programs at the University of Campinas (São Paulo, Brazil), gym users, and members of the Brazilian Society of Tai Chi Chuan and Oriental Culture, corresponding to N=34,652. The study excluded individuals who did not complete the questionnaire and were under 18 years old. The participants were contacted through e-mail addresses and WhatsApp numbers provided by their institutions of affiliation. After completing the questionnaire, the volunteers were asked to forward the survey to all their contacts to promote the study.

The sample size (N=368) provided a test power of 80% ($\beta=0.20$) and a 5% significance level ($\alpha=0.05$) when analyzing the association between Tai Chi practice and anxiety levels, showing 48% severe anxiety for the unexposed group.

An online questionnaire was prepared with simple objective questions to obtain a sample profile by collecting sociodemographic, clinical, and physical activity-related data. The questionnaire was developed on the Google Forms platform, including tools to evaluate anxiety (State-Trait Anxiety Inventory – STAI) (Spielberger 1983), stress (Perceived Stress Scale -PSS14) (Cohen et al. 1983), and the self-perception of happiness (Andrews Faces Scale) (McDowell and Newell 1996).

The Perceived Stress Scale (PSS14) (Cohen et al. 1983) measured stress levels, analyzing the extent to which events in the previous month were perceived as stressors, with scores from 0-14 (no stress), 15-

28 (mild stress), 29-42 (moderate stress), and 43-56 (severe stress). The State-Trait Anxiety Inventory (IDATE Form Y-1) (Spielberger 1983) investigated anxiety levels, with participants classifying their feelings (“How do you feel now?”; “At this moment”). The scores of this tool ranged from 20-30 (mild anxiety), 31-49 (moderate anxiety), and 50-80 (severe anxiety). Finally, a Visual Faces Scale helped assess the self-perception of happiness (McDowell and Newell 1996) by asking: Which faces best show how you feel right now? This seven-point scale consisted of stylized faces, each composed of a circle with eyes that did not change and a mouth ranging from a smile almost forming a semicircle to a similar semicircle upside down, representing sadness. The response was positive in the first three images (happy), medium in the fourth (neutral), and negative in the last three faces (sad).

The collected independent variables were sex (female and male), age (categorized by the median: ≤ 27 years and > 27 years), educational level (complete high school, complete higher education, and postgraduate studies), the practice of physical activities during the pandemic (yes and no), the practice of physical activities at least twice a week (yes and no), the practice of Tai Chi during the pandemic (yes or no), the duration of each physical activity session (< 60 min and ≥ 60 min), and the use of medication for anxiety and/or depression (yes and no). The outcome variables were stress and anxiety levels and the self-perception of happiness. The answers to “Have you practiced Tai Chi during the pandemic?” (yes or no) divided the participants into two groups: Tai Chi practitioners and non-practitioners.

The data were descriptively analyzed according to the associations of each independent variable, and the outcome variables (severe anxiety, severe stress, and moderate/severe stress, dichotomized into yes or no; and the self-perception of happiness, dichotomized into sad/neutral or happy) were evaluated with simple logistic regression models to estimate unadjusted odds ratios and respective 95% confidence intervals (95% CI). Variables with $p < 0.20$ in the raw analyses were tested in stepwise multiple logistic regression models. The final model estimated adjusted odds ratios and their respective 95% confidence intervals (95% CI). The Akaike information criterion (AIC) evaluated the final fit of the model. The analyses used SAS (SAS Institute Inc 2011 version 9.4, NC, USA) and R (R Core Team 2019, R: A language and environment for statistical computing, R Foundation for Statistical Computing, Vienna, Austria) software.

3. Results

A total of 368 participants answered the questionnaire, corresponding to 1,07% of answer rate. Among the 341 participants who did not practice Tai Chi, 71.6% were women, 53.7% were up to 27 years old, and 56.3% studied up to postgraduate level. Approximately 89% reported having exercised during the pandemic and 71.8% exercised at least twice a week. Furthermore, 79.8% did not use medication for anxiety and/or depression, 59.5% had a moderate or severe level of stress, 95.0% moderate or severe level of anxiety and 59.8% reported that they felt happy. Among the Tai Chi practitioners, 85.2% were women, 92.6% were over 27 years old, all (100.0%) reported have practiced physical exercise during the pandemic, 88.9% had performed physical exercises twice a week, 25.9% reported having taken antidepressants and/or anxiolytics, 33.3% had moderate or severe levels of stress, 70.4% moderate or severe levels of anxiety and 81.5% reported that they felt happy.

Tables 2 to 5 present the results of the analyses (raw and adjusted) of the associations between the independent variables and the outcomes analyzed.

In Table 2, 47.8% of those among the non-practitioners of Tai Chi were observed to have a severe level of anxiety whereas among the practitioners the percentage was 22.2%. Individuals who did not practice Tai Chi had 3.55 times more chances (95%CI: 1.37-9.20) of having a severe degree of anxiety than those who were practitioners ($p < 0.05$). Individuals who made use medication for anxiety and/or depression had 2.55 more chances (95%CI: 1.50-4.34) of having a severe level of anxiety than those who did not use medications ($p < 0.05$). The other variables did not remain significant in the multiple models for the outcome of severe level of anxiety ($p > 0.05$) and were therefore excluded from the final adjusted model.

According to Table 3 Individuals aged up to 27 years had 3.22 (95%CI: 1.40-7.39) times more chances of having a severe level of stress than those over 27 years of age ($p < 0.05$). Moreover, those who did not practice physical exercise during the pandemic had 2.88 (95%CI: 1.50-4.34) times more chances of

having a severe degree of stress than those who practiced physical exercise ($p < 0.05$). The other variables did not remain significant in the multiple model ($p > 0.05$) and were therefore excluded from the final model.

When the outcome moderate or severe level of stress (Table 4) was studied, 59.5% of those among the non-practitioners of Tai Chi were observed to have a moderate/severe degree of stress, and among practitioners the percentage was 33.3%. Individuals aged up to 27 years had 1.94 (95%CI: 1.23-3.04) times more chances of having a moderate/severe level of stress than those over 27 years of age ($p < 0.05$). Those who did not practice physical activity at least twice a week had 1.73 (95%CI: 1.09-2.74) times more chances of having a moderate/severe degree of stress than those who practiced physical activity ($p < 0.05$). Participants who did not practice Tai Chi had 2.60 (95%CI: 1.07-6.35) times more chances of having a moderate/severe degree of stress than those who practiced Tai Chi ($p < 0.05$). Individuals who did not use medication for anxiety and/or depression had 3.87 (95%CI: 2.07-7.22) times more chances of having a moderate/severe level of stress than those who did not use medications ($p < 0.05$). The other variables did not remain significant in the multiple model ($p > 0.05$) and were therefore excluded from the final model.

In Table 5 the participants who practiced Tai Chi were observed to have 3.18 (95%CI: 1.16-8.71) times more chances of perceiving themselves as being happy than non-practitioners. Individuals who do not use medication for anxiety and/or depression had 2.15 (95%CI: 1.28-3.61) times more chances of having a self-perception of being happy compared with those who used medication ($p < 0.05$). The other variables did not remain significant in the multiple model ($p > 0.05$) and were therefore excluded from the final model.

Table 1. presents the profile of the sample studied.

Variable	Categories	Total	Practitioners of Tai Chi	Non-Practitioners of Tai Chi
		N (%)	N (%)	N (%)
Sex	Female	267(72.55)	23 (85.19)	244 (71.55)
	Male	101(27.45)	4 (14.81)	97 (28.45)
Age (years)	¹ ≤ 27	185(50.27)	2 (7.41)	183 (53.67)
	>27	183(49.73)	25 (92.59)	158 (46.33)
Educational level	Complete high school	103(27.99)	2 (7.41)	101 (29.62)
	Complete higher education	58(15.76)	10 (37.04)	48 (14.08)
	Postgraduate	207(56.25)	15 (55.56)	192 (56.30)
Practiced physical activity during the pandemic	Yes	332(90.22)	27 (100.00)	305 (89.44)
	No	36(9.78)	0 (0.00)	36 (10.56)
Practiced physical activity at least 2times/week	Yes	269 (73.10)	24 (88.89)	245 (71.85)
	No	99 (26.90)	3 (11.11)	96 (28.15)
Time of duration of each physical activity session (min)	<60	148 (40.22)	6 (22.22)	142 (41.64)
	≥ 60	203 (55.16)	14 (51.85)	189 (55.43)
	Did not inform	17 (4.62)	7 (25.93)	10 (2.93)
Use of medication for anxiety and/or depression	Yes	76 (20.65)	7 (25.93)	69 (20.23)
	No	292 (79.35)	20 (74.07)	272 (79.77)
² Stress level	Absent	21 (5.71)	2 (7.41)	19 (5.57)
	Mild	135 (36.68)	16 (59.26)	119 (34.90)
	Moderate	180 (48.91)	9 (33.33)	171 (50.15)
	Severe	32 (8.70)	0 (0.00)	32 (9.38)
³ Anxiety level	Mild	25 (6.79)	8 (29.63)	17 (4.99)
	Moderate	174 (47.28)	13 (48.15)	161 (47.21)
	Severe	169 (45.92)	6 (22.22)	163 (47.80)
Face Scales	Happy	226 (61.41)	22 (81.48)	204 (59.82)
	Neutral	104 (28.26)	4 (14.81)	100 (29.33)
	Sad	38 (10.33)	1 (3.70)	37 (10.85)

Table 2. Analyses (raw and adjusted) of associations with moderate or severe level of anxiety (from 50 to 80) points on the STAI scale.

Variable	Category	n (%)	Severe level of anxiety		Raw OR (CI 95%)	p-value	Adjusted OR (CI 95%)	p-value
			No	*Yes				
			n (%)	n (%)				
Sex	Female	267 (72.6%)	147 (55.1%)	120 (44.9%)	Ref		-	-
	Male	101 (27.4%)	52 (51.5%)	49 (48.5%)	1.15 (0.73-1.83)	0.5397		
Age	≤ 27	185 (50.3%)	91 (49.2%)	94 (50.8%)	1.49 (0.98-2.25)	0.0590	-	-
	>27	183 (49.7%)	108 (59.0%)	75 (41.0%)	Ref			
Educational level:	Complete high school	103 (28.0%)	57 (55.3%)	46 (44.7%)	Ref		-	-
	Complete higher education	58 (15.8%)	33 (56.9%)	25 (43.1%)	0.94 (0.49-1.80)	0.8485		
	Postgraduate	207 (56.2%)	109 (52.7%)	98 (47.3%)	1.11 (0.69-1.79)	0.6556		
Practiced Exercise during the pandemic	Yes	332 (90.2%)	185 (55.7%)	147 (44.3%)	Ref		-	-
	No	36 (9.8%)	14 (38.9%)	22 (61.1%)	1.98 (0.98-4.00)	0.0577		
Practiced physical activity at least 2 times a week	Yes	123 (33.4%)	74 (60.2%)	49 (39.8%)	Ref		-	-
	No	245 (66.6%)	125 (51.0%)	120 (49.0%)	1.45 (0.93-2.25)	0.0976		
Time of duration of each physical exercise session (Minutes)	<60	148 (40.2%)	73 (49.3%)	75 (50.7%)	1.29 (0.84-1.97)	0.2402	-	-
	≥ 60	203 (55.2%)	113 (55.7%)	90 (44.3%)	Ref			
	Did not inform	17 (4.6%)	13 (76.5%)	4 (23.5%)	-			
Practiced Tai Chi	Yes	27 (7.3%)	21 (77.8%)	6 (22.2%)	Ref		Ref	
	No	341 (92.7%)	178 (52.2%)	163 (47.8%)	3.20 (1.26-8.14)	0.0143	3.55 (1.37-9.20)	0.0091
Use of medication for anxiety and/or depression	Yes	76 (20.6%)	28 (36.8%)	48 (63.2%)	2.42 (1.44-4.08)	0.0009	2.55 (1.50-4.34)	0.0006
	No	292 (79.4%)	171 (58.6%)	121 (41.4%)	Ref		Ref	

Table 3. Analysis (raw and adjusted) of associations with severe level of stress (from 43 to 56) points on the PSS14 scale.

Variable	Category	n (%)	Severe level of stress		Raw OR (CI 95%)	p-value	Adjusted OR (CI 95%)	p-value
			No	*Yes				
			n (%)	n (%)				
Sex	Female	267 (72.6%)	241 (90.3%)	26 (9.7%)	Ref		-	-
	Male	101 (27.4%)	95 (94.1%)	6 (5.9%)	0.58 (0.23-1.47)	0.2534		
Age	¹ ≤ 27	185 (50.3%)	161 (87.0%)	24 (13.0%)	3.26 (1.42-7.46)	0.0052	3.22 (1.40-7.39)	0.0060
	>27	183 (49.7%)	175 (95.6%)	8 (4.4%)	Ref		Ref	
Educational level:	Complete high school	103 (28.0%)	90 (87.4%)	13 (12.6%)	Ref		-	-
	Complete higher education	58 (15.8%)	51 (87.9%)	7 (12.1%)	0.95 (0.36-2.53)	0.9187		
	Postgraduate	207 (56.2%)	195 (94.2%)	12 (5.8%)	0.43 (0.19-0.97)	0.0423		
Practiced Exercise during the pandemic	Yes	332 (90.2%)	307 (92.5)	25 (7.5%)	Ref		Ref	
	No	36 (9.8%)	29 (80.6%)	7 (19.4%)	2.96 (1.18-7.44)	0.0207	2.88 (1.12-7.36)	0.0274
Practiced physical activity at least 2 times a week	Yes	123 (33.4%)	116 (94.3%)	7 (5.7%)	Ref		-	-
	No	245 (66.6%)	220 (89.8%)	25 (10.2%)	1.88 (0.79-4.48)	0.1529		
Time of duration of each physical exercise session (Minutes)	<60	148 (40.2%)	131 (88.5%)	17 (11.5%)	1.63 (0.78-3.37)	0.1911	-	-
	≥ 60	203 (55.2%)	188 (92.6%)	15 (7.4%)	Ref			
	Did not inform	17 (4.6%)	17 (100.0%)	0 (0.0%)	-			
Practiced Tai Chi	Yes	27 (7.3%)	27 (100.0%)	0 (0.0%)	-	-	-	-
	No	341 (92.7%)	309 (90.6%)	32 (9.4%)				
Use of medication for anxiety and/or depression	Yes	76 (20.6%)	66 (86.8%)	10 (13.2%)	1.86 (0.84-4.12)	0.1259	-	-
	No	292 (79.4%)	270 (92.5%)	22 (7.5%)	Ref			

*Event of outcome. Ref: Category of reference for the independent variables OR Odds ratio. CI: Confidence Interval ¹ for the Median of the sample ACI (empty model)=219.44; ACI (final model)=210.25.

Table 4. Analysis (raw and adjusted) of associations with moderate or severe level of stress (from 29 to 56) points on the PSS14 scale.

Variable	Category	n (%)	Moderate or severe level of stress		Raw OR (CI 95%)	p-value	Adjusted OR (CI 95%)	p-value
			No	*Yes				
			n (%)	n (%)				
Sex	Female	267 (72.6%)	114 (42.7%)	153 (57.3%)	Ref		-	-
	Male	101 (27.4%)	42 (41.6%)	59 (58.4%)	1.05 (0.66-1.66)	0.8474		
Age	≤ 27	185 (50.3%)	64 (34.6%)	121 (65.4%)	1.91 (1.26-2.91)	0.0025	1.94 (1.23-3.04)	0.0042
	>27	183 (49.7%)	92 (50.3%)	91 (49.7%)	Ref		Ref	
Educational level:	Complete high school	103 (28.0%)	38 (36.9%)	65 (63.1%)	Ref		-	-
	Complete higher education	58 (15.8%)	29 (50.0%)	29 (50.0%)	0.58 (0.30-1.12)	0.1066		
	Postgraduate	207 (56.2%)	89 (43.0%)	118 (57.0%)	0.78 (0.48-1.26)	0.3040		
Practiced Exercise during the pandemic	Yes	332 (90.2%)	148 (44.6%)	184 (55.4%)	Ref		-	-
	No	36 (9.8%)	8 (22.2%)	28 (77.8%)	2.82 (1.25-6.36)	0.0128		
Practiced physical activity at least 2 times a week	Yes	123 (33.4%)	63 (51.2%)	60 (48.8%)	Ref		Ref	
	No	245 (66.6%)	93 (38.0%)	152 (62.0%)	1.72 (1.11-2.66)	0.0156	1.73 (1.09-2.74)	0.0191
Time of duration of each physical exercise session (Minutes)	<60	148 (40.2%)	54 (36.5)	94 (63.5%)	1.36 (0.88-2.10)	0.1665	-	-
	≥ 60	203 (55.2%)	89 (43.8%)	114 (56.2%)	Ref			
	Did not inform	17 (4.6%)	13 (76.5%)	4 (23.5%)	-			
Practiced Tai Chi	Yes	27 (7.3%)	18 (66.7%)	9 (33.3%)	Ref		Ref	
	No	341 (92.7%)	138 (40.5%)	203 (59.5%)	2.94 (1.28-6.74)	0.0107	2.60 (1.07-6.35)	0.0355
Use of medication for anxiety and/or depression	Yes	76 (20.6%)	16 (21.0%)	60 (79.0%)	3.45 (1.90-6.28)	>0.0001	3.87 (2.07-7.22)	>0.0001
	No	292 (79.4%)	140 (48.0%)	152 (52.0%)	Ref		Ref	

*Event of outcome. Ref: Category of reference for the independent variables OR Odds ratio. CI: Confidence Interval 1 for the Median of the sample ACI (empty model)=503.60; ACI (final model)=470.81.

Table 5. Analyses (raw and adjusted) of associations with self-perception of happiness (Scale of Faces for Happiness).

Variable	Category	n (%)	Self-perception		Raw OR (CI 95%)	p-value	Adjusted OR (CI 95%)	p-value
			Sad or Neutral	*Happy				
			n (%)	n (%)				
Sex	Female	267 (72.6%)	102 (38.2%)	165 (61.8%)	1.06 (0.66-1.70)	0.8048	-	-
	Male	101 (27.4%)	40 (39.6%)	61 (60.4%)	Ref			
Age	≤ 27	185 (50.3%)	77 (41.6%)	108 (58.4%)	Ref		-	-
	>27	183 (49.7%)	65 (35.5%)	118 (64.5%)	1.29 (0.85-1.97)	0.2296		
Educational level:	Complete high school	103 (28.0%)	44 (42.7%)	59 (57.3%)	Ref		-	-
	Complete higher education	58 (15.8%)	18 (31.0%)	40 (69.0%)	1.66 (0.84-3.27)	0.1452		
	Postgraduate	207 (56.2%)	80 (38.6%)	127 (61.4%)	1.18 (0.73-1.91)	0.4909		
Practiced Exercise during the pandemic	Yes	332 (90.2%)	123 (37.0%)	209 (63.0%)	1.90 (0.95-3.79)	0.0690	-	-
	No	36 (9.8%)	19 (52.8%)	17 (47.2%)	Ref			
Practiced physical activity at least 2 times a week	Yes	123 (33.4%)	39 (31.7%)	84 (68.3%)	1.56 (0.99-2.47)	0.0555	-	-
	No	245 (66.6%)	103 (42.0%)	142 (58.0%)	Ref			
Time of duration of each physical exercise session (Minutes)	<60	148 (40.2%)	64 (43.2%)	84 (56.8%)	Ref		-	-
	≥ 60	203 (55.2%)	77 (37.9%)	126 (62.1%)	1.25 (0.81-1.92)	0.3164		
	Did not inform	17 (4.6%)	1 (5.9%)	16 (94.2%)	-			
Practiced Tai Chi	Yes	27 (7.3%)	5 (18.5%)	22 (81.5%)	2.96 (1.09-7.99)	0.0328	3.18 (1.16-8.71)	0.0245
	Do not	341 (92.7%)	137 (40.2%)	204 (59.8%)	Ref		Ref	
Use of medication for anxiety and/or depression	Yes	76 (20.6%)	40 (42.6%)	36 (47.4%)	Ref		Ref	
	Do not	292 (79.4%)	102 (34.9%)	190 (65.1%)	2.07 (1.24-3.45)	0.0052	2.15 (1.28-3.61)	0.0038

*Event of outcome. Ref: Category of reference for the independent variables OR Odds ratio. CI: Confidence Interval 1 for the Median of the sample AIC (empty model)=492.81; AIC (final model)=482.91.

4. Discussion

Tai Chi Chuan is a mind-body practice combining several resources (mindfulness, balance, strength, breathing techniques, flexibility, relaxation, and social support), benefiting the practitioners' physical and emotional health by improving their wellness and quality of life (Zheng et al. 2018; Kong et al. 2019; Xu et al. 2021). In this study, the group that did not practice Tai Chi during the pandemic showed higher anxiety and stress levels, with 47.8% having severe anxiety and 59.5% having moderate or severe stress.

Individuals who did not practice physical activities and did not exercise at least twice a week during the pandemic were more likely to present moderate/severe and severe stress, respectively. This finding agrees with studies conducted during the pandemic associating regular physical exercise with the promotion of wellness and quality of life and fewer symptoms of depression, anxiety, and stress, especially in women (de Camargo et al. 2021; Marconcin et al. 2022). Other studies have also demonstrated the benefits of exercising for physical health (reductions in mortality, heart disease, comorbidities such as hypertension and diabetes, and some cancers) and mental health (fewer symptoms of stress, anxiety, depression, and other psychological disorders) (Ströhle 2009; Kandola and Stubbs 2020; WHO 2020; Merlo and Vela 2021).

Moreover, younger participants (≤ 27 years) were more likely to experience severe stress. That may have occurred because students and professionals needed to adapt to performing activities remotely, suffered from the long isolation period during the pandemic, and had access to more information through the media and social networks, potentially increasing stress levels (Etxebarria et al. 2020; Souza et al. 2021). Furthermore, the lack of maturity and life experience represented the lack of psychological resources, such as resilience and coping strategies, that might have helped deal with stressful situations triggered during the pandemic (Flesia et al. 2020; Nwachukwu et al. 2020; Ozamiz-Etxebarria et al. 2020; Souza et al. 2021). Also, younger individuals may present lower resilience and higher resignation, complicating adaptability and affecting their emotions. It is worth noting that uncontrolled stress may become a concerning psychological condition that influences wellness. It also triggers and worsens other conditions, consequently affecting healthy and unhealthy individuals (Zheng et al. 2018).

This study also demonstrated that individuals who did not practice Tai Chi during the pandemic were more likely to present severe anxiety and moderate/severe stress. Authors have shown the effectiveness of Tai Chi in helping individuals reduce negative feelings and symptoms of anxiety, stress, and depression (Emard et al. 2021; Trevino et al. 2021; Yang et al. 2022; Yin et al. 2023). The benefits of this practice may originate from the release of pleasure hormones and more production of biological markers related to emotional regulation (Wang et al. 2023). Moreover, self-care promotion and mind-body integration help Tai Chi practitioners to focus on the moment and forget the stressful problems of their daily lives, also providing the social support typical of group activities (Chen et al. 2017; Ma et al. 2018; Zheng et al. 2018; Zou et al. 2018).

Self-perceived happiness was also associated with Tai Chi because those who practiced it during the pandemic more likely perceived themselves as happy. Other authors have also found such benefits of Tai Chi on the wellness and mood of practitioners (Lan et al. 2013; Chan et al. 2018). This finding confirms the body of evidence relating happiness or high wellness levels to good relationships, professional performance, creativity, health quality, longevity, and reduced mortality and morbidity. That is linked to biological and lifestyle factors, such as regular physical activities and food choices, indicating a bidirectional relationship between happiness and exercise (Diener et al. 2018; Cardona Arango et al. 2019; Steptoe 2019; Kushlev et al. 2020).

Our study also associated antidepressant and anxiolytic drugs with a higher likelihood of high stress and anxiety levels. Individuals who did not use these medications more likely perceived themselves as happy. That was an expected association because psychotropic drug users are common carriers of psychological disorders, such as mood swings and generalized anxiety and depression, and the beginning of treatment with these drugs may elevate stress, anxiety, and depression symptoms, requiring an adaptation period (Garakani et al. 2020). Studies have shown a reciprocal influence between psychological problems and stress, as their emergence relates to prolonged exposure to stressors. Moreover, anxiety

and depression make individuals more susceptible to suffering from the anticipation of future stressful events (Howe et al. 2017; Ray et al. 2017).

The Brazilian Ministry of Health has acknowledged the benefits of bodily and meditative practices, such as Tai Chi Chuan, to physical and mental health. Hence, in 2006, the Ministry included this martial art in the National Policy on Integrative and Complementary Practices (PNPIC) (Antunes and Fraga 2021). These practices are relevant therapeutic resources for preventing and treating psychological problems, as they expand people's attention and understanding of the disharmonies that stimulate mental suffering by encouraging self-care and favoring health integrality (Brasil 2013). Nevertheless, Tai Chi remains poorly disseminated in Brazil (Barbosa et al. 2019), emphasizing the need for the general population, especially those served by the Brazilian public health system (SUS), to learn about and access this practice and its benefits.

This study had some limitations. Using a self-reported online questionnaire for data collection may prevent verifying response accuracy. Also, using an online questionnaire may have influenced the low response rate (1.5%) of this study. However, considering the unique circumstances of social distancing measures, an online questionnaire was the best alternative for collecting data. The sample size of Tai Chi practitioners was also a limitation, considering that an unbalanced sample may complicate group comparisons. However, the low number of Tai Chi practitioners was expected because this practice is not widely spread and practiced in Brazil. Further studies with larger sample sizes are required.

Considering the numerous benefits of Tai Chi and how easily it can be practiced alone or in a group, its effect on the psychological health of individuals should be further investigated. That applies especially to the potential of Tai Chi to help people deal with stressful situations and lifestyle changes, regardless of whether they are healthy or carry illnesses, such as chronic diseases or psychological disorders, as this practice will improve their quality of life and wellness.

5. Conclusions

During the pandemic, Tai Chi (TC) practitioners presented lower stress and anxiety levels and greater self-perception of happiness. Do not practice TC during the pandemic was associated with greater chances of presenting severe anxiety and moderate/severe stress. The TC practice and not taking antidepressant and anxiolytic medication was associated with a perception of happiness. Other factors were associated with stress, such as not practicing physical activity regularly and being young. In summary, our study presents relevant findings about the importance of TC practice and maintaining the frequency of physical activity during the pandemic.

Authors' Contributions: CEZÁRIO, L.R.A.: conception and design, acquisition of data, and drafting the article; AMBROSANO, G.M.B.: analysis and interpretation of data and drafting the article; AMBROSANO, G.B.: analysis and interpretation of data and drafting the article; TAÍRA, A.: conception and design, acquisition of data, and drafting the article; POSSOBON, R.F.: conception and design, acquisition of data, analysis and interpretation of data, and drafting the article; MENEGHIM, M.C.: conception and design, analysis and interpretation of data, and drafting the article; CORTELLAZZI, K.L.: conception and design, acquisition of data, analysis and interpretation of data, and drafting the article. All authors have read and approved the final version of the manuscript.

Conflicts of Interest: The authors declare no conflicts of interest.

Ethics Approval: The study was approved by the Research Ethics Committee of the Piracicaba Dental School, University of Campinas (UNICAMP) (protocol number CAAE:33386620.3.0000.5418) in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Acknowledgments: The authors thank the volunteers, for allowing the research carried out.

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Received: 11 September 2022 | **Accepted:** 22 March 2024 | **Published:** 17 July 2024



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