



# Motivation and anxiety during the second COVID-19 lockdown in gym exercisers: The mediating role of affects and satisfaction with life

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## Abstract

The present study aimed to analyze the association between motivation (self-determined and non-self-determined motivation), positive and negative affect, life satisfaction and state-anxiety in a sample of gym exercisers, during the 2nd COVID-19 lockdown in Portugal. Also, we aimed to analyze the possible mediating role of positive and negative affect and life satisfaction in the relationship between motivation and levels of state-anxiety. A total of 201 gym participants ( $30.42 \pm 11.22$ ) were enrolled in the present study, of which 116 (57.7%) were women and 85 (42.3%) were men. The survey included sociodemographic data as well as the subsequently validated instruments: the State-Trait Anxiety Inventory, the Positive and Negative Affect Schedule, and the Satisfaction with Life Scale. The results revealed a positive association between state-anxiety and negative affect ( $r = .69$ ), controlled motivation ( $r = .33$ ), and autonomous motivation ( $r = .25$ ). Still, state-anxiety was negatively associated with positive affect ( $r = -.40$ ) and with satisfaction with life ( $r = -.43$ ). In addition, the results of mediation analysis, revealed inconsistent mediation of positive affect and life satisfaction in the relationship between autonomous motivation and state-anxiety. However, a total mediation was observed through negative affect and life satisfaction in the relationship between controlled motivation and anxiety since the indirect effect ( $\beta = .27$ ) is higher than the direct effect ( $\beta = .06$ ). Overall, the results reinforce that positive affect and satisfaction with life could act as a possible buffer against state-anxiety in gym exercisers and, thus, should be considered in future interventions and studies.

**Keywords** Anxiety · Coronavirus · Covid-19 · Motivation · Physical exercise · Well-being

## Introduction

Declared a pandemic by the World Health Organization (World Health Organization, 2020a), Coronavirus (COVID-19) has led, in many countries, to the implementation of measures to minimize the risk of infection (World Health Organization, 2020b). The Portuguese government declared a state of emergency on March 18<sup>th</sup>, 2020, and implemented

preventive measures to safeguard public health (Ribeiro et al., 2020).

The lockdown lived between March and June 2020 (Decree n. 2-A/2020, of 20 March, Resolution of the Council of Ministers n.40-A/2020, of 29th May), and later between January and April 2021 (Decree n.3-A/2021, from 14<sup>th</sup> of January, Resolution of the Council of Ministers n.19/2021, from 13<sup>th</sup> March) (Presidência do Conselho de Ministros, 2021; República Portuguesa, 2021) brought different constraints to people's lives. During these periods, in Portugal, people could leave their homes to take short walks or practice physical activity, although it should be in areas close to their residences. It was prohibited to practice physical exercise in groups or at gyms. Swimming pools, pavilions, stadiums, gyms and sports clubs were closed. Despite the clear benefits of these measures to mitigate the spread of the virus, research shown a negative impact on the physical and mental health of populations in different countries (Antunes et al., 2020; Cao et al., 2020; Ho et al., 2020; Morin & Carrier, 2020). An example of these effects is the clear impact on the levels of anxiety (Antunes

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et al., 2020; Brooks et al., 2020; Jeong et al., 2016), as well as worsening well-being levels of the worldwide population (Blasco-belled et al., 2020; Cheng et al., 2020).

The regular practice of physical exercise is recommended as a behavior with the potential to minimize the psychosocial effects of the pandemic (World Health Organization, 2020c). Thus, it assumes a crucial role not only in the well-known benefits for physical health but also in relation to the levels of anxiety (Chouchou et al., 2021; Stubbs et al., 2017) and subjective well-being (Brand et al., 2020).

Therefore, and considering its physical and mental benefits, particularly during the lockdown period, it becomes essential to understand the role of behavioral regulation in the practice of regular physical activity/exercise by individuals. Although, there are several theoretical models of motivation, in the last three decades the Self-Determination Theory (SDT) has been considered the most prominent model for understanding the cognitive, behavioral, and emotional patterns in several domains including physical activity (Duda, 2013).

## Conceptual framework

The SDT (Ryan & Deci, 2017) describes human motivation based on contextual/social aspects as well as aspects of personality and states that humans are intrinsically active and driven to accomplish optimal growth and well-being (Ryan & Deci, 2017). Particularly, in the exercise domain, this framework is being incisively studied, and therefore, its use is encouraged (Rodrigues et al., 2018; Teixeira et al., 2012). Overall, this theory regarding human motivation (Deci & Ryan, 2008) states that motivation is mediated by the satisfaction of three basic psychological needs: autonomy (i.e., a feeling of independence in which the individual regulates his own actions), competence (i.e., successful interactions with the environment), and relatedness (i.e., social connection with others) (Ryan & Deci, 2007). When these three needs are fulfilled, individuals will experience a higher quality of motivation (more self-determined or autonomous motivation), higher psychological well-being, and will engage and invest more in health-related behaviors (e.g., healthy eating, exercise participation, more positive affect, less state-anxiety, and an increase in the levels of satisfaction with life). However, when these needs are thwarted, lower motivational quality (controlled motivation or non-self-determined motivation), lower well-being, more anxiety, lower satisfaction with life and poor health manifestations may occur (Ryan & Deci, 2017; Vansteenkiste & Ryan, 2013). These three basic psychological needs determine behavior regulation along a motivational continuum of self-determined behavior as postulated by SDT (Ryan & Deci, 2017). Therefore, grounded in organismic integration theory, there are different forms of motivation: amotivation (i.e., characterized by a lack of intention to act or absence of regulation); external regulation

(i.e., to obtain social or material rewards or avoid punishment); introjected regulation (i.e., shame or guilt avoidance, or self-worth pursue); identified regulation (i.e., see value and benefits for the activity); and integrated regulation (i.e., behavior seen as being part of the self/identity). Lastly, intrinsic motivation is the highest degree of self-determined motivation as it is defined as the participation undertaken for the pleasure and enjoyment, satisfaction, and interest derived from the behavior itself (Ryan & Deci, 2017).

Over the years literature has shown that self-determined forms of motivation are positively associated with several outcomes, namely enjoyment (Rodrigues et al., 2020) positive affect (Teixeira et al., 2021) and several health-related outcomes (Ntoumanis et al., 2021). In contrast, controlled motivation has shown to be positively associated with several negative outcomes, including negative affect (Teixeira et al., 2021), anxiety (Vancampfort et al., 2021), exercise dropout, as well as several maladaptive outcomes (Teixeira et al., 2012).

## Correlates of positive and negative affect, life satisfaction and anxiety

Conceptually, positive affect is related to positive moods (e.g., happiness, interest, pride), which are subjectively experienced by individuals, while negative affect is associated with negative moods, including, for example, distress, sadness, and fear (Watson et al., 1988). In addition, it is important to clarify emotions and affect, since they are not equal (Ekkekakis & Dafermos, 2012). While emotions present characteristics of physiological arousal, affect is a mood state (Peterson, 2006). A study conducted by Schmukle et al. (2002) with a sample of fifty-one university students demonstrated that positive affect appears to be associated with a high energy state, as well as pleasurable and full concentration. Moreover, low positive affect is related to sadness; whereas negative affect is a global dimension of subjective distress that encompass several negative mood states. Low negative affect is conceived as being a state of serenity, for example.

Embedded in well-being, life satisfaction has also been considered an important aspect (Diener et al., 1985). In this regard, literature has made a great effort in identifying the factors that influence individual subjective well-being across the world (Kushlev et al., 2020). Concerning well-being, two dimensions have emerged in literature (e.g., Diener et al., 1985; Kuppens et al., 2008): cognitive (i.e., the evaluation of the satisfaction with one's life) and affective (i.e., positive, and negative emotions), which is analyzed in the present study, as we propose to examine the associations of positive and negative affect and life satisfaction.

Concerning the association between positive and negative affect and life satisfaction, research (Jovanović & Joshanloo,

2021) have shown that people make a life satisfaction judgment, where, primarily, affective positive experiences, seem to be an important predictor. A meta-analysis developed by Busseri (2018) on the correlations between life satisfaction and positive and negative affect showed that the correlation between positive affect and life satisfaction was stronger than the correlation observed between negative affect and life satisfaction. A similar finding in the exercise context was observed recently in a sample of 264 Portuguese exercisers (Rodrigues et al., 2021). Individuals with higher levels of positive affect dealt more successfully with mood states and attain a greater sense of life satisfaction. Contrarily, higher negative experience affect has been negatively associated with life satisfaction in several age groups and domains (Busseri, 2018; Jovanović & Joshanloo, 2021).

Furthermore, affect and life satisfaction appears to be important buffers against mental illness, including anxiety states, especially in an adverse situation like lockdown (Smith et al., 2020). Indeed, one of the consequences of the COVID-19 lockdown was the increase in anxiety levels, namely state-anxiety (Cao et al., 2020; Frontini et al., 2021). Conceptually, state-anxiety is a transitory emotional state that consists of feelings of apprehension and nervousness with a physiological activation such as increasing heart rate and/or breathing (Spielberger, 1972; Spielberger et al., 1983). Literature has shown that affect, particularly positive affect, and a clear definition of one's life are important variables against anxiety, specifically in controversial situations (Beutel et al., 2016; Eldeleklioglu, 2015). In contrast, negative affect has been negatively associated with anxiety in a considerable number of studies (Cohen et al., 2017; Smith et al., 2020; Taylor et al., 2020; Watson et al., 1988).

However, few studies have examined the association between motivation (including self-determined and non-self-determined motivation), positive and negative affect, life satisfaction and state-anxiety in gym exercisers, particularly during a lockdown. Specifically, the possible mediation role of positive and negative affect and life satisfaction in the relationship between motivation and anxiety in gym exercisers is still unclear. Previous studies have analyzed the relationship between motivation, positive and negative affect with life satisfaction as an outcome (Jovanović & Joshanloo, 2021; Rodrigues et al., 2021; Teixeira et al., 2021) showing promising results on the associations across these variables. Other studies have analyzed the associations between motivation and anxiety (Sheehan et al., 2018) and between positive and negative affect and life satisfaction with anxiety (Lawton et al., 2017). However, to the best of our knowledge, no study has been performed previously considering all formerly mentioned factors, nor explored the mediation role of positive and satisfaction with life.

## Present study

The present study aimed to analyze the association between motivation (self-determined and non-self-determined motivation), positive and negative affect, life satisfaction and state-anxiety in a sample of gym exercisers, during the second COVID-19 lockdown in Portugal. Specifically, we explored the mediation role of positive and negative affect and life satisfaction in the relationship between motivation and state-anxiety. Considering the above literature, it is hypothesized that:

- self-determined motivation is positively associated with positive affect and life satisfaction and negatively associated with negative affect and state-anxiety (Ryan & Deci, 2017; Teixeira et al., 2021);
- non-self-determined motivation has been positively associated with anxiety and negative affect and negatively associated with positive affect (Ryan & Deci, 2017; Teixeira et al., 2021);
- the positive and negative affect should be positively and negatively, respectively, related to satisfaction with life and state-anxiety (Beutel et al., 2016; Busseri, 2018; Eldeleklioglu, 2015; Jovanović & Joshanloo, 2021);
- life satisfaction is negatively associated with state-anxiety (Beutel et al., 2016; Eldeleklioglu, 2015);
- positive and negative affect and life satisfaction mediates the association between motivation (self-determined and non-self-determined motivation) and state-anxiety. Regarding this last hypothesis, while past studies have not examined simultaneously positive and negative affect as mediators in the proposed relationships, some researchers (Beutel et al., 2016; Busseri, 2018; Eldeleklioglu, 2015; Jovanović & Joshanloo, 2021; Lawton et al., 2017; Rodrigues et al., 2021; Teixeira et al., 2021) have demonstrated preliminary evidence suggesting the importance of these variables in the relationship between motivation and state-anxiety.

## Method

### Participants

A total of 201 gym participants ( $30.42 \pm 11.22$ , 14) were enrolled in the present study, of which 116 (57.7%) were women and 85 (42.3%) were men. The participants had a weekly training frequency (pre-lockdown) of  $3.81 \pm 1.60$  times a week.

The present sample size is in line with several simulations for mediation analysis in terms of the number of variables, thus, ensuring proper statistical power (Fritz & MacKinnon, 2007).

Participants were also informed of the possibility to withdraw from the study at any time. Moreover, subjects were asked to provide their consent before the survey's conclusion. Anonymity was guaranteed.

## Measures

**Behavioral regulations** To assess this construct, the Portuguese version of the Behavioral Regulation Exercise Questionnaire (BREQ-3) (Cid et al., 2018) was used. All six behavioral regulations were measured according to the SDT motivational continuum. This scale comprises 18 items and measures amotivation (e.g., “*I do not understand why I have to exercise*”), external (e.g., “*I exercise because others tell me to*”), introjected (e.g., “*I feel guilty when I fail to exercise*”), identified (e.g., “*It is important to me to exercise regularly*”), integrated (e.g., “*I exercise because it is part of my identity*”), and intrinsic (e.g., “*I exercise because it is fun*”) motivation. Participants had to answer to the items utilizing a five-point Likert scale varying from 0—“totally disagree” to 4—“totally agree”. Their answers were based on how they realized and perceived their motivation when performing physical exercise. This instrument encompasses two composite factors. One of the factors is autonomous motivation (i.e., intrinsic motivation, integrated and identified regulation) and the other one is controlled motivation (i.e., introjected, external regulation, and amotivation). The separation of the two parameters befalls to reduce the number of parameters to be estimated and avoid collinearity issues. Past studies support the use of this scale for measuring behavioral regulations in Portuguese exercisers (Cid et al., 2018; Teixeira et al., 2018a, b). Internal consistency for the subscales, in this study, ranged from acceptable to good (amotivation  $\alpha = 0.69$ ; external  $\alpha = 0.88$ ; introjected  $\alpha = 0.71$ ; identified  $\alpha = 0.81$ ; integrated  $\alpha = 0.93$ ; intrinsic  $\alpha = 0.93$ ).

**Positive and negative affect** The Portuguese version of the Positive and Negative Affect Schedule (PANAS) (Galinha et al., 2014) was used to measure the experience of positive and negative affect. This version contains ten items, preceded by the stem “*To what extent do you feel each of the emotions when training*” in which participants responded to each item using a five-point Likert scale ranging from 1—“totally disagree” to 5—“totally agree”. The PANAS 10-item version is recommended to be used when measures of positive (e.g., “*inspired*”) and negative (e.g., “*nervous*”) affect are studied (Teixeira et al., 2021). Internal consistency for the subscales, in this study, was good (positive affect  $\alpha = 0.82$ ; negative affect  $\alpha = 0.84$ ).

**Satisfaction with life** The Portuguese version of the Satisfaction with Life Scale (Neto, 1993) was used to measure

satisfaction with life. This 5-item (e.g., “*My life is close to my ideal in many fields*”) scale is designed to measure global cognitive judgments of one's life satisfaction. Study participants responded using a seven-point Likert scale ranging from 1—“totally disagree” to 7—“strongly agree” in each item. This scale has shown to be a valid and reliable measure of life satisfaction, which reflects the cognitive perspective of wellbeing (Diener et al., 1985). Internal consistency in this study was proved to be good (Satisfaction with life  $\alpha = 0.87$ ).

**State-anxiety** To assess state-anxiety, the Portuguese version (Silva, 2003) of the State-Trait Anxiety Inventory (STAI-state, STAI-trait) (Spielberger et al., 1983) was used. This instrument comprises two sections: Form 1 and Form 2. Each section has 20 statements. The participant must answer on a four-point Likert scale. In the present study, only Form 1—STAI State was used. The range of possible scores of the STAI-T (trait) and STAI-S (state) subscales varies from 20 (the minimum possible score) and 80. The scores are usually classified as “no or low anxiety” (20–37), “moderate anxiety” (38–44), and “high anxiety” (45–80). The Form 1 assesses temporary or transient anxiety, i.e., the anxiety the person is experiencing at the current moment (e.g., “*I'm worried*”). Internal consistency in this study was  $\alpha = 0.62$ .

## Procedures: Data collection

This study was conducted between February and March 2021, during which the second COVID-19 lockdown in Portugal occurred. The survey platform used was Google form. This platform was used for electronic distribution. Moreover, social media and newspapers were utilized in order to recruit possible participants as well as advertise the study. Procedures, methods, and techniques followed the requirements and guidelines for research in sports medicine and were implemented according to the Declaration of Helsinki.

## Statistical analysis

Means, standard deviation and bivariate correlations were calculated for all studied variables. In addition, to analyze the proposed relations, serial mediation analysis based on Hayes (2018) recommendations (specifically, model 6) was performed using SPSS PROCESS v.3.5. This analysis permits the estimation of direct and indirect effects of an independent variable (X) on a dependent variable (Y) while modelling a process in which the independent variable cause in mediator 1 (M1), which, in turn, causes in mediator 2 (M2), concluding with the dependent variable as the outcome (Hayes, 2018). In addition, model 6 allows the control of the indirect effects of each mediator while controlling for other variables, permitting also independent mediator effects



analysis, and providing regression coefficients for the causal steps of the specified indirect effects.

Bootstrap (5000 samples) was used according to several authors' recommendations (Hayes, 2018; Williams & MacKinnon, 2008). Bootstrapping is a nonparametric resample procedure that does not rely on the assumption of a normally distributed sampling of the indirect effect (Preacher & Hayes, 2004). This procedure demonstrates higher power with acceptable control over the Type-I error rate due to proper control of confidence intervals (Briggs, 2007).

### Results

Descriptive results (see Table 1) revealed that the participants presented a high value (above the midpoint) of autonomous motivation, positive affect, and satisfaction with life. In contrast, lower values (below the midpoint) appear in controlled motivation, negative affect, and anxiety. In addition, bivariate correlations exhibited a significant pattern across all studied variables. The highest bivariate correlation was observed between negative affect and anxiety ( $r=0.69$ ), while the lowest bivariate correlation was observed between controlled motivation and satisfaction with life ( $r=-0.15$ ).

A serial mediation of positive and negative affect and satisfaction with life in the interaction between controlled and autonomous motivation and anxiety are presented in Fig. 1a, b, c, and d. Results from Fig. 1a (positive affect and life satisfaction as mediators between autonomous motivation and anxiety) showed an inconsistent mediation since the indirect paths have opposite signs. Moreover, in Fig. 1b (positive affect and life satisfaction as mediators in the interaction between controlled motivation and anxiety) no mediation was exhibited with the direct effect ( $\beta=0.30$ ) being higher than the indirect effect ( $\beta=0.03$ ) and 1c (negative affect and life satisfaction as mediators in the relationship between autonomous motivation and anxiety), no mediation was observed due to the direct ( $\beta=-0.02$  IC [-0.122, 0.073]) and indirect effects ( $\beta=0.05$  IC [-0.049, 0.152]) are not significant. However, in Fig. 1d (negative affect and life satisfaction as mediators in the relationship

between controlled motivation and anxiety) a total mediation was observed since the indirect effect ( $\beta=0.27$ ) is higher than the direct effect ( $\beta=0.27$ ).

### Discussion

This study aimed to analyze the mediating role of positive and negative affect and satisfaction with life in the relationship between motivation (self-determined and non-self-determined motivation) and state-anxiety. Portuguese gym practitioners, during the second lockdown due to COVID-19 in Portugal, were recruited. Hypotheses a, b and c were totally confirmed, and hypothesis d was partially confirmed and will be discussed according to existing literature.

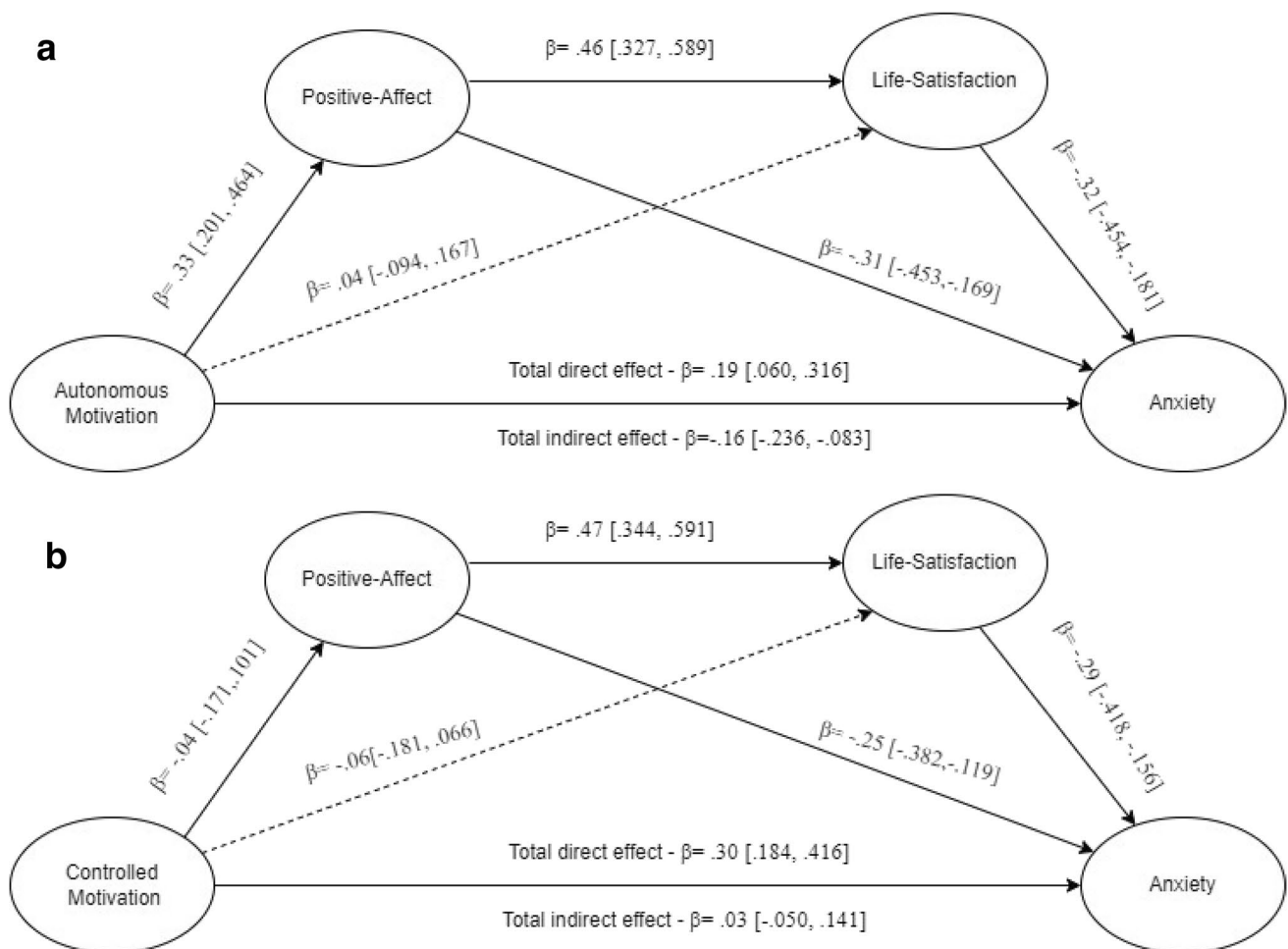
Most of the sample presented higher levels of autonomous motivation which is an interesting result considering that all participants have been practicing physical exercise for more than 6 months. This result is in line with the evidence found in past literature that has reinforced the role of autonomous motivation in the adherence and maintenance to the practice of physical exercise (Rodrigues et al., 2018; Sylvester et al., 2018; Teixeira et al., 2012). As regards to state-anxiety levels, the mean found in the present study was 40.58 (10.46), which corresponds to “moderate anxiety”. In a previous study (Antunes et al., 2020) that our team conducted during the first COVID-19 lockdown in a community sample of 1404 participants, we found higher levels of state-anxiety, i.e., 45.1 (11.2) with the mean corresponding to “high anxiety”. It should be interesting to compare both samples (i.e., a sample of gym practitioners and a sample of non-practitioners, for instance, during lockdown) in future studies, to better understand the possible buffer effect of physical exercise on anxiety levels. It is, however, important to note that the first study (Antunes et al., 2020) was conducted during the first COVID-19 lockdown, at a moment where the unknown and uncertainty may have helped rising anxiety levels as well as other negative emotions.

The auto determined motivation was positively associated with positive affect and satisfaction with life which was already found in past studies (Teixeira et al., 2021).

**Table 1** Descriptive statistics and bivariate correlations

Variables	M	SD	1	2	3	4	5	6
1.AM	3.05	.99	1	-	-	-	-	-
2.CM	.63	.52	-.27**	1	-	-	-	-
3.PA	3.39	1.92	.33**	-.13**	1	-	-	-
4.NA	1.92	.81	.16*	.42**	-.16**	1	-	-
5.SL	4.79	1.07	.19**	-.10*	.47**	-.25**	1	-
6. ANX	40.58	10.46	.25**	.33**	-.40**	.69**	-.43**	1

AM autonomous motivation, CM controlled motivation, PA positive affect, NA negative affect, SL satisfaction with life, ANX anxiety; \* =  $p < .05$ ; \*\* =  $p < .01$



**Fig. 1** Serial mediation analysis. *Note:* \_\_\_\_\_ = significant path; ---- = no significant path

However, contrary to what was hypothesized, it was also positively associated with negative affect and with state-anxiety. Furthermore, controlled motivation was positively associated with negative affect and with state-anxiety. Moreover, it was negatively associated with positive affect and with satisfaction with life which is in line with the literature (Ryan & Deci, 2017; Teixeira et al., 2021).

Positive affect was associated with satisfaction with life, while negative affect and satisfaction with life were negatively associated. This result is coherent with a vast of different studies regarding subjective well-being that found the same associations (Busseri, 2018; Jovanović & Joshanloo, 2021) including in the context of physical exercise (Rodrigues et al., 2021). Furthermore, state-anxiety was positively associated with negative affect, which is also in line with past literature (Cohen et al., 2017; Smith et al., 2020; Taylor et al., 2020).

In the present study, there was a negative association between satisfaction with life and state-anxiety. The associations between the levels of anxiety and subjective well-being

(i.e., negative, and positive affect as well as satisfaction with life), have been reported in past literature (Beutel et al., 2016; Eldeleklioğlu, 2015; Dias Lopes et al., 2020) including in studies carried out in this period of confinement which was experienced in different countries (Luo et al., 2021; Smith et al., 2020).

The mediating role of affect (positive and negative) in the relationship between motivation (autonomous and controlled) and state-anxiety was found. The mental consequences of this period of lockdown have also been explored (Antunes et al., 2020; Brooks et al., 2020; Frontini et al., 2021). Anxiety is a crucial variable to be better understood and analyzed during the COVID-19 pandemic. Thus, many studies were conducted focusing on anxiety and possible buffer variables, such as physical exercise. Because of the unquestionable relationship between physical exercise and levels of anxiety, namely the role of regular physical activity/exercise on lowering people's anxiety levels (Lesser & Nienhuis, 2020; Meyer et al., 2020; Pons et al., 2020; Stubbs et al., 2017), many studies were conducted during the first

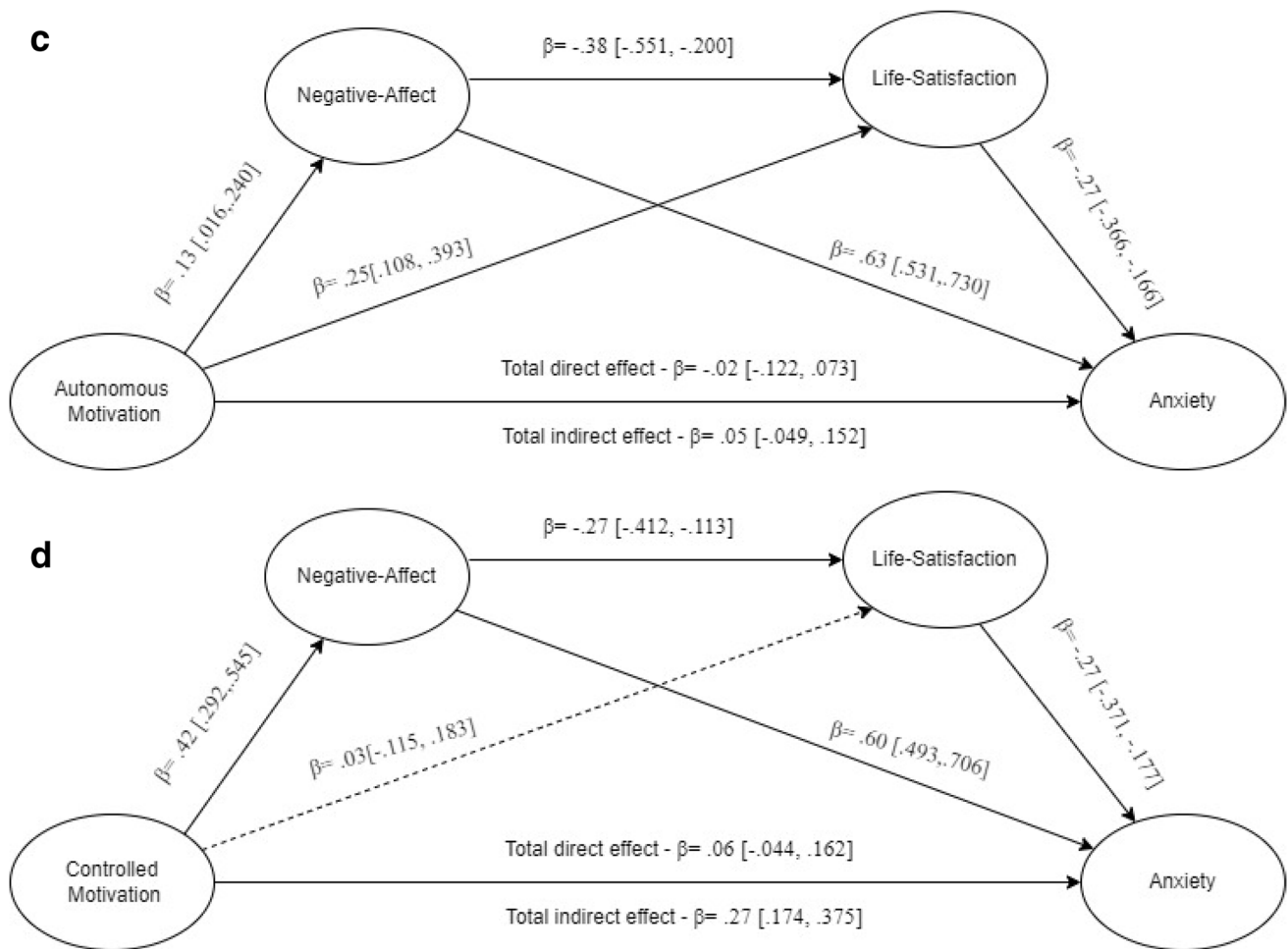


Fig. 1 (continued)

lockdown caused by COVID-19 (Antunes et al., 2021; Lai et al., 2020; Wang et al., 2020) However, there was still a need to better understand the role of motivation in the consequences of the practice of physical exercise, namely in lowering the levels of anxiety, during the lockdown. In fact, past studies (before lockdown) have found a relationship between anxiety and motivation for the practice of physical exercise (e.g., Sheehan et al., 2018) but more research in the area is still needed.

In the present study, higher levels of state-anxiety were associated with the practice of physical exercise regulated by higher levels of controlled and autonomous motivation. Because during COVID-19 lockdown people were forced to stop practicing physical exercise in their usual conditions, and considering that, according to the SDT theory, the more self-determined the motivation, the more positive the consequences (Vallerand, 1997) these results reinforce the importance of autonomous motivation for seeking the pleasure and satisfaction of the practice itself (Brunet & Sabiston, 2009; Deci & Ryan, 1985; Ryan &

Deci, 2002). By being forced to practice in different conditions, and not in an autonomous way, the benefits of physical exercise in anxiety levels may have been compromised. It is possible that those deprived of their usual practice (e.g., gyms) or deprived of environmental factors (Lawton et al., 2017; Rodrigues et al., 2018) such as the support from the instructor, the physical and social environment as well as the space and material conditions of the gyms, may have had consequences for finding the benefits of the practice.

Moreover, it is possible that people that used to practice physical exercise with higher levels of controlled motivation may have stopped the practice itself because they are usually less prone to adhere and maintain to the practice of physical exercise, which has been reinforced by literature (Rodrigues et al., 2018; Sylvester et al., 2018; Teixeira et al., 2012).

Although the present study explored associations between motivation and subjective wellbeing (positive and negative affect and satisfaction with life), the associations between motivation and state-anxiety and the association between

subjective wellbeing and state-anxiety had already been previously explored. However, the possible mediating role of positive and negative affect and the possible mediating role of satisfaction with life in the relationship between motivation and state-anxiety in gym exercisers are not yet clearly understood in the literature. Thus, to better understand these associations, a serial mediation with positive/negative affect as well as life satisfaction as possible mediators of the relationship between autonomous/controlled motivation and anxiety was analyzed. The results of the present study showed that the indirect paths have opposite signs. Thus, it is not possible to interpret the direction of the path, as suggested by Hayes (2018). That is, the weight of each path must be analyzed and understood based on its conceptual orientation (Hayes, 2018).

Specifically, as presented in Fig. 1a, the path from the independent variable (autonomous motivation) to the first mediator (positive affect) may explain the relationship (positive in this case) since the path that comes from the independent variable to the second mediator (satisfaction with life), is not significant (even if it is positive). Moreover, the paths from the first to the second mediator to the dependent variable are negative and significant ( $-0.31$  e  $-0.32$ ), respectively. Thus, it appears that this effect (specifically in the case of autonomous motivation) was, in a certain way, reduced in those people that had higher levels of wellbeing, namely regarding positive affect and satisfaction with life. This reinforces the strong relationship that literature has found between wellbeing and the levels of anxiety (Ryan & Deci, 2017; Teixeira et al., 2018a, b). Regarding the second significant mediation, in Fig. 1d, it is possible to see that the path from the independent variable (controlled motivation) to the first mediator (negative affect) may explain the relationship (positive in this model) since the path coming from the independent variable to the second mediator (satisfaction with life) is also not significant.

The results found regarding the serial mediation reinforce the role of positive and negative affect as mediators of the relationship between motivation (auto-determined and non-auto-determined) and the levels of state-anxiety. This result confirms some preliminary evidence of past research based on literature that suggested the fundamental role that affect may play in the relationship of these variables (Beutel et al., 2016; Busseri, 2018; Eldeleklioglu, 2015; Jovanović & Joshanloo, 2021; Lawton et al., 2017; Rodrigues et al., 2021; Teixeira et al., 2021). The results reinforce the role that the affective dimension of subjective well-being presents, acting as a buffer regarding higher levels of state-anxiety in gym practitioners. Even though literature already proposed and found evidence regarding the protector role of affect against higher levels of state-anxiety (Beutel et al., 2016; Eldeleklioglu, 2015), to the best of our knowledge, past studies did not analyze the mediating role of affect (positive and

negative) and satisfaction with life, simultaneously, in the relationship between motivation and state-anxiety.

The results of the present work indicate important practical implications specifically in a time when online and home training are becoming one of the major fitness tendencies (Thompson, 2021). Thus, gyms and fitness professionals should bethink about the implications of the practice of physical exercise from different perspectives. On the one hand, it is important to reflect on the absence of adequate supervision associated with this type of physical exercise practice (i.e., online, and home training). On the other hand, it is important to consider the repercussions that this may have on the levels of anxiety (especially on those that are compromised with its practice and that are capable of feeling pleasure with it), since the factors involved are, necessarily, different. It is important to also highlight the relevant role that affect appears to have as a protective and preventive element of state-anxiety. Thus, it is important that, in different contexts of practice, exercise and sports professionals seek to create conditions for their practitioners to experience positive emotions (e.g., enthusiasm) and avoid contexts where negative emotions, such as frustration, may arise.

Therefore, future studies may try to better understand, in more detail, how these new fitness tendencies (e.g., online and home training) may, in some way, affect and benefit the practice of physical exercise (e.g., regarding wellbeing and anxiety). It may be also important to consider bigger samples involving different types of practice e different modalities.

## Conclusion

COVID-19 pandemic brought to Portugal, and all over the world, a series of constringes caused, essentially, by the measures applied by different governments to mitigate and propagate the spread of the virus. These measures also had interference in the regular practice of physical exercise since numerous places were closed.

Thus, and considering the preventive role that the regular practice of physical exercise may have as well as the psychosocial consequences of the lockdown, it is important to characterize, on people that had to change its practices (for instance, people that had to change to online training or who saw its practice suspended) their levels of wellbeing and anxiety. Moreover, it is important to analyze and better understand the important role of motivation may have on the variables.

Despite the importance of the present study, some limitations must be acknowledged and should be addressed in future studies. First, this study was conducted in Portugal, thus results cannot be generalized to other countries and contexts. Second, we did not control for exercise intensity and duration. These questions seem to be a relevant aspect to the affective response to exercise as recently showed by (Ekkekakis et al. (2020).



Therefore, future studies should make an effort and control the timing of assessments. Third, the variables analyzed in the present study were collected at the same time, therefore, future studies should try to analyze them longitudinally so that causal relations can be tested.

However, this work gives an important contribution in this field by emphasizing the role that wellbeing (specifically its emotional dimension—*affect*) may have, since the result of this study suggests that it may be a possible buffer of the relationship between motivation and anxiety levels. Thus, wellbeing should be a variable to be considered when prescribing physical exercise.

**Author contribution** All authors contributed to the study conception and design. Material preparations were performed by Antunes, R. and Frontini, R. Data collection were performed by Silva, C., Filipe, and Cordeiro, F. Data analysis were performed by Monteiro, D. The first draft of the manuscript was written by Antunes, R. and Frontini, R. However, all authors commented on previous versions of the manuscript and all authors read and approved the final manuscript.

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**Data availability** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Conflict of interest** The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

The authors have no relevant financial or non-financial interests to disclose.

This study was performed in line with the principles of the Declaration of Helsinki as stated in the manuscript.

**Informed consent** Informed consent was obtained from all individual participants included in the study as stated in the manuscript.

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