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Original Research

Psychological Status During and After the Preparation of a Long-distance Triathlon Event in Amateur Athletes

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ABSTRACT

International Journal of Exercise Science 14(5): 134-148, 2021. Preparation for an endurance event among amateur athletes requires a major commitment on their part. Knowing amateur athletes' psychological characteristics during a training period should be a priority for coaches and athletes. The aim of our longitudinal study was to characterize the psychological profile of amateur athletes over a training period of six months prior to and after a long-distance triathlon. Thirty-two amateur athletes (13 females; 19 males; 1.5±1.3 years of experience) were recruited for this observational study. All participants (39±9.9 years old; weighs 73±12.9 kg; measure 172±10.2 cm) underwent a physical fitness assessment pre- and post 6-months of training, a monthly psychological questionnaire battery assessing mood, positive and negative affect, passion and motivation and, for some participants (n=5), an interview post event. Positive emotions increased until the sixth month, from 38.1±22.0 to 54.3±7.2 ($Z=3.49$, $p<0.001$, $r=0.80$). Participants were more harmonious (29.0±3.0) than obsessive (13.0±1.0) with their triathlon's passion ($Z=4.91$, $p<0.001$, $r=0.85$). Participants felt a high level of intrinsic motivation (15.9±1.76) and a low level of external motivation (4.9±1.08) about their triathlon training ($p<0.05$). The vigor score is the only sub scale that significantly changed from the 1st to the 6th month of training, and ranged between 21.4±10.6 and 28.1±4.1 ($Z=2.0$, $p=0.046$, $r=0.46$). This longitudinal observational study is the first to have explored athletes' psychological and emotional parameters over a training period of six months prior to a long-distance triathlon event and one month after. Thus, specific interventions and mental training can be structured around these important milestones.

KEY WORDS: Endurance, longitudinal, sport motivation, passion, mood

INTRODUCTION

In the last two decades, endurance sports, from a duration of 2h to 17h (e.g., half-marathons, marathons, ultramarathons, half Ironman™, Ironman™), have become popular in the general population (23). In light of these popular trends around long-distance triathlons, it appears that those participating in different triathlon distance events are not only elite athletes, but mainly

amateur triathletes that do not make a living practicing their sport (3). It is known that combining three sports for training sessions adds a training load to the athletes' life that could influence their behavioral (e.g., confidence, stress, mood) and psychological characteristics. However, the psychological characteristics (e.g., motivation, emotion, passion) of amateur triathletes have not been described or defined in previous studies (31, 45).

In this context, the athletes' participation in long-distance sporting events is motivated by the fact that health and healthy lifestyles are very much encouraged (41) to counteract sedentary behaviors that are typically related to many chronic diseases (3). Thus, the exposure of amateur athletes to triathlons can lead them to develop a new passion. In fact, passion, which can be defined on a continuum from harmonious (a strong desire to do an activity, but the activity remains under the person's control) to obsessive (an activity that becomes a controller and makes the individual a "slave" to the activity that he or she loves), can lead athletes to a better or a lesser performance in a sport (43), to live positive or negative emotions (11), or to burnout for the worse (24). Nevertheless, passion may be also be related to the athletes' motivation that explains why athletes continue to participate in events and push themselves harder (21, 27).

Motivation to participate and practice a sport can be defined on an intrinsic and extrinsic continuum of motivation (7). In the context of a long-distance triathlon, amateurs and athletes that participate are, in majority, between 40 and 49 years old (46). Many athletes train on their own, while others hire a coach (19). Due to the emergence of this discipline, some amateur triathletes -sometimes- head solely towards the unknown, despite the recommendation of supervised training by a kinesiologist, an exercise physiologist or a certified triathlon coach. In fact, one study indicated that amateur athletes training alone score lower in stress management, motivation, mental skills and influence of performance evaluation than professional athletes (31). Also, the psychological characteristics of amateur triathletes seem to play an important role in their sports performance (e.g.: completing the event regardless of the time) similarly to elite athletes (25, 26, 37).

Psychological characteristics, such as, positive (PA) or negative (NA) affect can be used to improve our knowledge of triathletes' general state or discharge. In fact, affect encompasses a set of psychological mechanisms influencing behavior (11). For example, a person with high PA is in a state of high energy, full concentration and engagement with pleasure, while a low PA is characterized by sadness and lethargy. On the other hand, a NA is described as a general dimension of distress and unpleasant engagement that encompasses several aversive moods, but a low NA is characterized by a state of calmness and serenity(11). Aside from its link with the motivation, performance, stress and relation with injuries (6, 11, 30), there is little (if any) observation of amateur athletes practicing an endurance sport such as triathlon in the literature. This is why the triathletes' psychological characteristics deserves to be investigated to help expand on the psychological notions of novice amateur athletes participating for the first time in a physically demanding event.

Consequently, it appears that amateur triathletes' psychological skills during a training period should be taken into account within the perspective of developing a holistic intervention (i.e.,

physical and mental training) for the athletes and the people around them (e.g., coach, family, other athletes). Thus, the aim of our study was to investigate the psychological characteristics (passion, motivation, mood and affect) of novice amateur athletes over a training period of six months prior to a long-distance triathlon and one month after.

METHODS

Participants

Thirty-two voluntary participants (Canadian amateur athletes) were enrolled in the research protocol. Inclusion criteria required that participants were aged 18 and over with no known cardiopulmonary conditions and without contraindications to exercise as assessed by the Physical Activity Readiness Questionnaire (40). Also, participants should never have taken part in a long-distance triathlon (i.e., Ironman^{tm} or half-Ironman^{tm}) event. To validate their participation in the research project, participants needed to be registered and have a proof of their enrollment for a long-distance triathlon (Ironman 70.3^{tm}; Mont-Tremblant, Quebec, Canada, 2016 edition). Exclusion criteria were: 1) that the participant had a pro and/or elite athlete status; 2) had a history of substance abuse; 3) had a severe heart or pulmonary disease; 4) had a diagnosis of cancer or any other physical limitation that may have limited triathlon training; or 5) being pregnant. This project was approved by the institutional ethics committee of the University of Quebec in Montreal (IRB certificate number: 2015-e-734) and was conducted in accordance with the World Medical Association Declaration of Helsinki. All participants gave their written informed consent, which was reviewed and signed before participating in the study. This research was carried out fully in accordance with the ethical standards of the International Journal of Exercise Science (29).

Protocol

At their entry in this study, participants underwent physical fitness tests and answered psychological questionnaires (Figure 1**)**. Physical fitness tests were described in a previous study (20), as follows: cardiovascular tests (i.e., cardiac echography measurement, maximal aerobic capacity test), field tests (i.e., half-cooper test, mean time on a 5x100m swim test), musculoskeletal tests (i.e., flexibility and grip tests) and a body composition assessment. The tests were performed before and after the six-month of a long-distance triathlon training program (Figure 1) supervised by a team of experienced kinesiologists' and cardiologists', led by the senior author Dr. Lalonde.

A twenty-four-week training periodization was built by the research team members (20). Each training session was supervised by two registered kinesiologists, a triathlon certified coach, and monitored using the Training peak^{TM} software. There were 3 training macrocycles: preparation, competition and transition. The different phases were separated into 3-week mesocycles (months), which typically included 2 weeks of build-up and one recovery week where volume and/or intensity was modulated. Microcyles (one week) consisted of a minimal of 2 training sessions in each of the following disciplines: swimming, cycling, running and strength and conditioning.

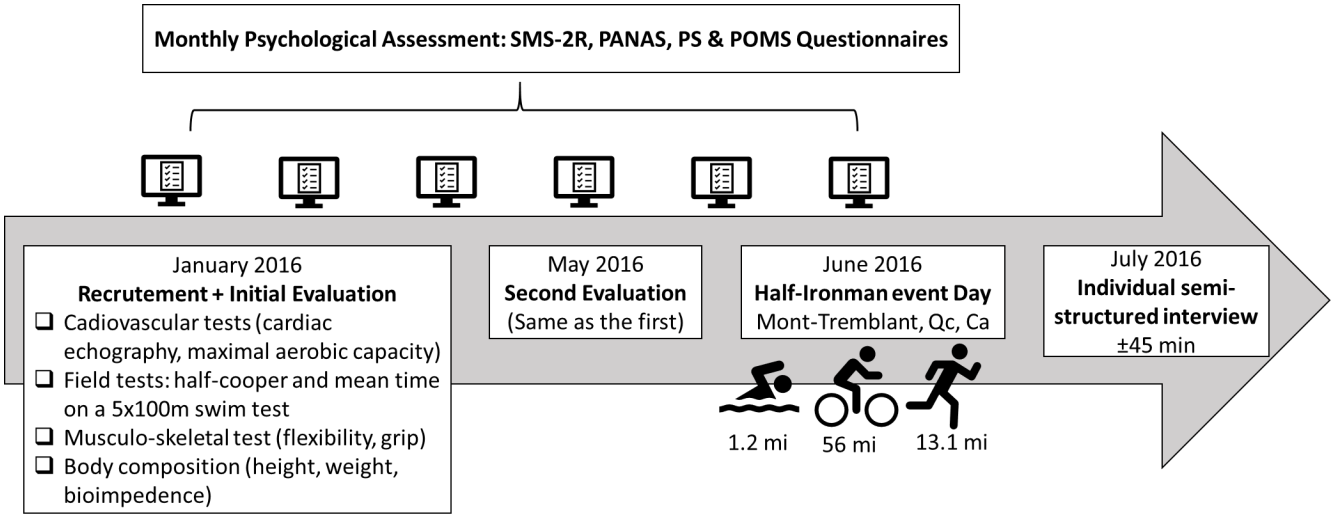

Figure 1. Physical fitness tests and data collection.

Measurement: Every month during the six months of training for the long-distance triathlon, participants received an email with a secure link to complete a monthly series of four questionnaires.

The Sport Motivation Scale 2 Revised - (SMS-2R Questionnaire) was designed to assess the individual's level of motivation towards sports (33), using the self-determination theory framework (7). Participants reported the extent to which the listed reasons for practicing their sport corresponded to their own personal reasons. Participant motivation was assessed using a 7-point Likert scale ranging from 1 (Does not correspond at all) to 7 (Corresponds completely). The scale consisted of 28 items measuring six factors: intrinsic, integrated, identified, introjected, external regulation and non-regulation (internal consistency of the present study: Cronbach's $\alpha = 0.45\text{-}0.83$).

The Positive and Negative Affect Schedule - (PANAS) questionnaire (positive and negative affect, PA and NA, respectively, schedule) measures the emotional traits of positive and negative emotion (47). The PANAS includes 20 items (10 items for PA and 10 items for NA) and is measured on a scale of 1 (not at all) to 7 (very strongly), with a maximal score of 70. The sub-themes of positive emotions and negative emotions obtained both excellent internal consistency in the current study (Cronbach's $\alpha > 0.85$) compared to the original study (Cronbach's $\alpha = 0.87$) (47). The original study gathered norms of PA (35.0 ± 6.4) and NA (18.1 ± 5.9) from a non-clinical undergraduate sample.

The Passion Scale - (PS) questionnaire contains two themes: the harmonious passion (Cronbach's $\alpha = 0.77$) and the obsessive passion (Cronbach's $\alpha = 0.84$), and it presented good internal

consistency in the present study. This 17-item questionnaire is validated, used, and converted to several contexts and sports (42).

The Profile of Mood State - (POMS) questionnaire is a standard validated psychological assessment (4). The questionnaire contains 65 words that describe the feeling people have. Scores for each item is recorded as 0 (Not at all) up to 4 (extremely) and divided into 6 subscales: tension-anxiety (9 items, score range 0-36), depression (15 items, score range 0-60), fatigue (7 items, range 0-28), confusion-bewilderment (7 items, score range 0-28), anger-hostility (12 items, range 0-48) and vigour-activity (8 items, range 0-32). Every subscale showed acceptable values of internal consistency in the present study (Cronbach's $\alpha = 0.63$-0.92).

Interview Process, Transcription and Data Analysis: In addition, an interview that lasted for an average of 45 minutes was conducted one week after the long-distance triathlon with five participants among the sample of 32 participants. Since this part of the study was in the exploratory phase, the goal was to recruit 15% of the initial participants for the interview. Participants were assured that everything they said during the semi-structured interview (10) would be kept confidential and anonymous. The interviewer asked the participants 9 open-ended questions to explore the participant's performance during his/her long-distance triathlon key moments, perception in regard to his/her physiological and psychological changes after the long-distance triathlon, management in the face of unforeseen events before, during and after the long-distance triathlon; and factors governing the participant's feelings after a long-distance triathlon. Data collection ended when the psychologist asked every question.

The transcription and data analysis phases of data management were conducted following the methodological process of Halcomb and Davidson to a verbatim transcription of managing audio-recorded interview data (13). In this sense, six steps were meticulously conducted by two researchers (MC and VGB): 1) Audiotaping of interview and concurrent note taking, 2) Reflective journalizing immediately after an interview, 3) Listening to the audiotape and amending/revising field notes and observations, 4) Preliminary content analysis, 5) Secondary content analysis, and 6) Thematic reviews. The preliminary content analysis was reviewed by a third research team member (FL) who had not been previously involved in the data collection.

Statistical Analysis

The descriptive statistics for all dependent variables are expressed by their means and standard deviations (Mean ±SD). The factorial analysis of variance (ANOVA) was used to determine pre-training difference between sex for age, triathlon experience, weight, height, body mass index and VO_2max. Correlation analysis (Pearson) were used to examine the relationship between psychological variables before (1st month) and after (6th month) the 6 months of training. Data analysis demonstrated a non-homogeneity of results (related to missing data) and non-parametric tests (Wilcoxon signed-rank test) were therefore employed for the statistical analysis. Wilcoxon signed-rank tests were performed to detect differences between psychological variables before (1st month) and after (6th month) the 6 months of training for the long-distance triathlon event and the difference between the subscales of questionnaires (e.g., positive affect and negative affect) by calculating the difference between their ranks. Effect size was calculated

with the following formula: r = Z / √N, were "r" is the effect size (0.1= small; 0.3 = medium; 0.5 = large), "Z" is the Wilcoxon rank and "N" is the total number of the samples (34). All data were analyzed with SPSS 19.0 software for Windows (IBM SPSS Statistic, USA). A level of $p \leq 0.05$ was selected for statistical significance.

RESULTS

Participants' Results: Participants' characteristics by sex are presented in Table 1. Among the 32 participants, 59% were male (n=19) and 41% were female (n=13). The mean weight of the whole cohort was 73.0±12.9kg, the mean height was 171.5±10.2cm and the mean body mass index was 25.0±2.8 kg/m^2. The mean age of the participants was 39 years (±9.9), and participants had an average of 1.5±1.3 years of triathlon practice and a $\dot{V}O_2$max of 46.2±8.5 ml.kg^{-1}.min^{-1}. Significant differences were observed between males and females for weight ($p<0.001$) and height ($p<0.001$).

Table 1. Participants' characteristics.

Variables (Mean ±SD)	Male (n=19)	Female (n=13)
Age (years)	40 ± 11.1	37 ± 8.0
Triathlon experience (years)	1.4 ± 1.3	1.4 ± 1.4
Weight (kg)	80 ± 10.4*	63 ± 8.5*
Height (cm)	178 ± 6.8*	163 ± 7.2*
Body mass index (kg/m^2)	26 ± 2.8	24 ± 2.7
Relative $\dot{V}O_2$max (ml/kg/min)	48.5 ± 9.3*	43.0 ± 6.4*

SD: Standard deviation; kg: kilogram; cm: centimeter; ml: milliliter; n: number of participants; *Significant difference between sex ($p < 0.001$)

Psychological Results: Psychological measures assessed every month of the six months of training pre-competition for the long-distance triathlon are presented in Table 2. The retention rate for questionnaire responses ranged from 100% (month 1) to 56% (month 6). The correlations between the psychological measures for the 1st and the 6th month of the training are presented in Table 3. At the 1st month, negative affect was positively correlated with the anxiety and tension (r=0.54, p=0.001), the anger and hostility (r=0.49, p=0.004) and the confusion (r=0.42, p=0.018) subscales of the POMS. At the 6th month, negative affect was only correlated with anxiety and tension (r=0.69, p=0.001). At the 1st month, positive affect was positively correlated with harmonious passion (r=0.40, p=0.025), intrinsic score (r=0.36, p=0.044) and the identified score (r=0.35, p=0.049). At the 6th month, positive affect was correlated with the vigor subscale (r=0.57, p=0.009) and the introjected score (r=0.50, p=0.025). As well, a significant correlation was observed between the external score at the 6th month and subscales of the POMS questionnaire: anxiety and tension (r=0.49, p=0.029), anger and hostility (r=0.72, p<0.001), confusion (r=57, p=0.009), depression (r=0.59, p=0.006) and fatigue (r=0.50, p=0.024).

The temporal evolution of obsessive passion decreased significantly from 2.73±1.24 to 2.05±1.21 (Z=-2.02, p=0.043, r=-0.45), while the harmonious passion remained the same (Z=-0.41, p=0.68, r=-0.09) throughout the months. Also, we observed that positive affect was stable, passing from an average score of 59.47±6.10 to 59.35±5.90 (Z=-0.34, p=0.73, r=-0.08) on a maximal score of 70.

Negative affect was also not significantly different between the 1st month and the 6th month ranging from 22.12±7.79 to 19.00±5.54 (Z=-0.95, p=0.343, r=-0.21). Positive affect was significantly higher than the negative affect at the 1st month (Z=-4.94, p<0.001, r=0.87) and at the 6th month of training (Z=-3.92, p<0.001, r=0.88). Athletes scored significantly higher for harmonious passion (average of 5.05±0.83) than obsessive passion (average of 2.73±1.24) at month 1 (Z=-4.94, p<0.001, r=-0.87) and month 6th (Z=-3.92, p<0.001, r=-0.88) of training.

Table 2. Psychological measures of the long-distance triathlon's athletes.

Scale	Subscale (SD)	1st Month n=32	2nd Month n=25	3rd Month n=26	4th Month n=19	5th Month n=18	6th Month n=20
POMS questionnaire	Anxiety	15.57 (5.00)	15.24 (4.58)	14.00 (3.82)	16.89 (4.76)	15.79 (4.71)	15.50 (3.93)
	Anger	20.57 (7.44)	21.24 (7.29)	19.15 (6.98)	21.95 (7.28)	20.21 (7.02)	19.55 (5.60)
	Confusion	13.74 (4.26)	12.80 (2.78)	12.38 (2.56)	13.68 (3.15)	12.63 (2.85)	12.35 (2.90)
	Depression	21.00 (8.47)	21.48 (7.83)	20.42 (8.08)	22.27 (8.06)	21.11 (9.08)	18.65 (4.64)
	Fatigue	10.91 (3.94)	10.52 (2.79)	13.27 (5.43)	11.89 (4.01)	11.79 (4.81)	10.30 (2.98)
	Vigour	25.63 (4.75)	26.60 (5.17)	25.77 (5.54)	26.21 (5.22)	26.05 (4é95)	28.15 (4.09)
PS questionnaire	Obsessive passion	2.73 (1.24)	2.43 (1.51)	2.05 (1.07)	2.47 (1.60)	2.03 (1.07)	2.05 (1.21)
	Harmonious passion	5.05 (0.83)	5.29 (0.99)	5.04 (0.94)	5.10 (1.00)	5.04 (0.93)	5.09 (1.05)
	Passion Criteria	5.13 (0.94)	5.16 (1.02)	4.94 (0.99)	5.02 (0.93)	5.08 (0.80)	5.23 (0.80)
PANAS questionnaire	Positive affect	59.47 (6.10)	56.96 (8.63)	57.61 (7.67)	57.84 (7.32)	57.63 (8.89)	59.35 (5.90)
	Negative affect	22.12 (7.79)	19.20 (6.67)	18.39 (6.36)	21.32 (8.08)	19.58 (8.29)	19.00 (5.54)
	Global index	37.34 (9.43)	37.39 (10.17)	39.23 (11.12)	36.53 (11.80)	38.05 (13.76)	40.35 (9.21)
SMS-2R questionnaire	Intrinsic score	5.70 (1.02)	5.75 (0.74)	5.68 (0.76)	5.75 (0.82)	5.51 (0.71)	5.73 (0.55)
	Integrated score	5.60 (1.00)	5.55 (0.97)	5.74 (0.74)	5.72 (0.80)	5.54 (0.76)	5.85 (0.70)
	Identified score	5.71 (0.81)	5.32 (1.09)	5.71 (0.61)	5.61 (0.89)	5.47 (0.90)	5.73 (0.56)
	Introjected score	4.68 (1.11)	4.74 (0.87)	4.64 (0.90)	4.96 (0.89)	4.58 (1.13)	4.70 (0.90)
	External score	1.60 (0.84)	1.59 (0.69)	1.85 (0.93)	2.16 (1.54)	1.81 (1.01)	1.42 (0.70)
	Amotivated score	1.10 (0.18)	1.19 (0.36)	1.41 (0.70)	1.40 (0.84)	1.33 (0.71)	1.15 (0.35)

SD: Standard deviation; n: number of participants: POMS: Profil of Mood State; PS: Passion scale; PANAS: Positive and Negative Affect Schedule; SMS-2R: Sport Motivation Scale 2 Revised.

Table 3. Correlation between psychological measures for the 1st and 6th month of training.

		6th month (n=20)															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1st month (n=32)	1.ANX	1	.605	.509	.649	.676	**.342**	.039	.155	.073	**.073**	.272	.050	.488	.096	.088	.689
	2.ANG	.837	2	.606	.677	.676	**.119**	**.152**	.036	**.242**	.022	.123	.272	.722	**.026**	.144	.314
	3.CONF	.766	.854	3	.482	.249	.159	.023	.002	**.302**	**.067**	.147	**.119**	.571	**.158**	.106	.323
	4.DEP	.689	.826	.807	4	.607	**.308**	**.152**	.067	**.212**	**.044**	.077	**.039**	.588	.272	**.040**	.438
	5.FAT	.559	.725	.534	.656	5	.535	**.124**	.237	**.067**	.014	.061	.410	.501	**.012**	.153	.211
	6.VIG	.01	**.037**	.03	**.246**	**.500**	6	.240	**.122**	.050	**.095**	**.051**	.003	.026	**.139**	.567	**.197**
	7.HP	**.068**	**.213**	**.203**	**.242**	**.271**	.314	7	.033	.381	.229	.544	**.202**	.128	.461	.365	**.214**
	8.OP	.198	.244	.221	.177	.143	.132	.323	8	**.098**	.464	**.304**	.273	.140	**.053**	.259	**.082**
	9.INTRI	.211	.031	.167	.142	.076	.032	.321	.242	9	.467	.598	.198	.061	.128	0253	.035
	10.INTEG	**.063**	**.194**	**.084**	**.062**	**.158**	.031	.161	.059	.647	10	.547	.092	.050	.025	**.084**	**.130**
	11.IDENT	.056	**.176**	**.076**	.012	**.051**	**.032**	.273	**.008**	.745	.614	11	.065	.390	**.024**	.275	.057
	12.INTROJ	.089	.063	.223	.229	.099	**.049**	.005	.294	.249	.330	.226	12	.265	.002	.498	**.293**
	13.EXT	.177	.228	.269	.310	.284	**.038**	**.032**	.143	.315	.122	.334	.334	13	**.030**	.430	.077
	14.AMOT	**.064**	**.166**	**.126**	**.196**	**.269**	.201	.454	.222	.271	.058	.075	**.093**	.007	14	**.078**	.371
	15.PA	**.155**	**.199**	**.099**	**.222**	**.242**	.292	.397	.212	.358	.306	.350	.097	.118	**.079**	15	**.295**
	16.NA	.534	.441	.426	.284	.176	.273	.078	.314	.176	.049	.061	**.222**	**.014**	**.112**	.093	16

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed); **In bold**: negative correlation; ANX: anxiety and tension POMS; ANG: anger and hostility POMS; CONF: Confusion POMS; DEP: depression POMS; FAT: fatigue POMS; VIG: vigor POMS; OP: Obsessive passion; HP: Harmonious passion; INTRI: Intrinsic score; INTEG: integrated score; IDENT: Identified score; INTROJ: Introjected score; EXT: External score; AMOT: Amotivated score; PA: Positive affects PANAS; NA: Negative affects PANAS

Over the 6 months of training, athletes' motivation score changed and varied for each type of regulation, but there were no significant differences within each type of regulation. Intrinsic regulation (1st month: 5.70±1.02 and 6th month: 5.73±0.55) and integrated regulation (1st month: 5.60±1.00 and 6th month: 5.85±0.70) were both significantly higher than the other type of regulations: identified, introjected, external and non-regulation ($p<0.001$). Identified regulation (1st month: 5.71±0.81 and 6th month: 5.73±0.56) and the introjected regulation (1st month: 4.68±1.11 and 6th month: 4.70±0.90) were higher than external (1st month: $Z=-4.95$, $p<0.001$, $r=-0.90$ and 6th month: $Z=-3.94$, $p<0.001$, $r=-0.70$; 1st month: $Z=4.87$, $p<0.001$, $r=-0.90$ and 6th month: $Z=-3.93$, $p<0.001$, $r=-0.69$, respectively) and non-regulation (1st month: $Z=-4.95$, $p<0.001$, $r=-0.90$ and 6th month: $Z=-3.93$, $p<0.001$, $r=-0.70$; 1st month: $Z=-4.94$, $p<0.001$, $r=-0.90$ and 6th month: $Z=-3.93$, $p<0.001$, $r=-0.69$, respectively). The athletes' scores on the external regulation (1st month: 1.60±0.84; month 6: 1.42±0.70) and the non-regulation (1st month: 1.10±0.18; 6th month: 1.15±0.35) subscales over the 6th month of training were both statistically lower than the other regulations ($p<0.001$). There was a significant difference between external and non-regulation at the 1st month ($Z=-3.54$, $p<0.001$, $r=-0.79$), but not after the 6th month ($Z=-1.38$, $p=0.17$, $r=-0.24$) of training for long-distance triathlon.

From the POMS questionnaire scores results, we observed that the vigor score is the only subscale that significantly changed from the 1st month to the 6th month of training and ranged between 25.63±4.75 and 28.15±4.1 ($Z=-2.0$, $p=0.046$, $r=-0.45$). Athletes mainly rated the vigor subscale (on 32) as the higher mood ($p<0.01$) and it was followed by the depression (ranged from 18.65 ± 4.64 and 22.27±8.1 on 60), the anger (ranged from 19.15±6.98 and 21.95±7.28 on 48), the anxiety (ranged from 13.00±3.82 and 16.89±4.76 on 36), the confusion (ranged from 12.35±2.90 and 13.74±4.26 on 28) and the fatigue (ranged from 10.30±2.98 and 13.27±5.43 on 28) scores.

Interview Results: All participants that engaged in the post-long-distance triathlon interview reported that prior to the competition, they were convinced that everything would be fine due to the training period. They had the feeling of being ready and having trained hard enough to achieve their goals: "*I knew I had everything I needed to get it right"* and "*I knew I was going to finish because I had trained hard*". This feeling was confirmed after the long-distance triathlon since participants reported a very positive experience: "*I'm really happy with my race*" and "*I'm still on a cloud*".

Participants reported very representative key moments of their state of mind. The representative words were "*confidence*", "*I am ready*", "*out of the water*", "*it was the plan*", "*energy*" and "*support from friends and family*". Among the five interviews, only one participant repeated key phrases during the triathlon. For swimming, it was: "*I am a North American river otter*"; for cycling, it was "*they closed the 117 road for you, take advantage of it*"; and for the race, it was: "*you do not think about anything anymore*". The only negative key moment reported by all participants was due to a very serious "accident" during the long-distance triathlon: "*The only negative moment of the race was the accident, honestly, I do not think there is anyone who missed that*" and "*Anyone can't be indifferent about the race accident*".

The qualitative analyses showed that there is a consensus among the participants regarding both physiological and psychological changes after the long-distance triathlon. All reported overall physiological fatigue in addition to muscle fatigue one week after the long-distance triathlon, in addition to lower limb pain. For psychological changes, they reported being happy and in a state of flow.

The responses of participants in the face of unforeseen events before the long-distance triathlon were very similar since everyone needed to manage their body, muscle, and pain. They reported "*having their bodies listened to*" in addition to "*consulting a physiotherapist and a chiropractor to get rid of pains*". They also reported that they communicated with their coach "*I trusted the people around me and it was good*", "*At this time, I said to my coach, the coach adjusted the training*".

In the face of unforeseen events during the long-distance triathlon, the responses of the participants were identical. They reported having "*listened to their body*" and have held "*on the plan*" that they had decided on with their coach. The participants that were least prepared, who did not specifically define a plan A, B or C, were those who needed to repeat "*listen to your body, listen to your body*" during the competition.

In the face of unforeseen events after the long-distance triathlon, all participants reported having taken the week off to allow a complete recovery of their body as recommended by their coach: "*I am taking this week easy and I am giving time to my body, even if I would like to go back to training*". There were two different feelings experienced by participants after the long-distance triathlon. Two participants had post-long-distance triathlon blues: "*I'm in my post-Ironman blues, so please, do not bother me too much*", while three participants experienced no post-long-distance triathlon blues since they were happy and in a state of flow. These three participants were already re-registered for another high-level sporting event: "*My experience was so positive that I have re-registered for another competition*".

DISCUSSION

The objective of this study was to characterize the psychological state of amateur triathletes over a training period of six months prior to and after a long-distance triathlon. Our data showed that participants were progressively living the experience of the triathlon sport in a harmonious state with their lifestyle (e.g., reconciliation work, family and sport) and living a more positive affect during their 6 months of training (e.g., enthusiastic, inspired). Also, over the six months of training, our study showed that intrinsic motivation (e.g., practicing my sport reflects a fundamental character of whom I am) tended to rise, and external and non-regulation (e.g., the people around me reward me when I do it) remained very low. To our knowledge, no other studies have been done on psychological monitoring of amateur athletes during the preparation of and after a long-distance triathlon event.

If we look at other studies measuring the psychological characteristics of athletes over a training period in other sports, harmonious passion was linked with better performance (swimming and water polo athletes) (43), better well-being (36, 43), less perceived stress and negative affect in 21 different sports (12). Also, harmonious passion was associated with approach-oriented coping strategies (less anxiety) (44). Although motivation can be a limiting factor for some people in participating in physical activity, being engaged in an important event such as a long-distance triathlon may be considered as a motivating source to maintain a healthy lifestyle and integrated psychological skills training (22). In our study, commitment was achieved when amateur athletes registered for the long-distance triathlon event, but the level of motivation to do that and complete every training session for 6 months was not planned and could change. Also, deliberate practice, which can be defined as intrinsic motivation, is linked with harmonious passion (43). However, to our knowledge, no study has observed the level of motivation for training or registering for long-distance sports events.

During the six months of training, the POMS scale showed in triathletes that the moods were stable, while vigor subscale increasing by 2.5 (on a maximal of 32) between the 1st month and the 6th month (just before the long-distance triathlon event). Even if change was not different between stages of the study, the different training phases (macrocycles, mesocycles and microcycle) had a potential effect on the mood and energy of the athletes (5, 28). This could be explained by the wide range of results for each subscale (high standard deviation). Thus, the

anxiety-tension subscale was at its highest point after the 4th month of training. Other studies have shown similar results over triathletes using the POMS scale (32, 45). One study found significant differences between their baseline and 6th month for the anxiety somatic (symptoms like muscle tension, headaches) subscale, using the competitive scale anxiety inventory, and the fatigue subscale of the POMS (32). This elevation in anxiety and fatigue scores before the event were also demonstrated in our results. A certain level of stress and fatigue seems optimal to perform, as some studies concluded with the rising level of arousal, motivation, or anxiety leading to athlete's performance (Yerkes-Dodson's law) (15, 39). However, reaching this level, which seems to be idiosyncratic, can result in "bad" performance (39). Following athletes' psychological characteristics, whatever their level, can be done with the proper questionnaires and interviews. While this is a good start, other studies focusing on psychological interventions helping athletes (and all their ecosystem) adhere to sports psychology and coping with distress, competitive anxiety, recovery from injuries and other difficulties are needed (8, 9, 17).

Another interesting aspect of the current study was the qualitative analyses. Indeed, one week after the long-distance triathlon, five participants voluntarily participated in a psychological interview in order to better understand their state of mind before, during and after their long-distance triathlon challenge. The study of these parameters was particularly relevant since athletes in the sport's performance field like to attribute outstanding achievements to their psychological states (18). Although our population was not elite athletes, we reported similar observations, especially at the end of the long-distance triathlon. Indeed, all amateur athletes who participated in the post-long-distance triathlon interview reported a very positive experience, in addition to reports that they were in a state of flow characterized by a simple sentence, which was *"I'm still on a cloud"*. This is in accordance with Swann et al (38) who described in their study the subjective experience of flow among European Tour golfer athletes. However, contrary to the literature (1, 14, 35) and in opposition with our quantitative analyses results, participants during the post-long-distance triathlon interview did not report feeling any anxiety before they started the long-distance triathlon, since we noted that *"they were ready"* and *"knew that they had worked hard to finish"*. This can be explained by the fact that all of the five amateur athletes who participated in the interview had participated in the long-distance triathlon to complete a personal achievement and not for performance per se. They participated in the competition for the long-distance triathlon experience and the sporting challenge. In novice karate competitors, those who experience increased psychological stresses are those who reduce their competitive capability (35). In our study, participants were *"confident"* and *"ready"* to achieve their goal. We also reported that those who had a plan or key phrases were those who experienced the competition most positively. Nevertheless, it is important to interpret these findings in a context of study limitations, since the interview was after the competition and, in this sense, after the completion of the long-distance triathlon, which may be a bias to the participants' feeling interpretation. Finally, we expected that all participants could experience a post-long-distance triathlon blues effect, but it seems that no decline in their mood was observed. In ultra-distance triathletes, no decline in mood has also been reported (16). This can be explained by the fact that they are already tuned to their next goal, as we observed in three of our participants.

In light of our findings, it appears important to share some psychological perspectives. Indeed, coaches, physical trainers and exercise physiologists mostly use physiological parameters in addition to performance testing in order to follow the progress of their athletes over the year. However, in a sports performance context, where it is important to take into consideration every parameter to optimize the athlete's performance, psychological parameters play a key role in the athlete's follow-up (31). Thus, our study demonstrated that the athletes' psychological and emotional parameters should be followed over a training period prior to a long-distance triathlon and that this could easily be done with amateur athletes preparing for their first endurance competition. In order to propose a better follow-up of athletes, coaches and physical trainers should adopt a holistic approach with their triathletes where physiological and psychological parameters are equally considered. Our study supported the link between the athletes' psychological and emotional fitness and the athletes' physiological fitness to improve physical performance. Such perspectives could help coaches and their athletes to prevent overtraining, injury or fatigue and to improve the follow-up of the overall fitness of their athletes (2).

Although this study is one of the first in terms of the follow-up of psychological factors (qualitative and quantitative methods) prior to and after a long-distance triathlon in amateur athletes, there were some limits that need to be discussed. Over the 6-months follow-up, 26% of the questionnaires were not completed by amateur athletes. Although the protocol was set up to avoid missing data, managing missing data was a challenge due to participants' compliance in answering questionnaires. This had the consequence of reducing the statistical power, but not the quality of our data. Moreover, it seems important to note that only a few interviews with amateur athletes after a long-distance triathlon allowed to raise preliminary data on how to experience a long-distance triathlon event. Future studies should refine their methodology in order to include more specific questions in the interview (e.g., "what comparison can be made between the sporting event and other events in the participant's life" or "what would they have done differently in their preparations for the event"). Finally, we recommend adding some select questionnaires around symptoms of overtraining, depression-anxiety and emotional management to better understand the psychological parameters of amateur triathletes.

In conclusion, this observational study is the first to have explored amateur triathletes' psychological and emotional parameters over a training period of six months prior to and after a long-distance triathlon. Our data demonstrated that athletes had a strong intrinsic engagement over the time of their training period to complete their goal, despite their work and family obligations. Our study showed that at the end of the training period, athletes mostly felt confident in their ability to complete their long-distance triathlon. The completion of the long-distance triathlon provided a lot of positive emotion in athletes such as a sense of self-achievement. From a coaching perspective, the use of psychosocial and emotional tools may be very helpful to provide a holistic approach to triathlon training between the different phases of preparation for a triathlon. From a coaching perspective, coaches and physical trainers should adopt a holistic approach with their triathletes where physiological and psychological parameters are equally considered to propose a better intervention plan and follow-up.

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