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RESEARCH

Life satisfaction in amateur long-distance runners: insights from the self-determination theory and the dualistic model of passion

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Abstract

Purpose The purpose of this study was to investigate the benefits of long-distance running through two prominent frameworks: the self-determination theory (SDT) and the dualistic model of passion (DMP). Specifically, we investigated the associations between the satisfaction of psychological needs (i.e., autonomy, competence, and relatedness), harmonious and obsessive passion, functional and dysfunctional psychobiosocial (PBS) states, and life satisfaction in a sample of amateur long-distance runners.

Methods Using a cross-sectional survey design, data on psychological needs satisfaction, passion, PBS states, and life satisfaction were collected from 209 amateur long-distance runners participating in the Italian Run for Science (R4S) event series (2017–2019).

Results Correlations and structural equation modeling results showed autonomy to be positively associated with functional PBS states and life satisfaction, and obsessive passion to be negatively associated with dysfunctional PBS states. Functional PBS states were found to mediate the relationship between autonomy and life satisfaction.

Conclusion We found partial support for our predictions based on the SDT and DMP. Findings suggest that autonomy, social connections, adaptive forms of passion, and functional PBS states are important correlates of life satisfaction of amateur long-distance runners.

Keywords Running · Psychobiosocial states · Self-determination theory · Passion · Life satisfaction

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Introduction

Running has grown popular over the past decades [1], likely due to its highly accessible and schedulable nature, affordability, and adaptability (e.g., outdoor or indoor). Although negative outcomes like exercise addiction [2] and running-related injuries [3] should not be ignored, running is generally linked to positive health benefits. These include improved physical health and longevity [4, 5], and improvement across physiological indicators, including weight, waist circumference, blood pressure, heart rate, heart rate variability [6]. Moreover, a recent scoping review revealed that runners showed higher psychological well-being and positive mood, and less stress and anxiety compared with a sedentary control population [2]. Altogether, running appears to be positively associated with improved psychological, biological, and social health, as well as well-being and life satisfaction [7, 8].

To unlock these benefits, understanding motivation for running is essential. Several studies have devoted attention to understanding what drives people to run [9] and connected types of motivations to well-being outcomes [10, 11]. Long-distance runners' motivations have received attention from scholars [12, 13], but motives that drive individuals to run long-distances deserve wider analyses because they are not uniform, may differ widely according to sociodemographic variables such as gender, age, education level, place of residence, and body composition [14]. Building on this, we use the self-determination theory (SDT)[15, 16] and the dualistic model of passion (DMP)[17, 18] to further examine the relationship between individual motivation, passion, emotion-related (psychobiosocial; PBS) states, and life satisfaction in amateur long-distance runners. These two theoretical frameworks were chosen because they align by considering passion in sport as stemming from basic psychological needs [19].

Psychobiosocial states

There has been a growing interest in exploring the pivotal role of emotions in influencing well-being through physical activities such as running [20]. A prominent theoretical framework to study emotions in sport and exercise settings is the individual zones of optimal functioning (IZOF) model [21], in which emotions are viewed as central components of performance-related psychobiosocial (PBS) states: "*a variety of emotional and non-emotional manifestations of subjective experiences (e.g., cognitive, motivational, volitional, bodily, behavioral, communicative) related to past, present, and future (anticipated) performances*" [22]. These states can be functional or dysfunctional for performance, physical activity, and life satisfaction defined as "*a global assessment of a person's quality of life according to his own chosen criteria*" [23]. Functional PBS states (e.g., feeling focused, confident) have been found to contrast burnout symptoms in the context of sport [24]. Similarly, functional PBS states are likely positively linked to life satisfaction, whereas dysfunctional PBS states (e.g., feeling doubtful, overwhelmed) are negatively linked.

Basic psychological needs

A prominent theoretical framework to understand motivation in exercise and sport is the self-determination theory (SDT) [15, 16]. SDT posits that clear and specifiable social-contextual factors support motivation by fulfilling three basic psychological needs: competence, autonomy, and relatedness [15].

The need for *competence* refers to "*feeling effective in one's ongoing interactions with the social environment and experiencing opportunities to exercise and express one's capacities*" [15]. Competence refers to both the sense of confidence and effectiveness in performing tasks and the persistent effort to seek and meet challenges that optimally match and enhance one's capacities and skills [15]. The need for *autonomy* refers to "*being the perceived origin or source of one's own behavior*" [23] and is generally experienced when individuals perceive their behavior to be self-endorsed [25]. In running, an example of autonomy is the degree to which a runner autonomously decides on the content and scheduling of their running.

Finally, the need for *relatedness* refers to feeling connected with significant others, feeling cared for, or feeling that one belongs in a given social milieu. The concept reflects "*the desire to have others to respond with sensitivity and care to one's experience and who convey that one is significant and loved*" [25]. Among runners, this experience of relatedness can come about through various sources, such as running with other people and feeling connected to them. Taken together, the satisfaction of these three non-hierarchical, innate, and universal psychological needs is hypothesized to result in increased self-determined motivation, which in turn is linked to higher self-efficacy and healthier lifestyle attitudes [26].

Passion

Building on SDT and its posited needs satisfaction, for some individuals the activity of running may resonate so profoundly that their associated motivation becomes deeply internalized. This can result in passion, described in the dualistic model of passion (DMP)[17, 18] as a "*strong inclination toward a self-defining activity that one loves,*

finds important (or highly values), and in which one invests time and energy" [18]. This internalization can occur in two ways: autonomously, driven by free choice and personal volition rather than internal or external pressure, resulting in *harmonious passion* (HP). Generally, HP is linked to more adaptive outcomes [27, 28]. Conversely, o*bsessive passion* (OP) occurs when the internalization process is controlled rather than autonomous, characterized by an uncontrollable urge to engage in the activity that becomes rigidly integrated into one's identity. This form of passion often derives from intrapersonal and interpersonal pressures, including contingencies such as the need for social acceptance. OP generally overwhelms other aspects of the person's life and is commonly linked to more maladaptive outcomes [3, 27]. HP is commonly adaptive in terms of outcomes (e.g., positive affect, flow, self-esteem), whereas OP is either unrelated or negatively related to these [18, 29]. Together, the DMP provides a worthwhile addition to the SDT in our goal of explaining PBS states and life satisfaction among amateur long-distance runners.

Aims and hypotheses

Promising as they are, the aforementioned theoretical frameworks have been simultaneously employed to understand athlete burnout in different sports [19] but not yet to understand wellbeing outcomes among runners. Understanding these relationships may function as a precursor for strategies aimed at enhancing runners' life satisfaction. Therefore, the aim of the current study was to investigate how motivation (i.e., psychological needs satisfaction) and passion in amateur long-distance runners are linked to their PBS states and life satisfaction. Specifically, we proposed the following hypotheses (see Fig. 1).

Hypothesis 1. *Psychological needs satisfaction* (*i.e.*, *autonomy*, *competence*, *and relatedness*) *shows a negative association with dysfunctional PBS states* (H_{1a}), *and a positive association with functional PBS states* (H_{1b}) *and life satisfaction* (H_{1c}).

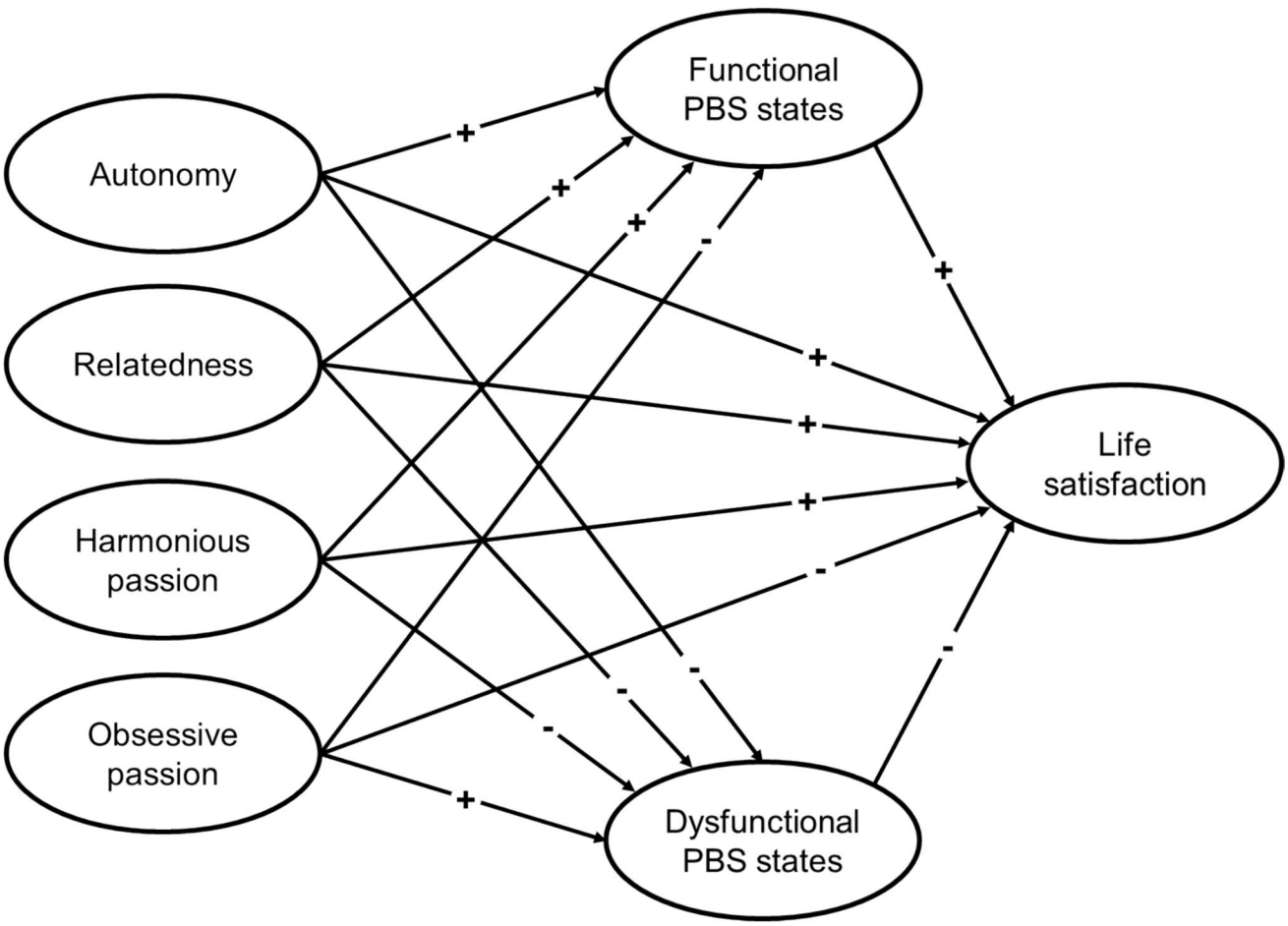

Fig. 1 Hypothesized mediation model of predictors of life satisfaction among long-distance runners

Hypothesis 2. *Harmonious passion* (*HP*) *shows a positive association with functional PBS states* (H_{2a}) *and life satisfaction* (H_{2b}), *and a negative association with dysfunctional PBS states* (H_{2c}).

Hypothesis 3. *Obsessive passion* (*OP*) *shows a negative association with functional PBS states* (H_{3a}) *and life satisfaction* (H_{3b}), *and a positive association with dysfunctional PBS states* (H_{3c}).

Hypothesis 4. *PBS states mediate the relationships between autonomy*, *relatedness*, *competence*, *harmonious passion*, *and obsessive passion* (*i.e.*, *the antecedent variables*) *and life satisfaction* (*i.e.*, *the outcome variable*).

Methods

Study design

We adopted a cross-sectional survey design to assess our measures of interest. We considered autonomy, relatedness, harmonious passion, and obsessive passion as independent variables; functional and dysfunctional PBS states as mediators; and life satisfaction as our outcome variable.

Procedure and eligibility criteria

Participants were gathered during yearly occurrences of the Run for Science (R4S; www.r4s.it) event from 2017–2019, a long-distance (i.e., 21 km) run designed specifically by the University of Verona to collect scientific data on running. To participate voluntarily in this study, participants had to meet the following criteria: (1) be amateur long-distance runners; (2) be aged 18 years or older; (3) be injury-free and medically certified as fit to engage in a 21 km run; and (4) engage regularly in amateur long-distance running. No other specific selection criteria were applied. Given their participation in a half marathon at this event, participants were –by definition– long-distance runners. After receiving a full description of the protocol of the study and giving written consent to voluntary participation, participants filled in a ~ 20-min written survey. Participants completed the survey, administered by the first and last authors, after the running event in a secluded location. All procedures were conducted in accordance with the Declaration of Helsinki. The Institutional Ethics Committee of the University of Verona provided ethical approval with anonymity, confidentiality, and participants' option to leave the study at any point without any explanations or consequences.

Participants

A total of 235 amateur long-distance runners completed the questionnaire in at least one edition of the R4S. To prevent bias, participants with multiple participations were excluded ($n = 26$). Our final sample was $N = 209$ (2017: $n = 101$; 2018: $n = 34$; 2019: $n = 74$). In total, 39 (18.7%) female runners and 139 (66.5%) male runners participated (14.8% had missing data on gender). No specific criteria were imposed for the participants' socioeconomic status, education level, or ethnicity. Most runners were middle-aged ($M_{age} = 46.21$, $SD = 12.30$ years), with the youngest being 21 and the oldest being an exceptional 93 years old. On average, runners had been training half or whole marathons for 5.73 years ($SD = 8.28$), stating they managed an average of 2.97 ($SD = 1.29$) running training sessions per week. BMI was available for 81 participants ($M_{BMI} = 23.49$, $SD = 2.54$). The descriptive characteristics of the participants are shown in Table 1.

Measures

The first part of the survey assessed information including the aforementioned age, gender, BMI (composed of voluntary on-location height and weight measurements), running experience, and number of running trainings per week. The second part of the survey included scales for our variables of interested, administered in Italian and detailed below.

The basic psychological needs in exercise scale (BPNES)

The BPNES [30] is a self-report instrument to assess satisfaction of innate needs for autonomy, competence, and relatedness in the domain of exercise [15]. The scale uses four items per need and was adapted to the context of running. First, the need for autonomy reflects the desire of individuals to be the origin or source of their own behavior [16] and is experienced when individuals perceive their behavior as self-endorsed [25]. For example: "*The running program I follow is highly compatible with my choices and interest*". Second, the need for competence refers to one's propensity to interact effectively with one's environment and to experience opportunities to exercise and express one's competencies and skills [25]. For example: "*I feel I have been making a huge progress in running with respect to the end result I pursue*". Third, relatedness describes feeling connected, cared for, and valued within a social setting. It captures the desire for others to respond sensitively and affirm one's significance and worth [25]. For example: "*I feel extremely comfortable when with the other running participants*". All items were answered on a 7-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"), averaged for each dimension via their respective items.

Table 1 Descriptives, AVE and Pearson Zero-order Correlations for study variables

Variable	*M*	*SD*	AVE[d]	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender[a]																
2. Age	46.21	12.3	–	−0.16												
3. BMI[b]	23.49	2.54	–	−0.29*	0.23*											
4. Running years	5.74	8.28	–	−0.11	0.46[§]	0.06										
5. Weekly runs	2.97	1.29	–	0.06	0.10	−0.27*	0.27*									
6. Harmonious passion	4.57	0.98	0.37	0.06	−0.04	0.23*	−0.13	0.11	(−0.78)							
7. Obsessive passion	2.41	1.12	0.50	−0.02	0.05	0.06	−0.02	0.09	0.47[§]	(−0.84)						
8. Autonomy	5.05	0.94	0.41	0.03	−0.04	< .01	0.10	0.36*	0.32*	0.18	(−0.74)					
9. Competence	4.72	0.99	–[e]	−0.08	−0.06	−0.13	0.11	0.34*	0.29*	0.14	0.79[†]	(−0.77)				
10. Relatedness	5.6	1.06	0.70	−0.03	−0.11	−0.02	0.01	0.09	0.29*	0.03	0.55[§]	0.50[§]	(−0.90)			
11. Functional PBS[c] states	3.34	0.62	0.42	−0.15	< .01	0.03	0.04	0.27*	0.18	0.16	0.47[§]	0.55[§]	0.38*	(−0.85)		
12. Dysfunctional PBS[c] states	1.65	0.7	0.52	0.14	−0.06	−0.13	−0.01	−0.03	−0.02	0.21*	−0.16	−0.25*	−0.11	−0.28*	(−0.88)	
13. Life satisfaction	5.16	0.95	0.55	−0.13	−0.06	0.06	0.01	0.10	0.11	0.04	0.39*	0.34*	0.36*	0.43[§]	−0.04	(−0.86)

$N_{demographics}$ = 76–206. N_{scales} = 205–209. Reliability coefficient Omega, displayed along the diagonal, was sufficient for all measures

[a]78.1% men (0) and 21.9% women (1). [b]*BMI* body mass index. [c]*PBS* Psychobiosocial. [d]Average Variance Extracted. [e]Including competence resulted an inadequate measurement model and was therefore omitted from further analyses and the structural model

*low, [§]moderate, [†]moderately high [31]

The passion scale (PS)

The PS [31] is rooted in the dualistic model of passion (DMP)[17, 27] and has 12 items equally distributed between measuring harmonious passion (HP) and obsessive passion (OP). HP refers to a strong desire to freely engage in the activity and results from an autonomous internalization of the passion into the person's identity (e.g., "*Running half marathons is in harmony with the other activities in my life*"), while OP refers to an uncontrollable urge to partake in the passion and results from a controlled internalization of the passion into one's identity (e.g., "*I have almost an obsessive feeling for half marathons*"). Both were measured on a 7-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree") and averaged for each dimension.

The psychobiosocial states in sport scale (PBS-ST)

The PBS-ST Scale [32] consists of 15 items: eight for functional PBS states and seven for dysfunctional PBS states. The terms "functional" and "dysfunctional" refer to the impact of PBS states on performance [22]. Grounded in the individual zones of optimal functioning (IZOF) model [21], the scale includes affective, cognitive, motivational, volitional (psychological), bodily-somatic, motor-behavioral (biological), operational, and communicative (social) modalities. An example of functional PBS states is "*Enthusiastic, confident, carefree, joyful*", and an example of dysfunctional PBS states is "*Distracted, overloaded, doubtful, confused*". Participants were asked to score how they felt about their momentary running performance on each of these items on a Likert scale ranging from 1 ("not at all") to 5 ("very much"). We computed two scores by averaging the items related to each dimension.

The satisfaction with life scale (SWLS)

The SWLS [33] consists of five items measuring overall life satisfaction. Life satisfaction is defined as "*a global assessment of a person's quality of life according to her/his chosen criteria*" [23]. Each of the items (e.g., "*In most way my life is close to my ideal*") was scored on a Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). A single score was computed by averaging the five items.

Data analysis

Descriptives, Pearson's zero-order correlations, and reliabilities were generated through SPSS version 26.0. Correlations were interpreted according to recent guidelines on effect size [34]. To test our proposed model, we performed structural equation modelling in Mplus 8.4, using multiple indices to judge model fit [35]. For our sample size, we adhered to the recommendation of at least 200 participants [36].

Results

An overview of the demographics and key variables is given in Table 1, including means, standard deviation, Pearson zero-order correlations, and reliability indicators (i.e., Average Variance Extracted). Per recent recommendations [34], we focus on correlation size rather than significance. The basic needs scales were positively related to one another, showing moderate to moderately high correlations ($r = 0.50$ to 0.79); passion scales showed a positive correlation of moderate strength ($r = 0.47$); and PBS states showed a low negative correlation ($r = -0.28$). Basic needs correlations with functional PBS states were all positive and of moderate strength ($r = 0.38$ to 0.55), and with dysfunctional PBS states only competence showed at least a low correlation strength ($r = -0.25$). For passion and PBS states, the only correlation being at least 'low' in strength was between obsessive passion and dysfunctional PBS states ($r = 0.21$). Life satisfaction had a moderate positive correlation with functional PBS states ($r = 0.43$) and no significant correlation with dysfunctional PBS states ($r = -0.04$). Life satisfaction also saw low positive correlations with all basic needs ($r = 0.33$ to 0.39) and no correlations with passion scales ($r = 0.04$ and 0.11). Similar to previous research [3], mean scores for harmonic passion were significantly higher than for obsessive passion ($p < 0.001$; Cohen's D = 1.09), and mean scores of functional PBS states were higher than for dysfunctional states ($p < 0.001$; Cohen's D = 1.05).

Prior to conducting SEM analyses, we tested assumptions and missing data patterns. Some indications of non-normality were detected (i.e., relatedness and dysfunctional PBS states), so we used the robust Huber-White MLR estimator [37]. Due to missing data on PBS states, sample size for SEM analyses was $n = 206$. Other data was partially missing (key variables: 1.2%; control variables: 19.1%) but this occurred at completely at random (Little's MCAR test: $\chi^2 = 1391.844$, df = 1429, $p = 0.754$) so full information maximum likelihood was employed.

We started SEM by establishing a measurement model. First, we tested the model using a second-order factor structure for basic needs, which revealed an inadequate fit, $\chi^2(884) = 1488.3$, $p < 0.001$; CFI = 0.844; TLI = 0.833; RMSEA = 0.058; SRMR = 0.069. Additionally, the latent variable covariance matrix was not positive definite. Upon reverting to a first-order factor structure for basic needs, we noted a significant improvement ($\Delta\chi^2(10) = 33.4$, $p < 0.001$) towards model fit, $\chi^2(874) = 1456.6$, $p < 0.001$; CFI = 0.850; TLI = 0.837; RMSEA = 0.057; SRMR = 0.066. However,

issues in latent variable covariance matrix occurred because of the factor "competence", likely because of redundancy and high multicollinearity. After review, "competence" was therefore omitted from the model, resulting in a significant improvement ($\Delta\chi^2(155) = 360.90$, $p < 0.001$) and model fits nearing acceptability, $\chi^2(719) = 1096.5$, $p < 0.001$; CFI = 0.884; TLI = 0.875; RMSEA = 0.050; SRMR = 0.063. Complex models, such as those with 40 observed variables, along with larger sample sizes, may require less stringent criteria [32]. We therefore decided to work with this model, and after allowing six sensible within-factor residuals to correlate, the final measurement model proved acceptable [32]: $\chi^2(713) = 963.0$, $p < 0.001$; CFI = 0.924; TLI = 0.916; RMSEA = 0.041; SRMR = 0.061 and was used to calculate the structural and indirect relations.

Standardized estimates of all structural relations and explained variances are reported in Fig. 2. Results showed a significant association between autonomy and functional PBS states ($\beta = 0.66$, $p < 0.01$) and dysfunctional PBS states ($\beta = -0.40$, $p = 0.02$), providing partial confirmation of H_{1a} and H_{1b}, and no evidence for H_{1c}. No evidence was found H_2, H_{3a}, or H_{3b}. However, we did note a significant relation between OP and dysfunctional PBS states ($\beta = -0.45$, $p < 0.01$), providing confirmation of H_{3c}.

Indirect relationships were estimated when two consecutive and significant associations were found. Findings showed a significant standardized estimate, $\beta = 0.20$, 95% CI [0.05, 0.35], $p = 0.01$, suggesting that autonomy influences life satisfaction through functional PBS states, providing partial confirmation of H_4.

Discussion

Understanding motivations for running can help runners stay connected to their sport in a healthy fashion. In this study, we asked to which extent life satisfaction and PBS states of amateur long-distance runners could be explained through the satisfaction of their basic psychological needs (i.e., autonomy, competence, and relatedness) and their harmonious and obsessive passion. Study findings provided support for several hypotheses: autonomy was negatively associated with dysfunctional PBS states (H_{1a}) and positively associated with functional PBS states (H_{1b}) and positively associated with life satisfaction through functional PBS states (H_4). Finally, obsessive passion showed a positive association with dysfunctional PBS states (H_{3c}).

Theoretical implications

Our findings reinforce the idea that autonomy, intended as the need to self-regulate one's experiences and actions, is a key driver of positive outcomes in activities, like running, where specifically freedom of choice is paramount. As in other recent studies [24], autonomy was positively associated with functional PBS states, suggesting that when amateur runners perceive their participation as self-endorsed and aligned with their personal values, they experience more positive emotional, motivational, cognitive, bodily-somatic, motor-behavioral, and social states related to running [16, 30]. The relationship between autonomy and life satisfaction

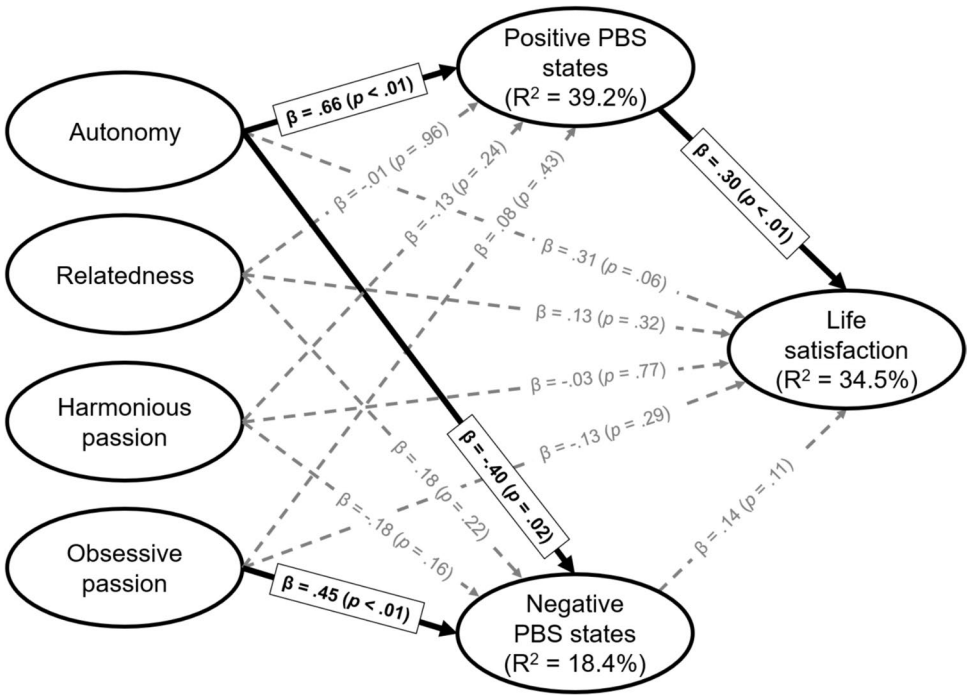

Fig. 2 Estimates of predictors of psychobiosocial states and life satisfaction among long-distance runners

via functional PBS states underscores autonomy's influence on overall well-being through positive subjective experiences.

We also found bivariate positive associations between relatedness and both functional PBS states and life satisfaction. These results are consistent with previous research demonstrating that satisfaction of the relatedness need is positively associated with pleasant emotions and psychobiosocial experiences and negatively associated with unpleasant emotions [38]. This suggests that relatedness and functional PBS states may contribute to higher overall life satisfaction.

With regard to passion, our findings did not support the expected direct associations between harmonious passion or obsessive passion and functional PBS states or life satisfaction. While the DMP posits that harmonious passion generally fosters adaptive outcomes and obsessive passion leads to maladaptive ones, our results suggest that in the context of amateur long-distance running, passion may not directly translate into momentary PBS experiences or global evaluations of life quality. One possible explanation for this divergence is the differing nature of the constructs: whereas passion reflects a stable, identity-integrated orientation toward running, PBS states capture situational, performance-related experiences that may be more immediately affected by contextual and self-regulatory factors. Consequently, the influence of passion on well-being may be indirect or conditional, acting through more proximal mediators, such as the basic psychological need for autonomy.

Furthermore, the positive correlation observed between harmonious passion and obsessive passion suggests that many runners experience both forms of passion simultaneously. This coexistence may blur the distinct effects predicted by the DMP, particularly in a sample of dedicated amateur runners for whom the sport is both a valued passion and a demanding commitment. Indeed, recent evidence indicates that the adaptive consequences of harmonious passion are most evident when obsessive passion is low [39], highlighting the importance of the interplay between the two forms of passion rather than their isolated effects. In the self-organized context of amateur running, harmonious passion may coexist with varying degrees of constraint, fatigue, or performance demands, potentially attenuating its direct association with situational states.

We did observe a positive association between obsessive passion and dysfunctional PBS states. This reaffirms the generally maladaptive nature of obsessive passion [27]. However, it is worth noting that mean scores of harmonic passion and functional PBS states were higher than their respective counterparts (i.e., obsessive passion and dysfunctional PBS states). These results suggest that participants' experiences were mainly characterized by adaptive behaviors and that they were more likely to engage in physical activities driven by intrinsic enjoyment and balance, rather than being controlled by obsessive or rigid passions. This aligns with prior research in leisure physical activity and sport [32] contexts, reinforcing the idea that functional experiences and adaptive attitudes tend to prevail among amateur long-distance runners.

Practical implications

Given the key role of autonomy, amateur long-distance runners and running coaches alike are advised to prioritize strategies that support autonomy. For example, allowing runners to set their own goals and choose their own training schedules can foster a feeling of ownership and intrinsic motivation. This is also relevant for solo runners who may rely on only online schedules or apps for guidance. Fostering autonomy may lead to improved intrinsic motivation and mental health outcomes [37, 40]. Furthermore, given the relationship between OP and dysfunctional PBS states, runners should opt for a balanced approach toward their running. Excessive engagement may lead to overtraining or other negative health outcomes [41]. Consequently, coaches should promote a running attitude with a balanced amount of autonomy, guiding runners to find meaningful engagement in the physical activity or sport without sacrificing other important aspects of their life. Lastly, practitioners should prioritize creating a supportive training environment to enhance functional PBS states linked to increased life satisfaction. This can be achieved by emphasizing relatedness and building social networks that connect runners to their peers.

Limitations and future perspectives

The cross-sectional design of our study prevents conclusions regarding temporal order and causality. Mediation analyses on cross-sectional data are also subject to criticism [42]. Moreover, common method bias has the potential to adversely affect construct reliability and validity [43]. The exclusion of competence indicated potential psychometric problems, warranting further research. Similarly, some constructs (harmonious passion, autonomy, and positive PBS) showed lower AVE. However, they exhibited strong reliability and contributed to an overall adequate CFA fit. Given their status as validated instruments, we deemed them suitable for inclusion in the final model. Finally, the sample consisting of primarily middle-aged men from a specific R4S event may limit the generalizability of our findings.

Future research should consider stratification by age, gender, socioeconomic status, education level, ethnicity, and BMI. Future studies may also consider longitudinal designs to understand how basic psychological needs, passion, PBS, and life satisfaction outcomes occur over time. More

running-specific outcomes are also recommended, as life satisfaction is multifactorial, and psychological constructs, such "satisfaction with running", might be more appropriately predicted by running-specific variables. Further integration between SDT and DMP may also be worthwhile.

Conclusions

This study highlights the importance of motivation and emotions in amateur long-distance running. Autonomy fosters functional PBS states and life satisfaction, highlighting the value of self-determined motivation. Conversely, OP is linked to dysfunctional PBS states, underscoring its risks. Collectively, autonomy and OP emerge as key correlates of PBS states and life satisfaction in runners.

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Data availability Data is available from the authors upon request.

Declarations

Conflict of interest All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Informed consent Participants were informed about the procedure, the measurements, and the general purpose of the study, and provided writteninformed consent before participation.

Ethical approval statement All the procedures were conducted under the ethics of the Declaration of Helsinki and ethical permission and approval were obtainedby the Institutional Person Research Approval Committee of the University of Verona (protocol number: 25.R1/2017, date of approvalMarch 09, 2017).

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