The Passion [AQ1] Scale—Portuguese Version: Reliability, Validity, and Gender and Sport Invariance

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Abstract

The aim of this study was to analyze the psychometric properties of the original version of the Passion Scale (14 items, two factors). We tested it within a sample of mixed gender Portuguese athletes from different sports, including adapted sports. In addition to demonstrating reliability, validity, and confirmatory factor analyses of the Passion Scale, we sought to analyze the invariance of this measure between males and females and across six types of sports (soccer, futsal, swimming, surf, bodyboard, and adapted sports). [AQ2] We recruited 1,316 athlete respondents to test this scale from both genders (1,109 males; 207 females), aged ~~between 14 and 59 years~~ ($M = 21.83$; $SD = 8.67$). Our main results revealed weaknesses in the factor model for the original instrument (14 items and two factors) leading us to reject the model. However, after adapting the model (eight items and two factors), the psychometric properties of the Passion Scale improved substantially and then exhibited (a) good fit to the data and (b) invariance between gender and across sports. Our new proposed version of the Passion Scale can be used with confidence to analyze the passion athletes feel when practicing their sport.

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Keywords

passion, sport, adapted sports, factor analysis, multigroup analysis

Introduction

According to Vallerand et al. (2003), the word “passion” comes from the Latin “*passio*” (suffer), highlighting a passion-holding perspective that can be anchored in loss of rationality and lack of emotional control. In other words, passion is a strong emotion that tends to control the individual’s thinking and behavior. However, in a less controlling perspective, we associate positive feelings with the concept of passion and view it as more rational. In sports, Vallerand and Miquelon (2007) define passion as a strong connection between the individual’s affinity for a sport, and the amount of time and energy devoted toward it. In this positive perspective, passion can be conceptualized as the energy source that sustains an athlete’s commitment and persistence to any particular sport. Put it in other words, passion is the energy that fuels motivation. In this perspective, the Dualistic Model of Passion (DMP; Vallerand et al., 2003) distinguishes two types of passion: harmonious passion (HP) and obsessive passion (OP), based on how they are internalized (integrated into the individual’s identity), with differentiating implications for individual behavior.

HP is associated with autonomous internalization, by which the individual practices sports by free-will, due to a love for the sport, rather than to strengthen personal identity. In this kind of passion, the activity does not control the individual; rather the individual practices it without resentment or internal pressure. Therefore, athletes who feel HP to a particular sport tend to better manage time spent on it without feeling conflict between the sport and other daily activities (Vallerand, 2012; Vallerand et al., 2003). Thus, in sports, we can say that an athlete is harmoniously passionate when he or she says, thinks, or feels, “The new things that I discover with this sport allow me to appreciate it even more” (see Item 2 of the Passion Scale [PS] in Table 1).

OP is associated with controlled internalization, in which the individual forces him or herself to engage in sports practice in a search for social acceptance or increased self-esteem, experiencing internalized pressure to do so. Unlike HP, an athlete experiencing OP cannot live without this sport practice and becomes emotionally dependent on it in order to achieve social acceptance and support a personal identity. Therefore, OP athletes have problems managing time spent on sports practice while still performing other activities (Vallerand, 2012; Vallerand et al., 2003). In sports, we can affirm that an athlete has an OP when he or she says, thinks, or feels, “The urge is so strong, I can’t help myself from doing this activity” (see Item 9 of the PS in Table 1).

Although DMP was developed over a decade ago, there has been rapidly growing recent research interest in its applicability, particularly in work

Table 1. Descriptive Analysis of the PSp—Initial Model.

	Minimum– Maximum	<i>M</i> (<i>SD</i>)
1) This activity allows me to live a variety of experiences.	1–7	6.05 (.98)
2) The new things that I discover with this activity allows me to appreciate it even more.	1–7	5.98 (.99)
3) This activity allows me to live memorable experiences.	1–7	6.21 (.98)
4) This activity reflects the qualities I like about myself.	1–7	5.54 (1.18)
5) This activity is in harmony with the other activities in my life.	1–7	5.22 (1.28)
6) For me it is a passion that I still manage to control.	1–7	5.25 (1.44)
7) I am completely taken with this activity.	1–7	5.81 (1.24)
8) I cannot live without it.	1–7	5.25 (1.61)
9) The urge is so strong, I cannot help myself from doing this activity.	1–7	5.37 (1.50)
10) I have difficulty imagining my life without this activity.	1–7	5.36 (1.51)
11) I am emotionally dependent on this activity.	1–7	4.73 (1.65)
12) I have a tough time controlling my need to do this activity.	1–7	4.36 (1.60)
13) I have almost an obsessive feeling for this activity.	1–7	4.21 (1.75)
14) My mood depends on me being able to do this activity.	1–7	4.72 (1.70)

Note. *M* = mean; *SD* = standard deviation; PSp = ■■. **[AQ9]**

activities (e.g., Egan, Turner, & Blachman, 2017), the music industry (e.g., Bonneville-Roussy, Lavigne, & Vallerand, 2010; Bonneville-Roussy & Vallerand, 2018; Lalande et al., 2015), video gaming (e.g., Bertran & Chamarro, 2016) and the sports and exercise context (e.g., Lefrenière, Bélanger, Sedikides, & Vallerand, 2011; Paradis, Cooke, Martin, & Hall, 2013; Philippe, Vallerand, Andrianarisoa, & Brunel, 2009; Vallerand et al., 2003, 2006; Vallerand, Mageau, et al., 2008; Verner-Filion, Vallerand, Amiot, & Mocanu, 2017). However, only recently have there been published studies based on the DMP in the Portuguese sport context (Cid, Ferreira, Sousa, & Moutão, 2014; Cid & Louro, 2010; Cid, Silva, Monteiro, Louro, & Moutão, 2016; Cid, Vitorino, Silva, Ferreira, & Moutão, 2014; Teixeira & Cid, 2011). A factor that has slowed DMP's applicability to the Portuguese sport context has been the difficulty assuming that DMP measurement tools are valid and reliable with Portuguese respondents. While the PS, developed by Vallerand et al. (2003), is the most frequently used measurement for studying passion based on DMP theory, there have been concerns regarding the number of PS items for each factor and, consequently, the psychometric properties of the scale. The PS was originally developed in French and later translated into English, with 14 items (seven per each of two factors) selected from an initial pool of 34 items based on factor

weight from exploratory factor analysis. This two-factor (14 items) instrument was later submitted to a confirmatory factor analysis that required an adjustment to fit the data. Thus, the authors (Vallerand et al., 2006) asserted that some items had “result components” that might have interference-enhancing elements, and they removed these items. Several other studies found similar concerns, since different versions of the scale had been used in separate research applications, including a 6-item version (three items per factor) by Vallerand et al. (2006) and another 8-item version (four items per factor) by Vallerand, Salvy, et al. (2008). These concerns led Vallerand (2010) to revise his own scale, proposing a new 12-item version (six items per factor) whose psychometric qualities, when analyzed by Marsh et al. (2013), showed measurement invariance between French and English and between genders. Teixeira and Cid (2011) were the first to translate and validate the original PS (Vallerand et al., 2003) for Portuguese athletes. Through exploratory factor analysis, they identified weaknesses in two items (one item per factor), including low factorial weight and cross-loadings that led these authors to consider eliminating those items. The psychometric properties of this revised Portuguese version of the PS were later reviewed by Cid, Silva, Baptista, Moutão, & Monteiro (2014) with results that were not entirely conclusive, leading to a rejection of the original measurement model of 14 items and two factors. After eliminating two items in each factor, these authors confirmed substantial improvement that demonstrated adequate psychometric proprieties. Given these inconsistencies in the past literature regarding the PS measurement model and its application to Portuguese respondents, we reexamined the psychometric properties of the original PS (Vallerand et al., 2003), in a population of Portuguese athletes coming from six types of sports, including adapted sports, and we also analyzed the instrument’s gender and sport invariance.

Method

Participants

A total of 1,316 Portuguese amateur athletes (soccer, futsal, swimming, surf, bodyboard, and adapted sports), from both genders, aged 14 to 59 years ($M = 21.83$; $SD = 8.67$) participated in this study. Participants’ time of practice in their chosen sports varied from 1 to 37 years ($M = 8.16$; $SD = 5.92$) and the number of training sessions per week ranged from 1 to 12 ($M = 3.77$; $SD = 2.13$). Of these participants, 1,109 were males (age range: 14–59 years, $M = 21.85$; $SD = 8.70$; years of practice range: 1–37, $M = 8.43$, $SD = 6.04$; and number of training sessions per week range: 1–12, $M = 3.74$, $SD = 2.19$); 207 were females (age range: 14–53 years, $M = 21.72$, $SD = 8.56$; years of practice range: 1–28, $M = 6.63$, $SD = 4.87$; and weekly training sessions range: 1–11, $M = 4.28$, $SD = 2.65$). For cross-validation (i.e., invariance between calibration and

Table 2. Subsamples Characteristics.

Samples	N	Age	Gender		Training experience (years)	Weekly training (sessions)
			Male	Female		
Soccer	350	14–35 (<i>M</i> = 17.61; <i>SD</i> = 4.86)	358	–	1–28 (<i>M</i> = 9.08; <i>SD</i> = 4.17)	1–12 (<i>M</i> = 3.28; <i>SD</i> = .631)
Swimming	214	14–25 (<i>M</i> = 15.39; <i>SD</i> = 1.90)	131	83	1–16 (<i>M</i> = 7.10; <i>SD</i> = 3.40)	4–12 (<i>M</i> = 6.86; <i>SD</i> = 1.51)
Surf	297	15–51 (<i>M</i> = 28.64; <i>SD</i> = 8.09)	246	51	1–37 (<i>M</i> = 9.09; <i>SD</i> = 7.71)	1–10 (<i>M</i> = 2.50; <i>SD</i> = 1.59)
Bodyboard	169	15–45 (<i>M</i> = 26.30; <i>SD</i> = 7.25)	131	37	1–26 (<i>M</i> = 9.12; <i>SD</i> = 6.69)	1–10 (<i>M</i> = 2.65; <i>SD</i> = 1.61)
Futsal	135	14–18 (<i>M</i> = 15.32; <i>SD</i> = 1.86)	135	–	1–10 (<i>M</i> = 3.73; <i>SD</i> = 2.30)	2–5 (<i>M</i> = 3.52; <i>SD</i> = 1.15)
Adapted sports	143	15–59 (<i>M</i> = 29.04; <i>SD</i> = 10.47)	106	37	1–28 (<i>M</i> = 9.12; <i>SD</i> = 6.69)	1–12 (<i>M</i> = 4.52; <i>SD</i> = 2.71)

Note. *N* = sample size; *M* = mean; *SD* = standard deviation.

validation samples), we randomly split data into two samples, each composed of approximately 50% of the participants, following suggestions by Byrne (2010).

Our calibration sample was composed of 676 athletes (male = 570, female = 106; age: 14–59 years, *M* = 21.93, *SD* = 8.93; years of practice range: 1–37, *M* = 7.96, *SD* = 5.84; and number of weekly training sessions range: 1–12, *M* = 3.74, *SD* = 2.19). Our validation sample was composed of 640 athletes (male = 539, female = 101; age range: 14–55 years, *M* = 21.72, *SD* = 8.38; practice years range: 1–30, *M* = 8.37, *SD* = 6.00); and weekly training sessions range: 1–12, *M* = 3.80, *SD* = 2.07). Finally, to test measurement invariance, the sample was split into six groups, according to the type of sports practiced. Characteristics of each group (i.e., type of sport practiced) are presented in Table 2.

Instruments

We used the Portuguese version of the PS (Teixeira & Cid, 2011), consisting of 14 items on which participants responded on a 7-point Likert-type scale ranging from 1 (*Totally disagree*) to 7 (*Totally agree*). Items are grouped into two factors,

representing HP (e.g., “I am completely taken with this activity”—Item 7 of the PS) and OP (e.g., “I have difficulty imagining my life without this activity”—Item 10 of the PS), underlying DMP.

Data Collection

Potential participants were individually contacted at their training place or specific location of competition and were questioned as to their willingness to participate voluntarily in this study. We presented participants with a questionnaire alongside a written description of the study’s purpose, the names of the authors, collaborators, and partnership identifications, and in which participants were assured of personal confidentiality. To avoid any influence on their sports performance, data were collected $\pm$ hour prior to competition. We obtained the participants’ informed consent through their signature on the title page. Time taken to complete the questionnaire was approximately 5 to 10 minutes. Before data collection, we obtained approval from the University for this Research Protocol. Whenever possible, athletes completed the questionnaire independently. However, some adapted sports participants completed the questionnaire with help from coaches, family members, friends, or researchers, and, in these circumstances, we reinforced the imperative of confidentiality and the need to not bias interpretations. Of note, we used several social media (e.g., Facebook) to contact adapted sport athletes when they were engaged in international competitions, or, for athletes with hearing impairments, we used Portuguese Sign Language to assist communications.

Data Analysis

Confirmatory factor analysis. For confirmatory factor analysis, we followed suggestions made by several authors (Hair, Black, Babin, & Anderson, 2014; Kline, 2011) and used a ratio of 5:1 for the number of participants for each parameter to be estimated. However, the Mardia’s (1970) coefficient indicated a non-normal multivariate data distribution in all samples under analysis: calibration sample (45.04), validation sample (32.99), male sample (42.32), female sample (30.34), soccer (53.56), futsal (18.65), swimming (8.66), surf (45.77), bodyboard (34.84), and adapted sports (20.92). Therefore, we used bootstrap bollen-stine of 2,000 samples, as suggested by Nevitt and Hancock (2001).

Data analysis was performed according to several authors (Byrne, 2010; Hair et al., 2014; Kline, 2011), such that we used the recommended Maximum Likelihood method, chi-square test (χ^2), the respective degrees of freedom (df), and significance level (p). In addition, we used the following adjustment indexes: standardized root mean square residual (SRMR), comparative fit index (CFI), non-normed fit index (NNFI), root mean square error of approximation (RMSEA), and its respective interval of confidence (IC: 90%). We adopted

cut-off values (Hair et al., 2014; Marsh, Hau, & Wen, 2004) for CFI and NNFI $\geq .90$, and for SRMR and RMSEA $\leq .08$. Lastly, we calculated convergent validity (i.e., to test items that converged with the factors) through average variance extracted (AVE), considering values AVE $\geq .50$ as acceptable. In addition, we reached discriminant validity (i.e., analyze if the factors are sufficiently distinct) by having squared correlation (r) of each factor below AVE. To examine internal consistency, we adopted composite reliability (CR) scores, using $\geq .70$ as cut-off values (Hair et al., 2014). The analyses were undertaken using AMOS 23.0

Invariance analysis. Multigroup analysis aims to assess whether the structure of the measurement model is equivalent (invariant) between different participant groups with different characteristics (e.g., male and female). We established the following criteria for models of invariance (Byrne, 2010; Cheung & Rensvold, 2002; Marsh, 1993): (a) individual model analysis (data must fit each group) and (b) there must be invariance of the following parameters: configural, metric, scalar, and residual. In line with Cheung and Rensvold (2002), configural invariance was met if ΔCFI was below .01. For metric invariance, ΔSRMR had to be less than .030 and ΔRMSEA less than .015 to support model fit; for scalar, ΔSRMR had to be less than .010 and ΔRMSEA less than .015 to indicate measurement invariance (Chen, 2007). According to Marsh (1993), metric invariance is considered to be the minimum criteria for measurement invariance, and the differences between unconstrained model and others (fixed parameters) must be less than $\leq .01$ (Cheung & Rensvold, 2002). Residual invariance is not indicative of not achieving model invariance, and some authors consider this criterion to be optional since it is too restrictive (Byrne, 2010). Of note, several researchers (e.g., Byrne, 2010) have claimed that analyzing invariance models based on chi-square differences is too restrictive. Therefore, it seems more reasonable to analyze and discuss results based on CFI differences.

Results

Preliminary and Descriptive Analyses

As our preliminary data analysis revealed that missing values were less than 0.1%, missing values were imputed using the full information maximum likelihood estimation (Cham, Reshetnyak, Rosenfeld, & Breitbard, 2017). In addition, we found no outliers (univariate and multivariate). As seen earlier, Table 1 shows a descriptive analysis of participants' responses to all test items. Participants used all levels of response available to them for each of the items, and the mean value per item varied from 4.21 ($SD = 1.75$) to 6.21 ($SD = 0.98$), in the calibration sample.

Table 3. Goodness-of-Fit Indexes of the PSp Measurement Model in All Samples.

Models	χ^2	df	p	SRMR	NNFI	CFI	RMSEA	90% CI
Initial model (CS)	735.392	76	<.001	.082	.830	.858	.113	[.106, .121]
Final model (CS)	215.774	19	<.001	.080	.901	.933	.124	[.109, .139]
Final model (VS)	193.293	19	<.001	.079	.910	.939	.120	[.105, .135]
Male model	321.139	19	<.001	.080	.909	.939	.120	[.109, .132]
Female model	71.251	19	<.001	.065	.901	.933	.116	[.088, .145]
Soccer model	82.461	19	<.001	.070	.936	.957	.097	[.076, .119]
Swimming model	61.047	19	<.001	.054	.920	.946	.102	[.074, .131]
Futsal model	67.455	19	<.001	.080	.901	.919	.138	[.103, .174]
Surf model	195.697	19	<.001	.080	.897	.901	.177	[.155, .200]
Bodyboard model	67.635	19	<.001	.079	.914	.942	.177	[.155, .200]
Adapted sport model	25.269	19	.152	.040	.981	.987	.048	[.000, .093]

Note. df=degrees of freedom; SRMR=standardized root means square residual; NNFI=non-normed fit index; CFI=comparative fit index; RMSEA=root mean square error of approximation; 90% CI=confidence interval; CS=calibration sample; VS=validation sample; PSp = ■■.

Initial model (14 items; two factors) and final model (eight items; two factors).

Construct Validity Analysis

Goodness-of-fit indexes are presented in Table 3. We found that the initial model (14 items and two factors) did not fit the data. Therefore, following recommendations of several prior authors (e.g., Byrne, 2010; Hair et al., 2014), we searched for potential issues through modification and factor weights indices, leading us to eliminate some items: (a) those with factor weights below .50 and (b) those with cross-loadings. The final model was an instrument containing eight items and two factors; and we tested this model on the calibration sample, and, subsequently, on all subsamples according to gender and sports type. As seen in Table 3, the data fit the model for all of these samples, considering the previously mentioned cut-off values. RMSEA scores in all models were higher to the cut-off predefined values adopted in methodology (Byrne, 2010; Hair et al., 2014; Kline, 2011). The only exception was verified in the model regarding adapted sports group (RMSEA = .048). However, Worthington and Whittaker (2006) indicate that values up to .10 are acceptable.

In Table 4, we present the CR coefficients and the convergent and discriminant validity for each subsample. There were satisfactory values for CR and convergent validity in all models. Similar results were found for discriminant validity for all models.

Regarding measurement invariance, the final model (the scale with two factors and eight items) revealed invariance between the calibration and validation samples, between males and females, and across all the different sports

Table 4. Internal Consistency, Convergent, and Discriminant Validity.

Models	CR-HP	CR-OP	AVE-HP	AVE-OP	r^2
Initial model (CS)	.79	.90	.37	.57	.38
Final model (CS)	.80	.90	.51	.70	.35
Final model (VS)	.81	.91	.52	.71	.35
Male model	.84	.88	.57	.64	.34
Female model	.79	.89	.51	.68	.41
Soccer model	.87	.88	.63	.64	.28
Swimming model	.81	.93	.52	.77	.37
Futsal model	.81	.92	.50	.75	.44
Surf model	.73	.89	.50	.68	.29
Bodyboard model	.79	.93	.50	.76	.44
Adapted sport model	.73	.90	.51	.68	.29

Note. CR=composite reliability; HP=harmonious passion; OP=obsessive passion; r^2 =correlation between factors; AVE=average mean extracted; CS=calibration sample; VS=validation sample.

Initial model (14 items; two factors) and final model (eight items; two factors).

(see Tables 5 and 6). These values indicated: (a) configural invariance (the same number of factors was present in each group), (b) metric invariance (the factors had the same meaning in all samples), (c) scalar invariance (the comparison of latent and observed means was valid between groups), and (d) residual invariance (the comparisons between the observed items were supported).

In terms of local indices, standardized factorial weights ranged from (a) HP of .54 to .79 in the calibration sample, and .77 to .87 in the validation sample and (b) OP of .76 to .86 in the calibration sample, and .77 to .87 in the validation sample. In addition, there was a positive correlation between the two factors of .59 in both samples (see Figure 1).

Discussion

This study aimed to analyze the psychometric properties of the adapted Portuguese PS (Teixeira & Cid, 2011). In addition, we tested measurement invariance between genders and the six types of sports (including adapted sports), since previous studies, especially among Portuguese and Spanish participants (e.g., Pedrosa, García-Cueto, Torrado, & Arce, 2017; Teixeira & Cid, 2011), have shown inconsistencies. Data from this study demonstrated that the initial model (two factors of seven items each) did not fit the data. After removing three items from each factor, the data exhibited an acceptable fit to the model, leading to an instrument with eight items (four in each of the two factors). In addition, the final model was also found to be invariant between gender samples and across six different sports types.

Table 5. Measurement Invariance of the Portuguese PS Between Samples, Gender, and Adapted Sports.

Models	χ^2	df	$\Delta\chi^2$	Δdf	p	CFI	ΔCFI	SRMR	$\Delta SRMR$	RMSEA	$\Delta RMSEA$
Calibration—Validation											
CI	409.066	38	—	—	—	.936	—	.068	—	.074	—
MI	411.440	44	2.373	6	.882	.936	.000	.068	.000	.073	.001
SI	415.345	47	6.279	9	.712	.936	.000	.063	.005	.068	.006
RI	447.508	55	38.442	17	.002	.932	.004	.059	.009	.064	.010
Male—Female											
CI	392.427	38	—	—	—	.938	—	.056	—	.078	—
MI	412.861	44	20.433	6	.002	.935	.003	.054	.002	.076	.002
SI	441.009	47	48.582	9	<.001	.931	.007	.052	.004	.071	.007
RI	455.390	55	62.963	17	<.001	.930	.008	.048	.008	.069	.009
Adapted sports—Swimming											
CI	86.295	38	—	—	—	.961	—	.067	—	.062	—
MI	93.700	44	7.405	6	.285	.960	.001	.062	.005	.062	.000
SI	117.877	47	31.582	9	<.001	.953	.008	.058	.009	.059	.003
RI	134.107	55	47.812	17	<.001	.937	.024	.052	.015	.058	.004
Adapted sports—Surf											
CI	220.797	38	—	—	—	.914	—	.078	—	.080	—
MI	226.974	44	6.177	6	.404	.914	.000	.075	.003	.080	.000
SI	230.006	47	9.209	9	.418	.914	.000	.073	.005	.075	.005
RI	329.231	55	108.435	17	<.001	.870	.044	.071	.007	.072	.008
Adapted sports—Futsal											
CI	92.734	38	—	—	—	.953	—	.078	—	.078	—
MI	94.239	44	1.505	6	.959	.949	.004	.076	.002	.078	.000
SI	113.552	47	20.818	9	.013	.948	.005	.074	.007	.082	.004
RI	139.530	55	46.797	17	<.001	.921	.032	.071	.007	.069	.009
Adapted sports—Soccer											
CI	107.707	38	—	—	—	.964	—	.069	—	.071	—
MI	114.810	44	7.102	6	.312	.963	.001	.065	.004	.069	.002
SI	131.206	47	23.499	9	.005	.957	.007	.061	.008	.067	.004
RI	145.327	55	37.620	17	.003	.953	.011	.059	.010	.063	.008
Adapted sports—Bodyboard											
CI	92.616	38	—	—	—	.958	—	.068	—	.074	—
MI	99.739	44	7.124	6	.310	.957	.001	.066	.002	.072	.002
SI	101.400	47	8.844	9	.457	.958	.000	.064	.004	.069	.005
RI	204.750	55	112.135	17	<.001	.885	.073	.062	.006	.067	.007

Note. df=degrees of freedom; $\Delta\chi^2$ =differences in χ^2 ; Δdf =differences in df; CFI=comparative fit index; ΔCFI =differences in CFI; CI=configural invariance; MI=metric invariance; SI=scalar invariance; RI=residual invariance; SRMR = standardized root mean square residual; $\Delta SRMR$ = differences in SRMR; RMSEA = root mean square error of approximation; $\Delta RMSEA$ = differences in RMSEA.

Table 6. Measurement Invariance of the Portuguese PS Across Different Sports.

Models	χ^2	df	$\Delta\chi^2$	Δdf	p	CFI	ΔCFI	SRMR	$\Delta SRMR$	RMSEA	$\Delta RMSEA$
Soccer – Swimming											
CI	143.522	38	–	–	–	.953	–	.057	–	.061	–
MI	171.003	44	27.488	6	<.001	.945	.008	.055	.002	.058	.003
SI	222.811	47	79.289	9	<.001	.943	.010	.051	.006	.054	.007
RI	251.016	55	107.494	17	<.001	.921	.032	.047	.010	.051	.010
Soccer – Surf											
CI	263.093	38	–	–	–	.900	–	.067	–	.072	–
MI	267.331	44	4.238	6	.645	.900	.000	.067	.000	.071	.001
SI	305.514	47	42.421	9	<.001	.894	.006	.062	.005	.067	.005
RI	359.872	55	94.779	17	<.001	.884	.016	.058	.009	.062	.010
Futsal – Bodyboard											
CI	134.832	38	–	–	–	.932	–	.078	–	.056	–
MI	146.652	44	11.820	6	.066	.928	.004	.078	.000	.051	.005
SI	182.713	47	47.881	9	<.001	.925	.007	.074	.004	.049	.007
RI	249.703	55	114.872	17	<.001	.905	.027	.071	.007	.048	.008
Futsal – Swimming											
CI	128.552	38	–	–	–	.934	–	.080	–	.062	–
MI	142.751	44	14.200	6	.027	.928	.006	.071	.009	.062	.000
SI	193.394	47	64.843	9	<.001	.925	.009	.070	.010	.058	.004
RI	204.164	55	75.616	17	<.001	.893	.041	.069	.011	.057	.005
Surf – Bodyboard											
CI	262.990	38	–	–	–	.909	–	.072	–	.065	–
MI	276.502	44	13.511	6	.036	.906	.003	.072	.000	.065	.000
SI	282.577	47	19.586	9	.021	.905	.004	.070	.002	.059	.006
RI	298.940	55	35.950	17	.005	.901	.008	.066	.006	.057	.008
Surf – Swimming											
CI	256.683	38	–	–	–	.910	–	.079	–	.065	–
MI	265.884	44	9.201	6	.163	.908	.002	.078	.001	.064	.001
SI	307.438	47	50.755	9	<.001	.900	.010	.072	.007	.063	.002
RI	383.313	55	126.630	17	<.001	.892	.018	.067	.012	.057	.008
Soccer – Futsal											
CI	150.039	38	–	–	–	.946	–	.072	–	.066	–
MI	154.675	44	4.635	6	.591	.946	.000	.071	.001	.062	.004
SI	158.817	47	8.777	9	.458	.946	.000	.065	.007	.061	.005
RI	192.290	55	42.251	17	.001	.933	.013	.064	.008	.055	.011
Futsal – Surf											
CI	278.198	38	–	–	–	.923	–	.071	–	.058	–

(continued)

Table 6. Continued

Models	χ^2	df	$\Delta\chi^2$	Δdf	p	CFI	ΔCFI	SRMR	$\Delta SRMR$	RMSEA	$\Delta RMSEA$
MI	294.118	44	15.920	6	.014	.919	.004	.069	.002	.058	.000
SI	334.972	47	56.774	9	<.001	.913	.010	.065	.006	.056	.002
RI	445.113	55	166.915	17	<.001	.874	.049	.060	.011	.051	.007
Soccer – Bodyboard											
CI	149.887	38	–	–	–	.951	–	.073	–	.061	–
MI	178.040	44	28.153	6	<.001	.942	.009	.071	.002	.059	.002
SI	219.750	47	69.863	9	<.001	.941	.010	.070	.003	.058	.003
RI	319.555	55	169.669	17	<.001	.885	.066	.069	.004	.052	.009
Bodyboard – Swimming											
CI	128.426	38	–	–	–	.944	–	.078	–	.079	–
MI	144.787	44	16.361	6	.012	.937	.007	.075	.003	.078	.001
SI	160.798	47	32.372	9	<.001	.935	.009	.072	.006	.077	.002
RI	254.501	55	126.075	17	.001	.929	.015	.067	.011	.074	.005

Note. df=degrees of freedom; $\Delta\chi^2$ =differences in χ^2 ; Δdf =differences in df; CFI=comparative fit index; ΔCFI =differences in CFI; CI=configural invariance; MI=metric invariance; SI=scalar invariance; RI=residual invariance; SRMR = standardized root mean square residual; $\Delta SRMR$ = differences in SRMR; RMSEA = root mean square error of approximation; $\Delta RMSEA$ = differences in RMSEA.

Figure 1. Standardized parameter (covariance's between factors, factor weights, and error of measurement) from calibration (left) and validation (right), all statistically significant in its respective factor (eight items and two factors).

OP = obsessive passion; HP = harmonious passion.

Construct Validity Analysis

Past analyses of the PS have led researchers to recommend shorter versions of the scale. For example, Vallerand et al. (2006) suggested a test with only six items, Vallerand, Salvy, et al. (2008) formed a scale with eight items, and Cid, Silva, et al. (2014) recommended a test for Portuguese athletes with eight items. Later, Vallerand (2010) proposed a new version of the PS that employed 12 items in two factors with some slight modifications that were later analyzed (in French and English versions) by Marsh et al. (2013), and a later validated to Spanish by Chamorro et al. (2015). However, these versions of the PS only showed an acceptable data fit after correlating measurement errors between two items in the HP factor and two items in the OP factor. This could mean that the shorter versions are a better option for analyzing these factors.

Interestingly, these results revealed that individuals from several different countries value both types of passion, a fact that seems to be demonstrated by the moderate and high means of all of the items (e.g., Vallerand et al., 2006; Vallerand, Salvy, et al., 2008). This may be due, in part, to the positive correlation between both types of passion, not only in this study ($r = .59$) but also in all studies validating this scale (Chamorro et al., 2015; Cid, Silva, et al., 2014; Marsh et al., 2013; Pedrosa et al., 2017; Vallerand et al., 2003).

Regarding the psychometric properties of the initial model in this study (i.e., the scale with 14 items in two factors), our data did not show an acceptable fit to the model, corroborating weaknesses in the full version. Therefore, it was necessary to analyze a shorter version, considering that it is not necessary to have so many items (observations) for each factor (latent construct). For example, Hair et al. (2014) recommended the use of only four items. This practice is common in scale validation when the models are complex and show construct validity problems associated with larger numbers of items (Cid, Moutão, Leitão, & Alves, 2012; Monteiro et al., 2018). This strategy has been used successfully by the PS author himself in several studies (Vallerand & Miquelon, 2007; Vallerand et al., 2006; Vallerand, Salvy, et al., 2008). These studies indicated that the shorter versions might be a better alternative than the full version, and our results support this conclusion.

Item elimination should be guided by the assurance of maintaining the integrity of the theoretical model (Henson & Roberts, 2006). Therefore, after analyzing the local adjustment indices and the modification indices, we eliminated three items from each factor (Items 12, 13, and 14 of the OP factor and Items 4, 5, and 6 of the HP factor), following two main principles: (a) We retained only factor weights $> .50$ and (b) we retained only items that did not correlate significantly with other items from the same factor (no cross-loadings). Thus, we ensured that no doubts were raised from a semantic point of view and no eliminated items would bias interpretation.

Following Hair et al. (2014) recommendations, our results support the use of the shorter and final version (two factors with eight items each), as items then

better reflect the latent construct that the scale is meant to measure. In addition, this shorter version exhibited good fit in accordance with such other important components as: (a) cross-validation (i.e., there were no differences between the calibration and validation samples), (b) convergent validity (i.e., all factors had scores above cut-off values), and (c) discriminant validity (i.e., both factors were distinct and measured different types of passion). CR values were acceptable ($\geq .70$), meaning that the scale measures both factors consistently and reproducibly (Hair et al., 2014) just as did the original scale (Vallerand et al., 2003).

Measurement Invariance

Our measurement invariance analyses supported the use of this revised scale for participants of both genders and all six types of sports examined (i.e., soccer, futsal, swimming, surf, bodyboard, and adapted sports) according to Marsh et al. (2013). The theoretical constructs underlying DMP were conceptualized in the same way in among all of these participant subsamples. Following several authors' recommendations regarding invariance analysis (Byrne, 2010; Chen, 2007; Cheung & Rensvold, 2002), we can confirm that (a) the proposed theoretical structure is equivalent in all samples examined, (b) factor weights corresponded in all samples, and (c) test users can compare results between males and females and between athletes engaged in different types of sports. In addition, there is a linguistic equivalence and applicability of this revised PS (Vallerand et al., 2003) across other countries in the sport context.

Study Limitations

Our results support the applicability of the Portuguese version of the PS for sport athletes, but there are some limitations to this research. First, the present scale was applied among Portuguese athletes, and generalization to other countries remains speculative until further research. Second, this study was cross-sectional in its design, meaning that it is not clear how the instrument's psychometric properties might change through athletes' development until longitudinal research has been conducted. Thus, this research was based on a strong theoretical model, and future interventions can help in assessing HP and OP in athletes and test for time invariance. Third, although we found solid evidence of a difference between Passion constructs of HP and OP, future studies should associate scores on this instrument with other motivational or emotional variables. For example, Zhao, St-Louis, and Vallerand (2015) in a study with Chinese participants demonstrated that HP was significantly positively associated with positive emotions and significantly negatively associated with negative emotions, while OP was significantly positively associated with both positive and negative emotions. Finally, this analysis exhibited an adjusted fit for measurement invariance between samples involving gender and six different types of

sports, and forthcoming studies should examine invariance between other group characteristics (e.g., countries, collectivism and individualism sports, amateur, and professional athletes).

Conclusion

The results of this study showed that is it not advisable to use all 14 items split between two factors as in the original version of the PS in Portuguese athletes, as this model exhibited construct validity problems. However, this research proposed an alternative shorter version of the PS with eight items in two factors in examining athlete's passion across gender and across different types of sports, including adapted sports. This shorter version exhibited an acceptable fit to the data and invariance between these subsamples. However, we agree with Barrett (2007) that more studies are needed, involving tests of invariance not only across other types of sports but also across another groups (e.g., age) and for trans-cultural validation (e.g., Portugal, Spain, and others Latino American countries). Importantly, future studies should also further explore the PS model proposed by Vallerand (2010) to better understand its broader meaning.

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