



Research article

Go, go You'll be happier. Psychological variables among cyclists during COVID-19 lockdowns

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ARTICLE INFO

Keywords:

Subjective vitality
Frustration tolerance
Affective status
Autonomy self-determination

ABSTRACT

COVID-19 lockdowns involved radical changes in the habits and lifestyles of many. Notably, athletes saw their training routines altered. The relationship between lockdown effects and psychological variables was analysed using a sample comprising 1032 cyclists (average age: 42.97 years, *s.d.* = 8.94), taking part in the first cycling competition after lockdown. The target variables included psychological variables such as frustration tolerance, subjective vitality, autonomy self-determination, and affective status, as well as sociodemographic and training habits-related variables.

The results showed that the constructs under analysis are related. Pre- and post-competition psychological variables were measured, and no significant differences were detected, except concerning subjective vitality. A regression analysis model was designed to analyse the impact of frustration tolerance, autonomy self-determination, and affective status on subjective vitality. The results reveal a lineal relationship ($F = 71.789$, $p < .001$) between subjective vitality and a set of independent variables: positive affects; health status; km of training per year; and frustration tolerance, which explain 46.7% of variance. Finally, since the variable that measures subjective vitality was shown to be significant, mediation analyses were undertaken to answer our hypothesis, following the results of the exploratory analysis. The results suggest that frustration tolerance has a direct effect on subjective vitality, and that this relationship is mediated by positive affects, health status, and km of training per year.

It is concluded that exercising increases subjective vitality, which is affected by frustration tolerance, positive affects, health status and km of training per year. In addition, it can be argued that these three variables mediate the relationship between frustration tolerance and subjective vitality. Finally, it is worth stressing that, given the positive effects of exercise not only in physical health but also in psychological, social and personal wellbeing, self-determined attitudes in training should be encouraged, as this promotes self-efficacy and self-satisfaction, in both training and competition settings.

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<https://doi.org/10.1016/j.heliyon.2023.e15300>

Received 11 November 2022; Received in revised form 24 March 2023; Accepted 1 April 2023

Available online 6 April 2023

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1. Introduction

The pandemic that began in 2019 and reached Europe in early 2020 drove Spain to total lockdown from mid-March. Owing to the propagation of COVID-19, the Spanish government restricted circulation on 14 March. This involved closing down non-essential commercial establishments, schools, universities, factories, gyms, bars, and restaurants, and forbidding any non-essential travel. Parents were forced to stay at home and, in addition to doing their house chores, look after their children, and work (remotely); time for leisure and exercise was sometimes very difficult to come by. This caused widespread distress not only among athletes but the population in general [1–4]. All public shows and sports competitions – including team sports (football, basketball, handball) and individual sports (swimming, athletics, cycling) – were cancelled. Athletes had to surrender their training. Although all athletes suffered this, the training schedules of swimmers and cyclists were particularly affected. The former because swimming pools were shut down, and the latter because non-essentially travelling was forbidden. Cyclists were forced to stay within their family bubble and surrender their daily/weekly training. Professional male road cyclists train between 16 and 28 h per week, and mountain cyclists between 14 and 18 h; amateur cyclists train less, but in many cases they train as much as 8–10 h per week [5]. Professional female road cyclists train approximately 12–16 h per week [6]. When conditions are adverse (excessive cold, rain and wind) cyclists use spinning bikes or cycle on rollers (balance, fluids, magnetic and direct transmission). Cyclists dislike these systems, as they find them boring, and only use them when strictly necessary; they eagerly wait for conditions to allow them to hit the road again.

During lockdown, Spanish cyclists took to train on rollers owing to the prohibition to train in the open, but it is inadvisable to train in this way for more than 2 h a day. Demand for rollers rocketed up. Even if they could still train at home, other routines (buying gear, visiting physios, training with friends, taking part in amateur competitions) were affected. The adverse effects of lockdown began to take their toll in the morale and mental health of cyclists. After the initial few days, lockdown conditions relaxed, and the population was allowed to travel within their municipality for work. Many cyclists began using their bikes to cycle to work. As lockdown relaxed even more, training for registered cyclists was allowed, followed later by all cyclists, always within their province of residence. Overall, the state of emergency lasted for 100 days, from 14 March to June 21, 2020, although lockdown was eased by steps; cycling was allowed again on 28 April.

The COVID-19 crisis increased the perception of stress nationwide, including athletes, and also led to an increase in dysfunctional psychological states [7]. Let us remember that mental health goes beyond the absence of illness, including also the presence of positive feelings (emotional wellbeing), functioning positively individually (psychological wellbeing) and collectively (social wellbeing), and lockdown had a deleterious effect on all these.

Affective states were particularly affected by lockdown, notably a double polarity between positive and negative affects [8,9]. According to this concept, positive affects occupy the dimension of pleasant emotions (motivation, energy, gregariousness, achievement, and success) while negative affects occupy that of unpleasant emotions (fear, inhibition, insecurity, frustration, and failure) [10]. People with high positive affects are extroverted, optimistic, and resilient, and they undergo feelings of satisfaction, friendship, enthusiasm, energy, closeness, affirmation, and self-confidence; people with high negative affects are temperamentally affected by negative stimuli – vegetative lability, stress, and unfavourable environments – and are prone to lack of interest, boredom, sadness, guilt, shame, and envy [11,12].

Moreover, in these affective states, motivation also intervenes; it is one of the most studied variables, with a high incidence for the explanation of numerous behaviors in the sports context. The theory of self-determination (TAD) [13] relates to a macro theory of people's volitional actions assuming that they are active organisms of psychological development that integrate their experiences in a coherent sense. Thus, TAD acts as a continuum encompassing different degrees of self-determination of such volitional conduct regulated by the subject internally or externally; that is, intrinsic motivation, extrinsic motivation and amotivation. Intrinsic motivation refers to the performance of an activity for the satisfaction derived from it without offering external reinforcements, distinguishing the intrinsic motivation towards knowledge, achievement and stimulating experiences. Extrinsic motivation is oriented towards an end and not by itself. It distinguishes external extrinsic motivation, introjected and identified regulation. Finally, amotivation refers to the lack of motivation to perform a task or sporting effort. In this way, motivation is a fundamental element to achieve the adherence and commitment of athletes with reference to their training reflecting a psychological disposition that represents the desire and the decision to continue participating actively [14].

Another important factor is frustration tolerance, which is the ability to cope with adverse conditions without being overwhelmed [15]. High levels of frustration tolerance enable individuals to adopt better decisions, better use their personal resources, and handle problems more efficiently. These individuals feel in control and able to affect stressful situations, do not yield to anxiety, stay calm, and show a wide range of responses [15].

Another important factor is subjective vitality, defined as the ability to feel energised and able to participate in rewarding and valuable activities, such as sport [16,17]. Subjective vitality is regarded as a form of eudemonic wellbeing [18], which goes hand-in-hand with feelings of purpose and meaning [19–21]. A critical feature that distinguishes eudemonic from hedonic wellbeing is the search of personally meaningful goals [22]; hedonic wellbeing is characterised by the search of pleasure-seeking or pain-avoiding goals [23,24]. Subjective vitality is the only central affect which is defined as a kind of eudemonic wellbeing.

Autonomy is often studied alongside these variables, owing to its relationship with positive variables – satisfaction with life and self-esteem [25], and negative ones – e.g. depression [26]. Autonomy is argued to facilitate election, initiative, and self-determination, and minimise feelings of pressure [27,28].

Finally, two recent meta-analyses point out that exercising during leisure time increases subjective wellbeing, stressing that physical activity plays a central role in psychological health [29,30].

Even if adults are aware of the health benefits of exercise [31–33], 40% of those who undertake physical activity has given it up

before three months, and only 24% of American adults follow the recommendations; many studies show that depression and anxiety encourages a sedentary lifestyle [34]. The road to adopting active habits is not necessarily easy, and patience and external help certainly contribute to success. The results yielded by this study should encourage the population in general, and cyclists in particular, to establish and reinforce physical training routines.

However, despite the positive benefits of exercise on mental health [35,36], cyclists, like the rest of the population, underwent feelings of depression, anxiety, and stress, as well as other psychological disorders (which increased by 22%), during lockdown and the months that followed [7,37]. Many did not seek professional help, as pointed out by Kuettel & Larsen [38], who also emphasised that adverse events increase the risk of mental illness among athletes. Previous work with senior adults has shown that structured physical activity programs increase subjective vitality [39]. Recent studies have shown that self-directed physical activity is positively correlated with subjective vitality [40,41]. However, few studies have examined whether self-directed physical activity during leisure time is associated with a similar increase in subjective vitality [35]. Therefore, this study aims to establish if self-directed physical activity during leisure time leads to an increase in subjective vitality among athletes, specifically cyclists.

As such, this study aimed to measure a set of psychological variables before and after the first post-lockdown BTT competition in Spain.

The study's starting hypotheses were: 1) participation has an effect on the psychological variables, increasing the subjective vitality of participants; and 2) subjective vitality is mediated by the psychological variables under study.

Table 1
Sample distribution (n = 1032).

		N	%
Gender	Man	956	93%
	Woman	72	7%
Marital status	Married/stable relationship	786	76.7%
	Single	161	15.7%
	Divorced	63	6.1%
	Other	15	1.5%
Works	Self employed	157	15.3%
	As an employee	714	69.5%
	Civil servant	118	11.5%
	Does not work	39	3.8%
Cycling	BTT	487	47.5%
	BTT and road	520	50.7%
	Road	18	1.8%
Competitions	BTT	491	67.7%
	BTT and road	217	29.9%
	Road	17	2.3%
Km per year	<2500 km	198	19.3%
	From 2500 to 5000 km	440	42.9%
	From 5000 to 10,000 km	298	29.0%
	>10,000 km	90	8.8%
Previous experience in the competition	None	613	59.6%
	Between 1 and 5 times	346	33.7%
	Between 6 and 10	62	6.0%
	Over 10	7	0.7%
Registered	Yes	283	27.6%
	No	742	72.4%
Days of training per week	One or less	138	13.4%
	Two	385	37.5%
	Three or more	505	49.1%
Training habits	Alone	475	46.3%
	With a partner	322	31.4%
	With a group	228	22.2%
Current health status	Very good	209	20.4%
	Good	671	65.3%
	Medium	132	12.9%
	Bad	12	1.2%
General health status	Very bad	3	0.3%
	Very good	124	12.1%
	Good	500	48.7%
	Medium	380	37.0%
	Bad	22	2.1%
	Very bad	–	–

2. Method

2.1. Participants

The sample (Table 1) comprised 1032 cyclists taking part in the first post-lockdown BTT competition in Spain. All participants were volunteers. The average age of participants in the study was 42.97 ($s.d. = 8.94$). All participants were asked to sign an informed consent form, and all the ethical considerations set forth in the Declaration of Helsinki were observed [42]. The study was endorsed by the Ethics Committee of research group OPIICS (S46_20 R), Psychology and Sociology Department. All ethical criteria for research with human beings were observed (volunteer participation, informed consent, right to information, data protection, confidentiality, non-discrimination, gratuity, and the right to abandon the study in any stage). The study was designed as a prospective ex-post facto analysis with pre and post measurements [43]. All results were handled anonymously.

2.2. Instruments

2.2.1. PANAS of positive and negative affects [10]

Positive and Negative Affect Scales PANAS comprise 20 items, 10 for positive affects and (AP) and 10 for negative affects (AN), expressed in a Likert scale. Responses must refer to the present, at the time the participant is filling the questionnaire, and range from 0 (absence of the emotion) to 5 (frequent presence of the emotion). The questionnaire returned a Cronbach's alpha coefficient of 0.88 for positive affects ($\Omega = 0.88$) and 0.86 for negative affects ($\Omega = 0.87$).

2.2.2. Subjective vitality scale [17]

Vitality was measured with the Spanish version [44] of this seven-item scale, which assesses subjective perception of overall vitality and energy. Responses are expressed in a Likert scale, and range from 1 (totally disagree) to 7 (totally agree). The items refer to perceived energy, enthusiasm and vivacity (e.g. I feel alive and energised). The total score is an average of the item-specific scores. The questionnaire yielded a Cronbach's alpha coefficient of 0.83 ($\Omega = 0.82$).

2.2.3. Frustration tolerance scale (Etf) Spanish version by oliva et al. [15]

Based on the Stress Management del Emotional Quotient Inventory [45]. (Bar-On & Parker, 2000). This scale comprises 8 items. Responses are expressed in a Likert scale, and range from 1 to 5 (Never; Seldom; Sometimes; Often; Always). The questionnaire yielded a Cronbach's alpha coefficient of 0.84 ($\Omega = 0.82$).

2.2.4. Perceived autonomy in real-life contexts [46]

The autonomy variable was measured using the positive emotions subscale of the Perceived Autonomy in real-life contexts scale [46]. The questionnaire comprises four questions, (e.g. "While I practice my sport I am happy"). Responses are expressed in a Likert scale, and range from "totally disagree" (1) to "totally agree" (7). The questionnaire yielded a Cronbach's alpha coefficient of 0.85 ($\Omega = 0.85$).

2.3. Protocol

The questionnaire was sent by email to the participants of the 2022 race, using a Google Forms format. In the email the PI explained the study's objectives and that it was important that all items were answered.

Prior to filling the questionnaires, the participants had to read and sign an informed consent form. They were reminded that all the data was to be handled anonymously and confidentially. The data was collected in 20–23 April 2022.

The statistical analysis of the data was undertaken with statistical software SPSS 26.0. Once the normality of the sample and the equality of the variances were established, parametric techniques were adopted. In order to examine the characteristics of the sample in detail, a basic central tendency descriptive analysis (median), percentages, frequencies, and dispersion (typical deviation) was undertaken for each variable. In order to establish median differences when variables were continuous and normal, Student's *t*-test was undertaken for independent samples. In all cases, the lowest signification level possible was used; differences $p < .05$ were regarded as significant. Bilateral contrasts were undertaken. Interactions were created following Aiken & West [47] and Campbell & Kashy [48]. In order to aid the interpretation, an effect (−1, 1) code was used for binary variables. Finally, mediation analyses were undertaken to establish if the relationship between subjective vitality and frustration tolerance is mediated by the remaining variables under study,

Table 2

Results of the variables under study in T1 and T2.

	Before the race	After the race	t	Sig.
1. Autonomy perception	25.01 (4.29)	24.75 (4.08)	.564	.573
2. Positive affects	30.87 (5.22)	30.88 (5.64)	−.002	.998
3. Negative affects	6.80 (3.57)	7.46 (4.83)	−1.519	.129
4. Frustration tolerance	11.46 (3.28)	11.86 (3.48)	−1.124	.261
5. Subjective vitality	34.75 (6.73)	36.25 (5.64)	−2.000	.046

following [49].

3. Results

First, differences in the values yielded by psychological variables before and after the competition were assessed (Table 2). Only in the subjective vitality value were significant differences observed, T2 values being above T1 values, which means that participants felt more vital after the race.

Correlations between the different variables were also calculated (Table 3). All variables were shown to be significantly correlated, especially autonomy and positive affects ($r = 0.757^{**}$). Negative affects and frustration tolerance were found to be negatively correlated with the remaining variables, that is, the higher the negative affects score, the lower were the autonomy and subjective vitality scores.

Since subjective vitality was the only variable found to vary significantly between T1 (before the race) and T2 (after the race), calculations were made to find predictor variables. First, a stepwise linear regression (MLR) model was undertaken to analyse the effect of frustration tolerance, emotional state and autonomy perception and the demographic variables on subjective vitality. Table 4 presents the results of the model with the best fit, showing that there is a lineal relationship between subjective vitality and a set of independent variables ($F = 71.789, p < .001$). Taken together, the variables introduced in the model explain 46.7% of the variance observed in subjective vitality. The variables that yielded significant values were positive affects ($\beta = 0.541, t = 14.785, p < .001$), overall health status ($\beta = 0.842, t = 2.867, p < .01$), km of training per year ($\beta = 0.550, t = 2.515, p < .001$), and frustration tolerance ($\beta = -0.124, t = -2.157, p < .05$). The remaining variables were dismissed by the MLR.

The tolerance values of the model were close to 1 (minimum: 0.914) and the VIF values were <10 (maximum: 1.094). Following (1990) (condition index >30 and two or more variables with high proportion of variance >0.50), so it can be argued that no collinearity between the variables exist.

Finally, as the variable that measured subjective vitality was shown to be significant, a mediation analysis using SPSS's PROCESS macro (Model 4) was undertaken in order to test our hypotheses. The initial proposition of the model is shown in Fig. 1. The purpose of this exercise is to establish the effect of the other psychological variables in the relationship between frustration and subjective vitality (Hypothesis 2).

Fig. 2 presents the regression coefficient of the criteria variables positive affects, overall health status, and km of training per year. The results suggest that frustration tolerance has a direct effect on subjective vitality and that this relationship is mediated by positive affects ($b = -0.11, p < .05$), overall health ($b = 0.01, p < .001$), and km of training per year ($b = 0.01, p < .001$) (see Fig. 2). These results confirm hypothesis 3, emphasising that positive affects, overall health, and km of training per year mediate the relationship between frustration tolerance and subjective vitality.

4. Discussion

This study aimed to analyse psychological variables in a sample of cyclists before the first post-lockdown in Spain, and also to examine the impact of the competition in these same variables. The study's starting hypotheses were: 1) participation has an effect on the psychological variables, increasing the subjective vitality of participants; and 2) subjective vitality is mediated by the psychological variables under study.

First, the sociodemographic variables were examined. The typical profile of participants is a 43-year-old married/in a stable relationship man, working as an employee; he mainly practices BTT but also road cycling; he takes part in this race for the first time; he trains more than 2500 km per year, is not registered, and trains more than two days per week; he trains on his own or with a partner, and defines his health as good or very good.

The first hypothesis was partially confirmed, as only one variable, subjective vitality, was shown to change significantly between T1 (before the race) and T2 (after the race). In addition, the study found that all variables under study (affects, frustration tolerance, autonomy and subjective vitality) correlate with one another. This may be because the very concept of subjective vitality refers to the feeling of being "alive" and "alert"; that is, of having energy available to oneself, reflecting a psychological experience of enthusiasm and inspiration [17]. This feeling may be influenced by the fact of having finished a test described as "hard or difficult" by its route and having been held after the end of the pandemic, which would undoubtedly influence that feeling of "being alive" [16].

Afterwards, since the only variable to vary significantly was subjective vitality, calculations were made to establish predictor variables. It was found that positive affects, general health, and km trained per year have a positive effect on subjective vitality,

Table 3
Correlations between the variables under study.

	1	2	3	4
1. Autonomy perception				
2. Positive affects	.757 ^a			
3. Negative affects	-.149 ^a	-.171 ^a		
4. Frustration tolerance	-.101 ^a	-.130 ^a	.171 ^a	
5. Subjective vitality	.361 ^a	.448 ^a	-.109 ^a	-.118 ^a

^a $p < .01$.

Table 4
Linear regression model of subjective vitality.

	B (ET)	t	p-value
Positive affects	.541 (.037)	11.974	.000
Overall healthcare	.842 (.294)	1726	.004
Km/year	.550 (.219)	−6683	.012
Frustration tolerance	−.124 (.058)	−0,61	.031
R ² (%)	46.7		
Model	F (17,1032) = 71.789; p < .001		

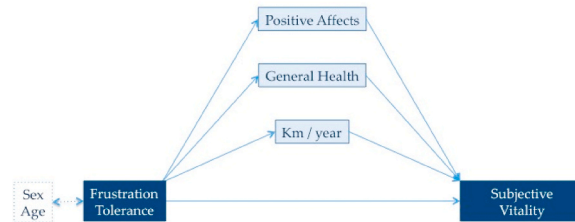


Fig. 1. Mediation model for the effect of Perception of autonomy in the relationship between Frustration Tolerance and Subjective Vitality, by sex and age.

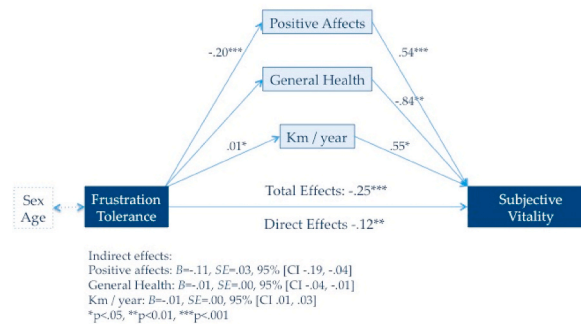


Fig. 2. Mediation model for the effect of Perception of autonomy in the relationship between Frustration Tolerance and Subjective Vitality, by sex and age. ** $p < .01$, *** $p < .001$.

whereas frustration tolerance was found to be negatively correlated with subjective vitality. Subjective vitality determines personal and psychological wellbeing and is a health indicator [17]. The results of this study are in line with previous research [50,51]. Despite the muscular fatigue caused by exercise, many individuals feel energised after a training session, and this is, in fact, one of the reasons that drive them to exercise in the first place [52,53]. Following this, and in order to test the second hypothesis, the relationship between these two variables (frustration tolerance and subjective vitality) was examined in detail, while assessing whether the predicting variables – positive affects, overall health, and km of training per year – act as mediators in this relationship. Mediation analyses took into account age and sex, but these variables were found to have no significant effect. The results suggest that emotional states (positive affects), overall health and km of training per year play a mediating role in the relationship between frustration tolerance and subjective vitality. These results are in line with recent research, which points out that physical exercise plays a central role in emotional states [34,54–57]. Moreover, some authors have argued that subjective vitality is an axial affect, with a direct effect on motivation [16, 58]. It must be recalled that subjective vitality is a kind of eudemonic wellbeing, specifically the amount of energy available to an individual to relate adaptively to their environment [59,60]. It has been pointed out that subjective vitality can be used to predict physical health and overall wellbeing, and the results of this study suggest that physical health can also be used as predictor of vitality, as shown not only by the fact that these variables are correlated, but also by the mediating effect of physical health on the relationship between frustration tolerance and vitality [60–62]. This suggests that the individual can use subjective vitality to increase intentional mobilisation [16,58]; that is, people who feel energised can cope with problems, stress and challenges more adaptively [63–65], and have better physical/psychological health [66–69].

The hypothesis was, therefore, confirmed. The data revealed a total mediation effect of the model, establishing the mediating effect that positive affects, overall health, and km of training per year play in the relationship between frustration tolerance and subjective vitality. This conclusion has already been suggested by previous research [35], but not fully or examining a sample comprised by athletes.

5. Conclusions

These results have direct implications for sport training strategies; cyclists and other athletes, as well as their coaches, must pursue self-determined attitudes, including positive affects, frustration tolerance, self-perceived autonomy and subjective vitality. This will help athletes to feel more efficient in their training, leading to greater satisfaction. This can also prevent deficient training habits and improve their psychological performance during competitions.

Programs designed by sport psychologists can help cyclists to improve their experience, contributing to their development, preventing them dropping off from competitions, and enhancing their performance.

These results encourage me to continue researching, considering new psychological variables, and seeking questions with which to define methodologies that help athletes with their personal, social and psychological development.

5.1. Limitations of the study

The main limitation of this study is its lateral nature; data were collected in a very specific setting, following lockdown and just before the first post-restrictions competition. This is at the same time a strength and a weakness. Scores can change from year to year, and even within the same year, according to such varied variables as the weather in the days prior to data collection or the personal and social context of cyclists; this is significant, even when working with such a large sample. Also, although quantitative measurement is the most widespread and accepted method to assess psychological variables, these are always open to oscillations from year to year and even within the same season. Similarly, the participants of the study were selected because they were taking part in the competition and are not representative of all cyclists. Therefore, the results may be geographically biased, or be affected by other factors, such as the participants' cycling discipline of preference. A more balanced sample in terms of gender and age would also have been desirable, allowing more generalised conclusions to be drawn towards the general population.

5.2. Future prospects

Future research should implement longitudinal models to track the evolution of the psychological variables under study over time. This, however, poses a significant logistic challenge, as such a study would need to identify various cycling competitions throughout the year. It would also be interesting to expand the model to other sport disciplines, including both individual and team sports. It would also be of interest to address the mediating role played by cycling in psychological aspects, and even consider additional psychological variables that can play a part in the psychological, social and personal wellbeing of cyclists. Variables such as sex, age, intensity of training, and health factors should also be considered further.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors thank all the participants, who collaborated selflessly in the study.

References

- [1] E. Cartigny, E. Vickers, F. Harrison, R. Appleby, N. McCulloch, The impact of COVID-19 on dual career athletes: three typologies of coping, *J. Sports Sci.* (2022), <https://doi.org/10.1080/02640414.2022.2065088> (in press).
- [2] A. Córdova-Martínez, A. Caballero-García, E. Roche, D. Pérez-Valdecantos, D.C. Noriega, Effects and causes of detraining in athletes due to COVID-19: a review, *Int. J. Res. Publ. Health* 19 (2022) 5400, <https://doi.org/10.3390/ijerph19095400>.
- [3] S. Costa, G. Santi, S. di Fronso, C. Montesano, S. Di Gruttola, S. Giorgio Ciofi, et al., Athletes and adversities: athletic identity and emotional regulation in time of COVID-19, *Sport Sci. Health* 16 (2020) 609–618, <https://doi.org/10.1007/s11332-020-00677-9>.

- [4] L. Jia, M.V. Carter, A. Cusano, X. Li, J.D. Kelly, J.D. Bartley, R.L. Parisien, The effect of the COVID-19 pandemic on the mental and emotional health of athletes: a systematic review, *Am. J. Sports Med.* (2022), <https://doi.org/10.1177/03635465221087473> (in press).
- [5] A. Sassi, F.M. Impellizzeri, A. Morelli, P. Menaspá, E. Rampinini, Seasonal changes in aerobic fitness indices in elite cyclists, *Appl. Physiol. Nutr. Metabol.* 33 (2008) 735–742, <https://doi.org/10.1139/H08-046>.
- [6] D. Sanders, T. van Erp, J.J. de Koning, Intensity and load characteristics of professional road cycling: differences between men's and women's races, *Int. J. Sport Physiol.* 14 (2019) 296–302, <https://doi.org/10.1123/ijsp.2018-0190>.
- [7] R. Schinke, A. Papaioannou, K. Henriksen, G. Si, L. Zhang, P. Haberl, Sport psychology services to high performance athletes during COVID-19, *J. Sports Exercise Psychol.* 18 (2020) 269–272, <https://doi.org/10.1080/1612197X.2020.1754616>.
- [8] D. Watson, A. Tellegen, Toward a consensual structure of mood, *Psychol. Bull.* 98 (1985) 219–235.
- [9] Y. Longo, The simple structure of Positive Affect, *Soc. Indic. Res.* 124 (2015) 183–198.
- [10] D. Watson, L.A. Clark, A. Tellegen, Development and validation of brief measures of positive and negative affect: the PANAS scales, *J. Personality Soc. Psychol.* 54 (1988) 1063–1070.
- [11] L.A. Clark, D. Watson, Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications, *J. Abnorm. Psychol.* 100 (1991) 316–336.
- [12] J.R. Crawford, J.D. Henry, The Positive and Negative Affect Schedule (PANAS): construct validity, measurement properties and normative data in a large non-clinical sample, *Br. J. Clin. Psychol.* 43 (2004) 245–265.
- [13] E.L. Deci, R.M. Ryan (Eds.), *Handbook of Self-Determination Research*, University of Rochester Press, Rochester, NY, 2002.
- [14] D.M. Sánchez, Diferencias entre aspectos psicológicos en Educación Primaria y Educación Secundaria. Motivación, Necesidades psicológicas básicas, Responsabilidad, Clima de aula, Conductas antisociales y Violencia, *Espiral. Cuad. Profr.* 14 (28) (2021) 9–18.
- [15] A. Oliva, L. Antolin, M. Pertegal, M. Rios, A. Parra, A. Hernando, M. Reina, Instrumentos para la evaluación de la salud mental y el desarrollo positivo adolescente y los activos que lo promueven, *Consejería de Salud, Sevilla*, 2011.
- [16] F. Martela, K.M. Sheldon, Clarifying the concept of well-being: psychological need-satisfaction as the common core connecting eudaimonic and subjective well-being, *Rev. Gen. Psychol.* 23 (4) (2019) 458–474.
- [17] R.M. Ryan, C. Frederick, On energy, personality, and health: subjective vitality as a dynamic reflection of well-being, *J. Pers.* 65 (1997) 529–565.
- [18] R.M. Ryan, E.L. Deci, On happiness and human potentials: a review of research on hedonic and eudaimonic well-being, in: S. Fiske (Ed.), *Annual Review of Psychology*, Annual Reviews, Palo Alto, CA, 2001, pp. 141–166.
- [19] C. Salavera, P. Usán, Propiedades psicométricas del cuestionario QEWB de bienestar eudaimónico en adolescentes, *Psicol. Educ.* 25 (2019) 139–146, <https://doi.org/10.5093/psed2019a3>.
- [20] A.S. Waterman, Reconsidering happiness: a eudaimonist's perspective, *J. Posit. Psychol.* 3 (2008) 234–252, <https://doi.org/10.1080/17439760802303002>.
- [21] A.S. Waterman, S.J. Schwartz, B.L. Zumbo, R.D. Ravert, M.K. Williams, V.B. Agocha, M.B. Donnellan, The Questionnaire for Eudaimonic Well-Being: psychometric properties, demographic comparisons, and evidence of validity, *J. Posit. Psychol.* 5 (2010) 41–61, <https://doi.org/10.1080/17439760903435208>.
- [22] D.J. Disabato, F.R. Goodman, T.B. Kashdan, J.L. Short, A. Jarden, Different types of well-being? A cross-cultural examination of hedonic and eudaimonic well-being, *Psychol. Assess.* 28 (5) (2016) 471–482, <https://doi.org/10.1037/pas0000209>.
- [23] S.L. Murphy, D.L. Eaves, Exercising for the pleasure and for the pain of it: the implications of different forms of hedonistic thinking in theories of physical activity behavior, *Front. Psychol.* 7 (2016) 843, <https://doi.org/10.3389/fpsyg.2016.00843>. Article.
- [24] E.G. Hepper, A. Dennis, From rosy past to happy and flourishing present: nostalgia as a resource for hedonic and eudaimonic wellbeing, *Curr. Opin. Psychol.* 49 (2023), 101547, <https://doi.org/10.1016/j.copsyc.2022.101547>.
- [25] F.L. Philippe, R.J. Vallerand, Environments do affect motivation and psychological adjustment: a test of self-determination theory in a natural setting, *Motiv. Emot.* 32 (2008) 81–89.
- [26] E.H. Wong, D.J. Wiest, Adolescent depression: link to academic coping and perceive autonomy support, *Education* 119 (1999) 668–673.
- [27] E.L. Deci, R.M. Ryan, *Intrinsic Motivation and Self-Determination in Human Behavior*, Plenum, New York, 1985.
- [28] E.L. Deci, R.M. Ryan, The "what" and "why" of goal pursuits: human needs and the self-determination of behavior, *Psychol. Inq.* 11 (2000) 227–268.
- [29] S. Bueckler, T. Simacek, B. Ingwersen, S. Teriel, A. Simonsmeier, Physical activity and subjective well-being in healthy individuals: a meta-analytic review, *Health Psychol. Rev.* 1 (2020) 1779.
- [30] C.W. Wiese, L. Kuykendall, L. Tay, Get active? A meta-analysis of leisure-time physical activity and subjective well-being, *J. Posit. Psychol.* 13 (1) (2018) 57–66.
- [31] M.D. Bird, G.M. Chow, G. Meir, J. Freeman, Student-athlete and student non-athletes' stigma and attitudes toward seeking online and face-to-face counseling, *J. Clin. Sport Psychol.* 12 (2018) 347–364, <https://doi.org/10.1123/jcsp.2017-0010>.
- [32] M.T. Kiviniemi, A.M. Voss-Humke, A.L. Seifert, How do I feel about the behavior? The interplay of affective associations with behaviors and cognitive beliefs as influences on physical activity behavior, *Health Psychol.* 26 (2) (2007) 152.
- [33] World Health Organization, *Prevention and Promotion in Mental Health*, WHO Press, Geneva, 2002.
- [34] T. Dodge, S. Vaylay, J. Kracke-Bock, Subjective vitality: a benefit of self-directed, leisure time physical activity, *J. Happiness Stud.* (2022), <https://doi.org/10.1007/s10902-022-00528-z> (in press).
- [35] J.J. Heisz, M. Marashi, E. Nicholson, M. Ogrodnik, HIIT as a tool for improving mental health and cognition, *ACSM's Health & Fit. J.* 25 (5) (2021) 13–17, <https://doi.org/10.1249/FIT.0000000000000700>.
- [36] R. Neil, H.M. McFarlane, A.P. Smith, Well-being in sport organizations, in: C.R.D. Wagstaff (Ed.), *The Organizational Psychology of Sport*, Routledge, London, 2017, pp. 101–119.
- [37] M.Y. Marashi, E. Nicholson, M. Ogrodnik, B. Fenesi, J.J. Heisz, A mental health paradox: mental health was both a motivator and barrier to physical activity during the COVID-19 pandemic, *PLoS One* 16 (4) (2021), e0239244, <https://doi.org/10.1371/journal.pone.0239244>.
- [38] A. Kuettel, C.H. Larsen, Risk and protective factors for mental health in elite athletes: a scoping review, *Int. Rev. Sport Exerc. Psychol.* 13 (2019) 231–265, <https://doi.org/10.1080/1750984X.2019.1689574>.
- [39] M. Uphill, D. Sly, J. Swain, From mental health to mental wealth in athletes: looking back and moving forward, *Front. Psychol.* 7 (2016) 935, <https://doi.org/10.3389/fpsyg.2016.00935>.
- [40] K. Gunnell, P. Crocker, P. Wilson, D. Mack, B. Zumbo, Psychological need satisfaction and thwarting: a test of Basic Psychological Needs Theory in physical activity contexts, *Psychol. Sport Exerc.* 14 (2013) 599–607, <https://doi.org/10.1016/j.psychsport.2013.03.007>.
- [41] W.H. Liao, J.W. Chen, X. Chen, L. Lin, H.Y. Yan, Y.Q. Zhou, R. Chen, Impact of resistance training in subjects with COPD: a systematic review and meta-analysis, *Respir. Care* 60 (8) (2015) 1130–1145, <https://doi.org/10.4187/respcare.03598>.
- [42] WMA, Declaración de Helsinki de la AMM. Principios éticos para las investigaciones médicas en seres humanos, 2004. <https://www.wma.net/es/politicas-post/declaracion-de-helsinki-de-la-amm-principios-eticos-para-las-investigaciones-medicas-en-seres-humanos/>.
- [43] M. Ato, G. Vallejo, *Diseños de investigación en Psicología*, Pirámide, 2015.
- [44] I. Castillo, I. Tomás, I. Balaguer, The Spanish-version of the subjective vitality scale: psychometric properties and evidence of validity, *Spanish J. Psychol.* 20 (2017), e26.
- [45] R. Bar-On, *The Emotional Intelligence Inventory (EQ-I)*, technical manual, Multi-Health Systems, 1997.
- [46] M.R. Blais, R.J. Vallerand, Échelle de perception d'autodétermination dans les domaines de vie (ÉPADV-16). Unpublished Manuscript, Université du Québec, 1991.
- [47] L.S. Aiken, S.G. West, *Multiple Regression: Testing and Interpreting Interactions*, Sage Publications, 1991.
- [48] L. Campbell, D.A. Kashy, Estimating actor, partner, and interaction effects for dyadic data using PROC MIXED and HLM: a user-friendly guide, *Pers. Relat.* 9 (2002) 327–342, <https://doi.org/10.1111/1475-6811.00023>.
- [49] R.M. Baron, D.A. Kenny, The moderator-mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations, *J. Personality Soc. Psychol.* 51 (1986) 1173–1182.

- [50] C.M. Frederick, R.M. Ryan, Differences in motivation for sport and exercise and their relations with participation and mental health, *J. Sport Behav.* 16 (3) (1993) 124–146.
- [51] P.C. Parker, A.M. Beeby, L.M. Daniels, Examining the relationship between basic psychological needs and athlete identity during the COVID-19 pandemic, *Front. Sports Act. Living* 4 (2022), 814301, <https://doi.org/10.3389/fspor.2022.814301>.
- [52] A. Gulliver, K.M. Griffiths, H. Christensen, Barriers and facilitators to mental health help-seeking for young elite athletes: a qualitative study, *BMC Psychiatr.* (2012) 157–171, <https://doi.org/10.1186/1471-244X-12-157>.
- [53] M. Sarkar, D. Fletcher, Psychological resilience in sport performers: a review of stressors and protective factors, *J. Sports Sci.* 32 (2014) 1419–1434, <https://doi.org/10.1080/02640414.2014.901551>.
- [54] P. Gorczynski, A. Currie, K. Gibson, V. Gouttebauge, B. Hainline, J.M. Castaldelli-Maia, et al., Developing mental health literacy and cultural competence in elite sport, *J. Appl. Sport Psychol.* (2020) 1–30, <https://doi.org/10.1080/10413200.2020.1720045>.
- [55] K. Henriksen, R. Schinke, K. Moesch, S. McCann, W.D. Parham, C.H. Larsen, et al., Consensus statement on improving the mental health of high performance athletes, *Int. J. Sport Exerc. Psychol.* 18 (2020) 553–560, <https://doi.org/10.1080/1612197X.2019.1570473>.
- [56] Z.A. Pouchet, K.A. Tamminen, G. Kerr, J. Cairney, A commentary on mental health research in elite sport, *J. Appl. Sport Psychol.* 33 (2019) 60–82, <https://doi.org/10.1080/10413200.2019.1668496>.
- [57] R. Purcell, K. Gwyther, S.M. Rice, Mental health in elite athletes: increased awareness requires an early intervention framework to respond to athlete needs, *Sports Med.* 5 (2019) 46, <https://doi.org/10.1186/s40798-019-0220-1>.
- [58] O. Lavrusheva, The concept of vitality. Review of the vitality-related research domain, *New Ideas Psychol.* 56 (2020), 100752.
- [59] E. Diener, D. Wirtz, R. Biswas-Diener, W. Tov, C. Kim-Prieto, D. Choi, S. Oishi, New measures of well-being, in: E. Diener (Ed.), *The Collected Works of Ed Diener*, Springer, The Netherlands, 2009.
- [60] C.L.M. Keyes, The mental health continuum: from languishing to flourishing in life, *J. Health Soc. Behav.* 43 (2002) 207–222, <https://doi.org/10.2307/3090197>.
- [61] C.L.M. Keyes, Promoting and protecting mental health as flourishing: a complementary strategy for improving national mental health, *Am. Psychol.* 62 (2007) 95–108, <https://doi.org/10.1037/0003-066X.62.2.95>.
- [62] C. Lundqvist, F. Sandin, Well-being in elite sport: dimensions of hedonic and eudaimonic well-being among elite orienteers, *J. Sport Psychol.* 28 (2014) 245–254, <https://doi.org/10.1123/tsp.2013-0024>.
- [63] A. Carmeli, B. Ben-Hador, D.A. Waldman, D.E. Rupp, How leaders cultivate social capital and nurture employee vigor: implications for job performance, *J. Appl. Psychol.* 94 (2009) 1553–1561, <https://doi.org/10.1037/a0016429>.
- [64] P. Dubreil, J. Forest, F. Courcy, From strengths use to work performance: the role of harmonious passion, subjective vitality, and concentration, *J. Posit. Psychol.* 9 (4) (2014) 335–349, <https://doi.org/10.1080/17439760.2014.898318>.
- [65] M. Muraven, M. Gagne, H. Rosman, Helpful self-control: autonomy support, vitality, and depletion, *J. Exp. Soc. Psychol.* 44 (2008) 573–585, <https://doi.org/10.1016/j.jesp.2007.10.008>.
- [66] L.D. Kubzansky, R.C. Thurston, Emotional vitality and incident coronary heart disease: benefits of healthy psychological functioning, *Arch. Gen. Psychiatr.* 64 (2007) 1393–1401, <https://doi.org/10.1001/archpsyc.64.12.1393>.
- [67] C. Niemiec, R. Ryan, E. Deci, The Path Taken: consequences of attaining intrinsic and extrinsic aspirations in post-college life, *J. Res. Pers.* 73 (2009) 291–306, <https://doi.org/10.1016/j.jrp.2008.09.001>.
- [68] C. Swencionis, J. Wylie-Rosett, M.R. Lent, M. Ginsberg, C. Cimino, S. Wassertheil-Smolter, A. Caban, C.J. Segal-Isaacson, Weight change, psychological well-being, and vitality in adults participating in a cognitive-behavioral weight loss program, *Health Psychol.* 32 (4) (2013) 439–446, <https://doi.org/10.1037/a0029186>.
- [69] R.E. Tremblay, Prevention of youth violence: why not start at the beginning? *J. Abnorm. Child Psychol.* 34 (2006) 481–487, <https://doi.org/10.1007/s10802-006-9038-7>.