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Protective and Educational Effects of Physical Activity Practice on Mental Health in Young Age during COVID-19 Lockdown

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Abstract: Background: The restrictions imposed by the COVID-19 pandemic have modified the lifestyle of young people, worsening their mental health. Although some countries were allowed to practice outdoor physical activity (PA) in cases of lockdown, the PA level in the general population decreased. The current study aims to assess the differences in fear of COVID-19, anxiety, neuroticism, and general self-efficacy between university students who practiced PA during the second wave of lockdown and those who did not practice any PA. Methods: The sample consisted of 276 university students (176 females, 63.8%; mean age: 22.13, SD: ± 3.94) who answered an online questionnaire detecting life habits (e.g., PA practice) during COVID-19 restrictions, fear of COVID-19, anxiety, neuroticism, and general self-efficacy. In addition, a 2 (gender) \times 2 (physical activity) MANCOVA model was used to compare the variables' differences. Finally, a path analysis model was performed to assess the protective effect of physical activity. Results: The students engaging in PA during lockdown showed lower fear of COVID-19, state and trait anxiety, neuroticism, and higher levels of general self-efficacy. Gender differences concerning fear of COVID-19 and a significant interaction with physical activity emerged: physically active females displayed the highest fear of COVID-19 compared to sedentary females and active males. Gender differences also emerged concerning state and trait anxiety and neuroticism. The path analysis model confirmed a light protective effect of sport/PA practice on mitigating neuroticism and anxiety, which, in turn, affect general self-efficacy. Conclusions: According to the results, it emerged that physical activity could represent a protective and educational factor for male students' mental health during the COVID-19 restriction and partially for female ones.

Keywords: physical exercise; self-efficacy; neuroticism; anxiety; fear of COVID-19; university students



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1. Introduction

The COVID-19 pandemic arose in early 2020, violently impacting European countries, especially Italy [1]. The Italian government imposed severe restrictions and a lockdown to limit the spread of the contagion over two different periods: from March 2020 to June 2020 and from October 2020 to May 2021 [2]. The limitations undertaken in this emergency included social distancing, self-isolation, and social avoidance to prevent any COVID-19 contagion [3]. However, these restrictions severely impacted daily life, constraining people from adapting to a number of limitations that could have worsened their mental health [4–6]. Consequently, a considerable number of studies have investigated the quality of life, anxiety levels, depression, stress, and similar variables during lockdown [7–9] and across different life stages [10,11].

A number of studies were conducted on young adults, which revealed them to be an age group at particular risk of developing mental health problems [12]. Indeed, the transitional period between adolescence and adulthood is characterized by feelings of uncertainty and challenge, and individuals at this stage need to juggle important developmental tasks [13]. Additionally, the COVID-19 pandemic might have increased the

difficulty of these challenges (e.g., job uncertainty, educational dropout), together with the levels of anxiety and depressive symptoms [14,15].

The rapid escalation of COVID-19 cases within the population has increased fear of COVID-19 and fear of contagion levels [16]. A meta-analysis by Luo et al. [17] reported that the fear of COVID-19 was higher in females than males, but no differences were found concerning age groups. Other studies also reported gender differences concerning the fear of COVID-19 [18,19]. Moreover, personality traits were associated with fear of COVID-19, and neuroticism has been indicated as a risk factor associated with mental health problems [20,21]. In other words, people with high levels of fear of COVID-19 and high levels of neuroticism seemed more at risk of developing mental health problems [22].

The COVID-19 pandemic has exacerbated anxiety and mood disorders among people who already suffered from these diseases [23], but also among the general population [24], where females tend to report higher anxiety levels than males [25]. In previous studies, fear of COVID-19 has been associated with anxiety, which, on the one hand, significantly predicted severe fear of COVID-19, and, on the other hand, high fear of COVID-19 predicted an increase in anxiety [26,27]. In addition, the university student population faced high levels of stress and anxiety, mainly caused by the closure of universities and the adoption of distance learning [28,29], and this impact was even bigger on freshmen [30] who were not able to manage the ability to regulate the emotions related to their studies because of the novelty of their studies. Conversely, older students tended to be more confident and reported higher scores in online learning readiness [31,32].

In relation to lifestyle choices during the pandemic, the fear associated with COVID-19 has certainly influenced daily practices, such as using social networks [33], technological devices [34], and sports practice. Despite several countries allowing outdoor PA during lockdown restrictions, scientific literature reported a decrease in PA amounts [35,36]. The decrease in PA amount might have had consequences not only for physical and mental health but also for the public health level for specific populations [35]. Notably, the practice of sports creates an educational environment for youth growth [37], which helps shape personality, cognition, and emotions [38]. Moreover, performing physical activity during quarantine had a protective effect on hospitalization for COVID-19 [39] and respiratory pathologies derived from the infection [40].

A number of studies about protective factors have found that physically active people tend to display lower levels of negative effects, such as stress, anxiety, and depression [41,42]. For example, a study by Kekäläinen et al. [43] reported that the more women engaged in PA, the lower their neuroticism level was. Another protective factor could be self-efficacy, which helps people keep their motivation high in stressful life situations and avoid permanent mental health damage after exposure to a traumatic situation like the pandemic [44]. It was observed that physically active people tend to report higher levels of general self-efficacy than sedentary people [45,46]. Additionally, other studies have indicated general self-efficacy as a protective factor against negative effects through the enhancement of psychological resilience [47,48]. General self-efficacy is impacted in cases of high levels of neuroticism since this personality trait impacts the evaluation of a new life event [49]. State and trait anxiety negatively influence self-efficacy, particularly in the academic domain and more so in the case of university students [50].

Finally, the relationship between PA and personality traits is considered unidirectional, i.e., a certain pattern of personality traits predicts engagement in PA, but it is also possible that, in the case of stressful life events, the practice of PA protects against the increase of neuroticism levels [51]. In this sense, it could be possible that people engaging in PA during the pandemic restrictions experienced protective effects for their mental health [52–54].

Furthermore, there were no previous studies that investigated the protective effect of PA on personality factors and anxiety and their influence on general self-efficacy during the COVID-19 pandemic in young adults. Therefore, the aim of the current study is to clarify if sports practice might have had a protective effect on young adults' fear of COVID-19, anxiety levels, and neuroticism. We hypothesize that:

Hypothesis 1 (H1). *Youngsters who practiced outdoor sports or PA would display lower levels of fear of COVID-19, lower levels of anxiety, lower levels of neuroticism, and higher levels of self-efficacy compared to people who did not practice any PA.*

Hypothesis 2 (H2). *Females would obtain higher scores of COVID-19 fear, state and trait anxiety, and neuroticism.*

Hypothesis 3 (H3). *High levels of fear of COVID-19, being female, and not practicing any sport/PA negatively influence neuroticism levels, which in turn positively influence state and trait anxiety that determine a decrease in general self-efficacy level in young adults.*

2. Materials and Methods

2.1. Participants

The sampling was conducted online through social networks, using the “snowballing” procedure of spreading the link of the survey during the COVID second-wave Italian lockdown phase (from March to May 2021). During this period, students attended university classes through distance learning, and going out of the house was not allowed.

Further, out of an initial sample of 305 students, 29 questionnaires were disregarded due to incompleteness. The final sample consisted of 276 university students from the University of Palermo (176 females, 63.8%), whose mean age was 22.13 years (SD: ± 3.94). The sample mainly consisted of students from the first year of study (48.6%), the second year (28.3%), and students with a bachelor’s degree (69.6%). A greater number of the students did not study and work at the same time (85.9%) and lived in a city apartment during the pandemic (53.3%) with their family (90.6%). The students mainly attended sport science (24%) and pedagogy classes (24%), followed by psychology (13%), engineering (13%), and philosophy (11%).

The participants expressed their consent to anonymously participate in the survey, respecting the principles of the Declaration of Helsinki. The Bioethics Committee of the University of Palermo has approved the current study (n. 38/2021).

2.2. Measures

2.2.1. Pandemic Habits during COVID-19 Restrictions

The first section of the questionnaire collected information on participants’ habits during the COVID-19 pandemic (see Supplementary Materials). Information about the course year of study, working condition, living place during the pandemic, and practice of sports and physical activity were detected. Based on the answers to the question “did you practice any outdoor sport or physical activity during the pandemic restrictions?”, we categorized “active youngsters during the pandemic” and “sedentary youngsters during the pandemic.”

2.2.2. Fear of COVID-19

The Fear of COVID-19 [16] is a self-report questionnaire consisting of 7 items on a 5-point scale (from 1—“strongly disagree”—to 5—“strongly agree”). The questionnaire consists of a unique scale measuring the fear of COVID-19 in adults (e.g., “I am most afraid of Coronavirus-19”). The total score was calculated by calculating the sum of all the item scores (Cronbach’s alpha = 0.86), whose reliability is similar to that reported in the Italian version [55].

2.2.3. State-Trait Anxiety Inventory (STAI)

The Spielberger State-Trait Anxiety Inventory (STAI-S; [56]) is a questionnaire assessing state and trait anxiety levels in adults through two independent subscales of 40 items. For the purpose of the study, the Italian adaptation of the STAI was adopted, consisting of 10 items divided into two subscales. Five items measured state anxiety (e.g., “I feel that difficulties are piling up so that I cannot overcome them”), while the other five assessed trait anxiety (e.g.,

“I feel confused”) on a 4-point scale (1—not at all, 2—somewhat, 3—moderately so, and 4—very much so). A higher score indicates higher anxiety. Cronbach’s alphas were 0.85 for STAI-trait and 0.89 for STAI-state, which were similar to the original standardization [57].

2.2.4. Neuroticism

The personality inventory (PI; [58]) was used in measuring neuroticism. The PI which is a questionnaire consisting of 20 items and comprising five subscales corresponding to five personality dimensions: neuroticism (N), conscientiousness (C), extraversion (E), agreeableness (A), and openness (O). Each item is rated on a 5-point scale (from 1: strongly disagree to 5: strongly agree). In the present study, we referred to the total score for neuroticism only (Cronbach’s alpha coefficient: 0.75), whose reliability was similar to the one reported in the original study [58].

2.2.5. Self-Efficacy

The General Self-Efficacy Scale (GSE; [59]) is a self-reported measure of self-efficacy. It comprises items with good internal reliability (Cronbach’s alphas between 0.76 and 0.90). Each item is assessed on a 4-point scale (from 1: “Not at all true” to 4: “Exactly true”). The total score was obtained by calculating the sum of all items. The score ranges between 10 and 40, with a higher score corresponding to a more general SE. In the present study, the standardized Cronbach’s α coefficient of general SE was 0.85, similar to other studies [60].

2.3. Data Analysis

The data were analyzed through the R software (version 4.0.5.). Additionally, descriptive statistics were performed on habits during the pandemic and on fear of COVID-19, anxiety, neuroticism, and self-efficacy.

The differences between genders and between sedentary and active students were estimated by performing a 2 (gender: male vs. female) \times 2 (physical activity: sedentary vs. active) factorial ANOVA concerning fear of COVID-19, state anxiety and trait anxiety, neuroticism, and self-efficacy. A post-hoc test for the ANOVAs was performed using Tukey’s test.

For the estimation of the influence among the considered variables (i.e., gender, sport/PA practice, fear of COVID-19, state and trait anxiety, neuroticism, and self-efficacy), we first calculated Pearson’s r . Finally, a path analysis model was performed to better clarify the relationship occurring among the overmentioned variables.

3. Results

3.1. Descriptive Statistics

In outdoor sport/PA practices, 164 participants (59.4%) declared themselves to be sedentary during the pandemic. Figure 1 shows the percentages of males and females distinguished by being physically active or sedentary during the pandemic. The chi-squared test did not evidence any association between the outdoor sport/PA practice and gender ($\chi^2 = 0.13$, $p = 0.71$).

Descriptive statistics were also performed for the scores of COVID-19 fear, state and trait anxiety, neuroticism, and self-efficacy. Table 1 reports descriptive statistics of fear of COVID-19, state and trait anxiety, neuroticism, and self-efficacy scores distinguished for gender and sport/PA practice.

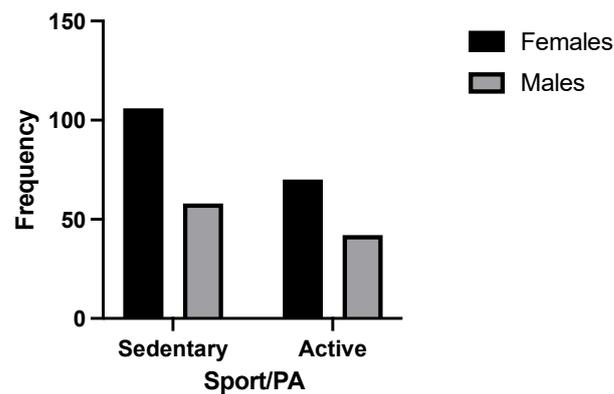


Figure 1. Sport/PA practice distinguished by gender.

Table 1. Descriptive statistics of fear of COVID-19, anxiety, neuroticism, and self-efficacy scores.

	Gender					Sport/PA Practice				
	Female (<i>n</i> = 176)		Male (<i>n</i> = 100)		<i>t</i>	Sedentary (<i>n</i> = 164)		Active (<i>n</i> = 112)		<i>t</i>
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Fear of COVID-19	17.11	6.53	13.79	5.16	4.37 ***	15.91	6.24	15.90	6.34	0.02
State Anxiety	13.36	4.27	11.74	3.90	3.13 **	13.57	4.02	11.61	4.22	3.91 ***
Trait Anxiety	13.55	3.75	11.74	3.55	3.93 ***	13.57	3.75	11.90	3.60	3.70 ***
Neuroticism	12.07	3.28	10.24	3.24	4.59 ***	11.76	3.32	10.90	3.24	2.12 *
Self-efficacy	27.17	5.20	28.28	3.83	−1.86	26.75	4.97	28.78	4.20	−3.54 ***

*** $p < 0.001$. ** $p < 0.01$. * $p < 0.05$.

3.2. Differences between Genders and Sport/PA Practice

3.2.1. Fear of COVID-19

The ANOVA model (see Figure 2) showed a significant difference in terms of fear of COVID-19 between males and females ($F_{1,272} = 22.26$, $p < 0.001$, $\eta^2_p = 0.08$), but not in physical activity ($F_{1,272} = 0.27$ ns). The interaction between gender and physical activity was significant ($F_{1,272} = 4.91$, $p = 0.03$, $\eta^2_p = 0.02$).

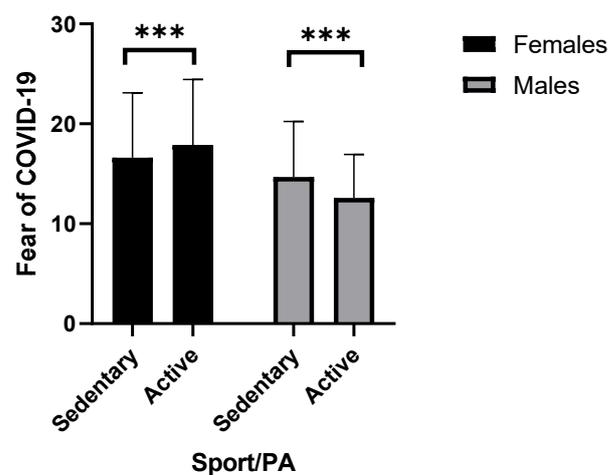


Figure 2. Differences between male and female students and between sedentary and active students concerning fear of COVID-19. (***) $p < 0.001$.

In the post-hoc test, a nonsignificant difference emerged between active and sedentary females ($t = -1.40$, $df = 272$ ns), as well as active and sedentary males ($t = 1.72$, $df = 272$ ns), but not between sedentary females and sedentary males ($t = 1.95$, $df = 272$ ns). However,

significant differences emerged between active males and females ($t = 4.52$, $df = 272$, $p < 0.001$), where active females reported a higher level of fear of COVID-19 than active males, active females, and sedentary males ($t = 3.01$, $df = 272$, $p = 0.02$), and between sedentary females and active males ($t = 3.65$, $df = 272$, $p = 0.02$).

3.2.2. Anxiety

Gender differences emerged in state-anxiety (Figure 3; $F_{1,272} = 9.30$, $p = 0.003$, $\eta^2_p = 0.03$), where females reported higher levels of state-anxiety ($t = 3.05$, $df = 272$, $p = 0.003$). Youth practicing sports/physical activity reported a lower level of state-anxiety compared to their sedentary counterparts ($F_{1,272} = 13.85$, $p < 0.001$, $\eta^2_p = 0.05$). The interaction between gender and physical activity was nonsignificant ($F_{1,272} = 0.01$ ns).

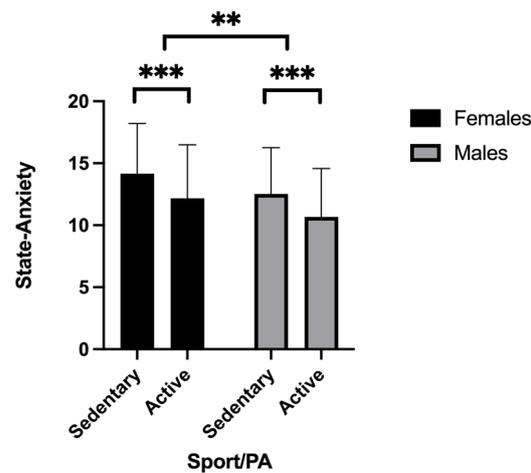


Figure 3. Differences between male and female students, and between sedentary and active students concerning state anxiety. (** $p < 0.01$; *** $p < 0.001$).

Additionally, in the trait anxiety (Figure 4), gender differences emerged ($F_{1,272} = 15.21$, $p < 0.001$, $\eta^2_p = 0.05$), where females reported higher levels of anxiety ($t = 3.90$, $df = 272$, $p < 0.001$). It was observed that there were significant differences between sedentary and active people, where sedentary people reported higher anxiety levels than active people ($t = 3.61$, $df = 272$, $p < 0.001$, $\eta^2_p = 0.05$). Further, the interaction between gender and physical activity was nonsignificant ($F_{1,272} = 0.03$ ns).

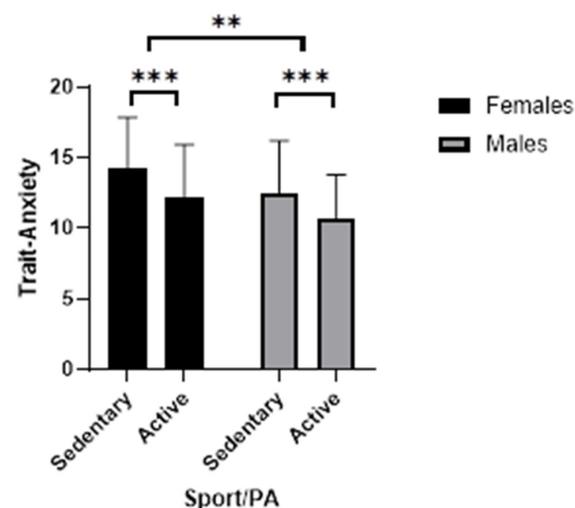


Figure 4. Differences between male and female students and between sedentary and active students concerning trait anxiety. (** $p < 0.01$; *** $p < 0.001$).

3.2.3. Neuroticism

On neuroticism (Figure 5), gender differences emerged ($F_{1,272} = 20.34$, $p < 0.001$, $\eta^2_p = 0.07$), where females reported higher levels of neuroticism than males ($t = 4.51$, $df = 272$, $p = 0.04$, $\eta^2_p = 0.05$). Additionally, significant differences emerged between sedentary and active people ($F_{1,272} = 4.18$, $df = 272$, $p = 0.04$, $\eta^2_p = 0.02$), where sedentary people reported higher levels of neuroticism than physically active people ($t = 2.04$, $df = 272$, $p = 0.04$). Further, no significant interaction emerged between gender and physical activity ($F_{1,272} = 0.01$ ns).

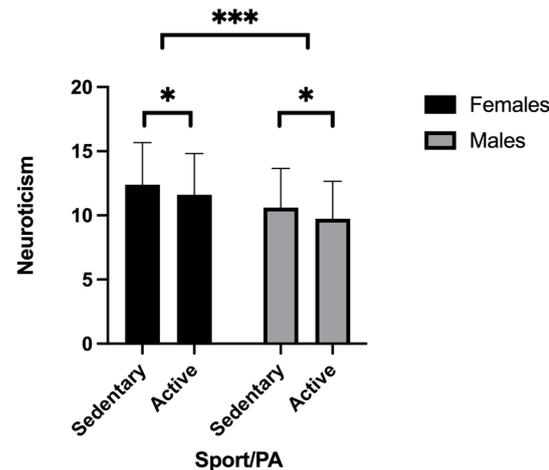


Figure 5. Differences between male and female students and between sedentary and active students concerning neuroticism. (** $p < 0.001$; * $p < 0.05$).

3.2.4. Self-Efficacy

There were no gender differences in terms of self-efficacy (Figure 6; $F_{1,272} = 3.13$ ns), while there were significant differences between active and sedentary people ($F_{1,272} = 11.15$, $p < 0.001$, $\eta^2_p = 0.04$), where physically active people reported higher levels of self-efficacy ($t = -3.54$, $df = 272$, $p < 0.001$). No interactions were retrieved concerning gender and physical activity ($F_{1,272} = 0.02$ ns).

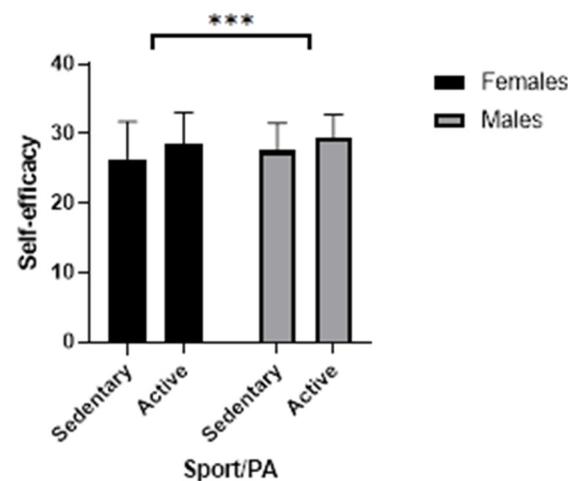


Figure 6. Differences between male and female students and between sedentary and active students concerning self-efficacy. (** $p < 0.001$).

3.3. Relationships among Variables

3.3.1. Correlations among Variables

The considered variables showed a good intercorrelation, apart from sport and PA practice, that does not have a direct relation with fear of COVID-19, while gender does not have any relation with self-efficacy or with PA practice (Table 2).

Table 2. Correlation among the considered variables.

	1	2	3	4	5	6	7
Fear of COVID-19 (1)	-						
State Anxiety (2)	0.27 ***	-					
Trait Anxiety (3)	0.25 ***	0.73 ***	-				
Neuroticism (4)	0.34 ***	0.58 ***	0.70 ***	-			
Self-efficacy (5)	-0.10	-0.26 ***	-0.37 ***	-0.42 ***	-		
Sport/PA (6)	0.00	-0.23 ***	-0.22 ***	-0.13 *	0.21 ***	-	
Gender (7)	-0.26 ***	-0.19 ***	-0.23 ***	-0.27 ***	0.11	0.02	-

*** $p < 0.001$. * $p < 0.05$.

3.3.2. Path Analysis Model

The path analysis model showed a good fit ($\chi^2 = 198.92$, $df = 81$, $p < 0.001$; RMSEA = 0.07, 90% CI: 0.06–0.08; CFI = 0.93, TLI: 0.91; SRMR: 0.05). The results of the model reported a positive relationship between fear of COVID-19 and neuroticism ($\beta = 0.29$, $p < 0.001$), which in turn is related to state anxiety ($\beta = 0.58$, $p < 0.001$) and trait anxiety ($\beta = 0.73$, $p < 0.001$). The trait of anxiety, in turn, is negatively related to self-efficacy ($\beta = -0.52$, $p < 0.001$). The male (1 = female, 2 = male; $\beta = -0.19$, $p < 0.001$) and physically active (0 = sedentary, 1 = active; $\beta = -0.12$, $p < 0.05$) are negatively associated with neuroticism as well. In addition, no relationship between state anxiety and self-efficacy or neuroticism and self-efficacy was found (Figure 7).

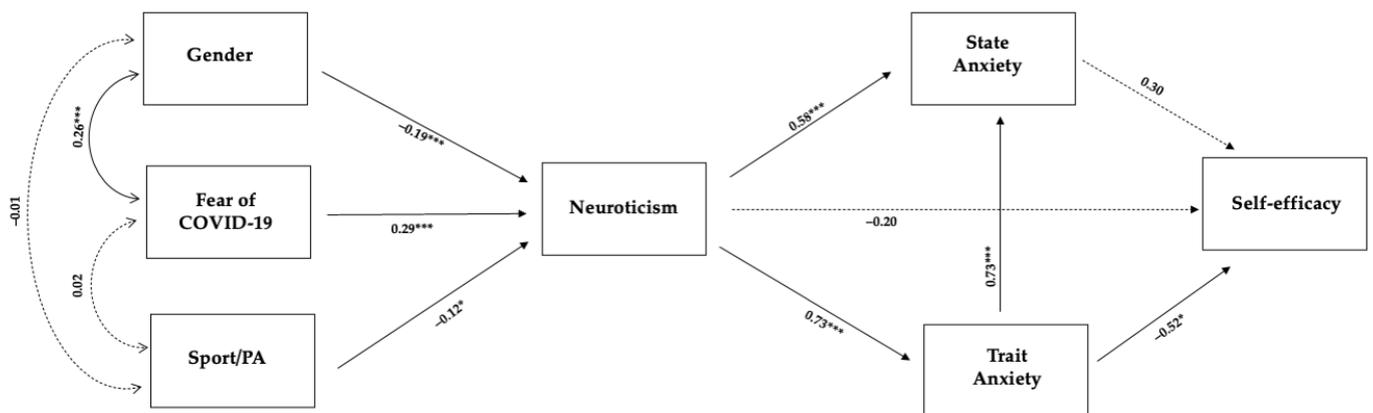


Figure 7. Path analysis model results. Legend: *** $p < 0.001$, * $p < 0.05$.

4. Discussion

The aim of the current study was to clarify if the sport/PA practice could have had a protective effect on youth psychological health, limiting the negative impact of COVID-19. Specifically, we detected the scores of COVID-19 fear, neuroticism, anxiety, and self-efficacy for both physically active and sedentary youth and between males and females in the university student population.

The initial hypothesis predicted that youngsters who practiced outdoor sports or PA would have displayed lower levels of fear of COVID-19, lower levels of anxiety, lower levels of neuroticism, and higher levels of self-efficacy compared to people who did not practice any PA. In our results, we found lower levels of state and trait anxiety and neuroticism, as well as higher levels of self-efficacy, in youth practicing outdoor physical activity.

However, similar results were reported on a sample of adolescents by Wright, Williams, and Veldhuijzen van Zanten [52], where physical activity counteracted the negative effects of fear of COVID-19 on anxiety, stress, and depression levels. Moreover, a study by Puccinelli et al. [61] found that high levels of anxiety were associated with sedentary behavior during the COVID-19 quarantine, while another study by Marashi et al. [62] found that a decrease in aerobic and strength-based physical activity during the pandemic was associated with higher levels of anxiety and depressive symptoms.

According to our second hypothesis, females would have obtained higher scores of COVID-19 fear, state and trait anxiety, and neuroticism, and our results were in this direction. It is well known that females display higher levels of neuroticism, anxiety, and fear [63,64]. In addition, having a higher level of neuroticism could determine higher levels of fear of COVID-19 when exposed to situations interpreted as being at risk of contagion. From the other side, females usually report higher levels of fear of COVID-19 [19,65].

Furthermore, our study found a significant interaction between the practice of sport/PA and gender concerning fear of COVID-19: while PA seemed to be protective for males, the same apparently did not happen for sedentary females, who reported lower levels of fear of COVID-19. A number of studies found that being male and practicing physical activity were protective factors against the development of mental issues [66], but no studies in the literature reported PA as a protective factor for males only. In addition, females were more likely to comply with COVID-19 limitations than males [67,68]. It can be that the fear of COVID-19 increases due to the high levels of neuroticism and anxiety, combined with the attempt to respect COVID-19 limitations. However, gender differences emerged in anxiety and neuroticism levels and between sedentary and physically active youngsters, but the protection effect of PA similarly acted for both genders. In our third hypothesis, we stated that high levels of fear of COVID-19, being female, and not practicing any sport/PA negatively influence neuroticism levels, which in turn positively influence state and trait anxiety that determine a decrease in general self-efficacy level in young adults. From the path analysis model, high fear of COVID-19 and being sedentary during the pandemic were related to a higher level of neuroticism, which in turn was related to higher levels of state and trait anxiety, and trait anxiety was related to lower levels of general self-efficacy. Conversely, being physically active was associated with lower levels of neuroticism, which in turn was related to lower trait anxiety and then higher self-efficacy.

In our model, state anxiety was not related to self-efficacy. In addition, previous studies highlighted that the link between state anxiety and self-efficacy is controversial, especially if state anxiety refers to an academic context, probably because state anxiety encourages students to express their potential [69,70].

University students particularly suffered from increased anxiety and depression, especially freshmen and sophomores compared to senior students, and this was mainly due to the sudden transition to distance learning [71]. However, in our model, the contribution of physical activity to protecting youngsters' mental health is very small. The current study attempts to create a picture about the interactions among gender, personality factors, mood, and PA practice.

Finally, the study comes out with several limitations: first of all, we lack information about the frequency and intensity of PA during the week and before the pandemic, nor the type of sport/physical activity performed, so we cannot estimate the extent to which exercise increases mental health. Moreover, we could not assess contextual variables, such as socioeconomic status, that could have affected our results. Finally, the correlational nature of the study does not allow inferences on causal relations among the variables.

5. Conclusions

The COVID-19 pandemic restrictions have severely impacted daily life, increasing mental health issues at different life stages. The COVID-19 pandemic represented a challenge, especially for young adults that face important change at this life stage. Additionally, for students approaching university, the adoption of distance learning and staying home

with their families could have increased anxiety and neuroticism levels due to familiar dynamics [72], changing routines [73], and sharing small spaces. The results of the current paper highlight a potential role of physical activity in protecting university students' mental health while also finding some controversial results concerning females' fear of COVID-19. Women's mental health is another important topic that needs to be further investigated, since it is well known that they usually report higher levels of anxiety, neuroticism, and fear than their male counterparts. A disruptive event such as the pandemic might have worsened women's mental health.

Given the importance of this topic, future research should collect more detailed information about the protective effect of PA at different ages and clarify better what variables can protect females from the detrimental effects of negative life events.

Supplementary Materials: The following are available online at <https://www.mdpi.com/article/10.3390/su15010752/s1>.

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Informed Consent Statement: Participants signed an informed consent to complete the study.

Data Availability Statement: Data are available under formal request to the Bioethics Committee of the University of Palermo.

Conflicts of Interest: The authors declared no conflict of interest.

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