

Table I - Main characteristics of the studies included in the review

Authors, year	Country	Study design	Sample size (age, in years)	Gender/Sex	Population	Recruitment
Antunes <i>et al.</i> , 2020 [24]	Portugal	transversal	1404 (36.4 ± 11.7)	F = 977 (69.6%) M = 426 (30.3%) NI = 1 (0.1%)	General population	Social networks and newspapers
Romero-Blanco <i>et al.</i> , 2020 [25]	Spain	transversal	213 (20.5 ± 4.56)	F = 172 (80.8%) M = 41 (19.2%)	University students	Online questionnaire (Google Forms)
Xiang <i>et al.</i> , 2020 [26]	China	transversal	1396 (20.68 ± 1.84)	F = 515 (36.9%) M = 881 (63.1%)	University students	Internet via WeChat public platform
Zhang <i>et al.</i> , 2020 [27]	China	longitudinal	66 (20.7 ± 2.11)	F = 41 (62.1%) M = 25 (37.9%)	University students	Internet via WeChat public platform
Alzahrani <i>et al.</i> , 2021 [28]	Saudi Arabia	transversal	518 (37.3 ± 14.3)	F = 169 (32.6%) M = 349 (67.4%)	General population	Social networks Twitter, Facebook, WhatsApp
Antunes <i>et al.</i> , 2021 [29]	Portugal	transversal	1404 (36.4 ± 11.7)	F = 977 (69.6%) M = 426 (30.3%) NI = 1 (0.1%)	General population	Social networks (Facebook and Instagram) and regional newspapers
Czenczek-Lewandowska <i>et al.</i> , 2021 [30]	Poland	longitudinal	506 (24.67 ± 4.23)	F = 355 (70.2%) M = 151 (29.8%)	Residents in Southeast Poland	Online questionnaire (Google Forms)
Faulkner <i>et al.</i> , 2021 [31]	United Kingdom, Ireland, New Zealand, and Australia	transversal	8425 (44.5 ± 14.8)	F = 5956.5 (70.7%) M = 2468.5 (29.3%)	Physically active individuals	Online questionnaire (Google Forms)

Gierc <i>et al.</i> , 2021 [32]	Australia Canada USA Hong Kong Ireland Philippines UK/Northern Ireland	transversal	522 (32.2 ± 13.6)	F = 452 (86.8%) M = 66 (12.6%) Not binary = 2 (0.8%) NI = 2 (0.4%)	English speaking adults	Internet via hyperlink to an online questionnaire
Kirmizi <i>et al.</i> , 2021 [33]	Turkey	transversal	170 F = 28 (median: 23 in the 1 st quartile and 28 years in the 3 rd quartile) M = 29 (median: 24 in the 1 st quartile and 39 years in the 3 rd quartile)	F = 85 (50.0%) M = 85 (50.0%)	Individuals living in the urban area	Social networks (Instagram, Facebook, WhatsApp)
Puccinelli <i>et al.</i> , 2021 [34]	Brazil	transversal	1853 (38.6 ± 12.4)	F = 1110 (59.9%) M = 743 (40.1%)	General population	Websites, email, and social networks (Instagram, Facebook, WhatsApp)
Reigal <i>et al.</i> , 2021 [35]	Spain	transversal	328 (37.06 ± 10.82)	F = 209 (63.7%) M = 119 (36.3%)	General population of the region of Andalusia	Social networks

USA = United States of America; UK = United Kingdom; F = female; M = male; NI = not informed

Table II - Objectives, measures (instruments), and results of studies included in the review

Studies	Objectives	Measures/ Instruments	Results
Antunes <i>et al.</i> [24]	To understand the life habits (sleep, food, physical activity) of the Portuguese adult population and analyze the levels of anxiety and the satisfaction of basic psychological needs during the COVID-19 pandemic.	IPAQ-SF STAI BNSG-S	Men showed higher values for total energy expenditure and for competence satisfaction. The group of younger adults, aged between 18 and 34 years, had higher anxiety scores, lower competency satisfaction scores, and lower levels of physical activity.
Romero-Blanco <i>et al.</i> [25]	To analyze the changes in the practice of physical activity, adherence to the Mediterranean diet, and motivation to sedentary behavior, resulting from alcohol and tobacco consumption, anxiety/depression symptoms of university students, during confinement.	IPAQ-SF EQ-5D PREDIMED TTM	Students spent more time doing physical activities, but when their usual environment was limited, they spent more time sitting. There were no changes in behavior among students who, even before confinement, were already overweight or obese.

Xiang <i>et al.</i> [26]	To assess the relationship between the type of physical activity (adequate/inadequate) and anxiety and depression during the COVID-19 outbreak.	IPAQ-SF SAS SDS	The prevalence rate of anxiety among university students was 31% and that of depression was 41.8%; Moderate and high intensities of physical activities such as resistance training and housework were protective factors against anxiety or depression among college students.
Zhang <i>et al.</i> [27]	To examine the mitigating effects of exercise on mental disorders and determine the dose-response relationship between physical activity and mental distress.	IPAQ-SF C-PSQI DASS-21 BPAQ	The adequate amount of weekly physical activity to minimize negative emotions was about 2500 METs, corresponding to daily physical activities of 108 min at a light intensity, 80 min at moderate intensity, or 45 min at vigorous intensity.
Alzahrani <i>et al.</i> [28]	To investigate associations between physical activity and levels of psychological status and quality of life in Saudi adults during the COVID-19 pandemic.	IPAQ-SF DSM-5 PCL-5 HRQoL SF-8 DASS-9	Physical activity and psychological state levels revealed that, regardless of the level of psychological impact, there was a significant increase in quality of life improvement for highly active and sufficiently active practitioners compared to inactive participants.
Antunes <i>et al.</i> [29]	To examine the associations between physical activity, different levels of anxiety, and perceived satisfaction of basic psychological needs, during social isolation due to the 2019 coronavirus pandemic.	IPAQ-SF STAI BNSG-S	People with higher levels of physical activity have higher values of autonomy and competence satisfaction, and lower levels of anxiety, both when analyzing the variation related to the physical activity category, and when testing the moderating effect on gender in the associations between physical activity and state of anxiety.
Czenczek-Lewandowska <i>et al.</i> [30]	To analyze the magnitude of the harmful effects of the COVID-19 pandemic on the physical and mental well-being of the young population.	IPAQ-SF FFQ-6 PSQI GAD-7	The pandemic caused a significant reduction in physical activity levels and a prolonged sedentary time, a significant increase in the feeling of generalized anxiety and worsening of sleep quality, and a significant increase in the consumption of alcohol and fatty foods.
Faulkner <i>et al.</i> [31]	To assess the amount of exercise performed, mental health, and well-being during social restrictions due to the COVID-19 pandemic among young and physically active populations.	IPAQ-SF SCS DASS-9 WHO-5	Individuals who reduced the amount of physical exercise due to social restrictions had worse mental health and well-being; Individuals who maintained or increased the amount of physical exercise during the pandemic demonstrated a positive change or no decline in mental health and well-being.
Gierc <i>et al.</i> [32]	To investigate associations between changes in regular physical activity (moderate to vigorous) and mental health (depressive and anxiety symptoms, and life satisfaction) in adults during the COVID-19 pandemic.	IPAQ-SF PHQ-9 GAD-7 SWLS	Individuals who maintained or increased levels of physical activity demonstrated less psychological disturbance; Individuals with a decline in the practice of regular physical activity with moderate and/or vigorous intensities reported relatively greater psychological distress and lower life satisfaction.
Kirmizi <i>et al.</i> [33]	To compare the relationship between the levels of anxiety between genders and investigate the symptoms with the practice of physical activity.	IPAQ-SF SHAI NMQ	Women became less physically active than men and had a higher level of anxiety.

Puccinelli <i>et al.</i> [34]	To study the impact of social distancing and the association between physical activity level and mood state (symptoms of depression and anxiety).	IPAQ PHQ-9 GAD-7	The higher presence of symptoms related to anxiety and depression was associated with low levels of physical activity, low monthly family income, and younger age. Higher percentage of men without a mood disorder among the most physically active.
Reigal <i>et al.</i> [35]	To analyze the relationships between the level of physical activity, mood, state of anxiety, and health perception in a group of adults in the COVID-19 pandemic.	IPAQ-SF POMS STAI GHQ-12	The practice of physical activity is related to better mental health states, better mood, fewer anxiety symptoms, and better self-perception of health.

IPAQ-SF = International Physical Activity Questionnaire Short-form; STAI = State-Trait Anxiety Inventory; BNSG-S = Basic Need Satisfaction in General Scale; EQ-5D = EuroQol 5D questionnaire to assess health status and the existence of anxiety/depression problems; PREDIMED = Mediterranean Diet Assessment Questionnaire; TTM = Transtheoretical model; SAS = Self-Rating Anxiety Scale; SDS = Self-Rating Depression Scale; C-PSQI = Pittsburgh Sleep Quality Index Chinese version; DASS-21 = Depression Anxiety Stress Scale; BPAQ = Buss-Perry Aggressive Questionnaire; DSM-5 = Diagnostic and Statistical Manual of Mental Disorders; PCL-5 = Posttraumatic Stress Disorder Checklist; HRQoL SF-8 = Health-related Quality of Life Short Form-8; DASS-9 = Depression, Anxiety and Stress Scale-9; FFQ-6 = Modified Food Frequency Questionnaire; PSQI = Pittsburgh Sleep Quality Index; GAD-7 scale = Generalized Anxiety Disorder, 7-item; SCS = Stages of Change scale for exercise behaviour change; WHO-5 = World Health Organisation-5 Well-being Index; PHQ-9 = Patient Health Questionnaire, 9-items; SWLS = Satisfaction with Life Scale; SHAI = Short Health Anxiety Inventory; NMQ = Nordic Musculoskeletal Questionnaire; POMS = Profile of Mood States; GHQ-12 = General Health Questionnaire

Table III - Relationship between physical activity and anxiety levels

Study	Physical activity levels	Anxiety states	Result
Antunes <i>et al.</i> [24]	Low: 447 ± 31.8 Moderate: 697 ± 49.6 High: 260 ± 18.5	Anxiety state: 45.1 ± 11.2 Anxiety trait: 37.9 ± 10.3	Higher levels of PA are recommended to lessen the effects of anxiety in people who have decreased amounts of PA.
Romero-Blanco <i>et al.</i> [25]	Vigorous PA days = 2.19 ± 2.02 Moderate PA days = 3.15 ± 2.05 Minutes of vigorous PA = 30.66 ± 30.94 Moderate PA minutes = 47.74 ± 50.80 Total minutes of weekly PA = 383.17 ± 438.90	EuroQol 5D (EQ-5D) = 366.20 ± 409.69	PA reduced anxiety levels.
Xiang <i>et al.</i> [26]	Mean (min/week) of intense PA: 90.09 ± 78.53; moderate PA: 133.34 ± 79.70; light PA: 157.45 ± 95.31	Anxiety: Severe: -0.121, T=-4.066 (p≤0.001*), Moderate: -0.012, T=0.391 (p≤0.695), Low: NA *Statistically significant Depression: Severe: -0.179, T=-6.071 (p≤0.001*), Moderate: -0.095, T=3.221 (p=0.001*), Low: NA	PA reduced anxiety levels.
Zhang <i>et al.</i> [27]	Recommends an average of 2500 METs of PA per week	Reduction of psychological damage. The ideal amount to decrease anxiety levels was 2500 MET/week.	PA reduced anxiety levels.

Alzahrani <i>et al.</i> [28]	Inactive: < 600 MET/wk Sufficiently active: ≥ 600 MET/week Very active: ≥ 3000 MET/week Health-related QoL Scale: the average impact of COVID on perceived QoL. They report a low level of impact associated with high perceived QoL, at least 3000 MET-min/wk, (=n predictable marginal mean HRQoL = 89.13; p=0.008) than when they engaged in less than 600 MET-min/week (p=0.019) and moderate (p<0.001). For individuals who reported a moderate level of impact from COVID, concerning the expected marginal average, those who practiced between 600 and 3000 MET/wk, the average was higher (77.34 vs. 79.08), evidencing the increase in AF high impact of COVID, at least 600 MET/without PA increased the QoL perception (66.15; p=0.019).	Psychological suffering. People who reported high, moderate, and low. Among high, those in psychological distress were lower when they engaged in at least 600 MET-min/week of total PA (predicted marginal mean psychological distress = 44.31) than when they engaged in less than 600 MET-min/week of the total PA.	PA reduced anxiety levels.
Antunes <i>et al.</i> [29]	Participants reported PA levels as low: 447 ± 31.8; moderate: 697 ± 49.6; high: 260 ± 18.5	Anxiety state: low: 46.94 ± 11.51; moderate: 44.79 ± 11.04; high: 42.68 ± 10.40 Anxiety trait: low: 39.70 ± 10.71; moderate: 37.42 ± 9.88; high: 36.01 ± 9.98	PA reduced anxiety levels.
Czenczek-Lewandowska <i>et al.</i> [30]	PA = 8752.5 median MET [± 5288.9 Anxiety level. General Pre-PA: Mild (74.7%), Moderate (18.4%), Moderate-Severe (5.1%), Severe (1.8%).	PA = 5483.0 median MET [PA reduction] ± 4933.3 Post-PA general anxiety level: mild (48.0%), moderate (32.8%), moderate-severe (11.3%), severe (7.9%) (PA) (general anxiety) Z=9.59, p<0.001.	Increased levels of emotional disorders, but with possibilities of reduction through higher PA scores.
Faulkner <i>et al.</i> [31]	IPAQ-SF ratings n (%) Low AF [707 (8.4%)], Moderate [4,521 (53.7%)], High [3,198 (37.9%)].	Spearman's correlation coefficient (rho [95% CI]) showed negative correlations between PA and anxiety (rho = -0.13 [-0.15, -0.11]; p<0.001) during the initial restrictions of the COVID-19.	PA reduced anxiety levels.
Gierc <i>et al.</i> [32]	Before the COVID-19 pandemic, 68.2% of participants reported being sufficiently active for health benefits (ie > 150 min 193 MVPA per week). This decreased to 60.6% of participants during the initial period of the pandemic.	Reports of improved perception of QoL and reduction of symptoms of anxiety and depression for those who did more than 150 min/week of PA.	PA reduced anxiety levels.
Kirmizi <i>et al.</i> [33]	157 (24.3%) [Low (less than 1 day per week)], 318 (49.3%) [Medium (2-4 times per week)], 170 (26.4%) [High (more than 5 times a week)].	In women, SHAI = significant change for anxiety (p = 0.042) was mild to weak (p = 0.387) in relation to TPA.	PA reduced anxiety levels.

Puccinelli <i>et al.</i> [34]	Δ (IPAQ vs. GAD-7).	Δ IPAQ score associated with GAD-7 (General Anxiety) in the pre and post difference = 36.99	PA reduced anxiety levels.
Reigal <i>et al.</i> [35]	Mean min/week of intense PA 234.53 \pm 208.04, moderate PA 194.34 \pm 223.14, low PA 168.27 \pm 161.79.	State-anxiety Intense: -1.11 ($p \leq 0.05$), Moderate: -0.19 ($p \leq 0.01$), low: -0.15 ($p \leq 0.001$)	PA reduced anxiety levels.

PA = physical activity; QoL = quality of life; EuroQol 5D (EQ-5D) = questionnaire to assess health status and the existence of anxiety/depression problems; NA = not applicable; MET = multiples of metabolic equivalents of physical activity; min = duration of physical activity in minutes; HRQoL = health-related quality of life; IPAQ = International Physical Activity Questionnaire; MVPA = moderate- to vigorous-intensity physical activity; SHAI = Short Health Anxiety Inventory; TPA: total amount of physical activity; GAD-7 scale = Generalized Anxiety Disorder, * = significant difference for levels < 0.05