Desarrollo y características psicométricas preliminares del cuestionario PODIUM para corredores populares de maratón

Development and preliminary psychometric characteristics of the PODIUM questionnaire for recreational marathon runners

Desenvolvimento e propriedades psicométricas preliminares do questionário PODIUM para os corredores amadores de maratona

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Resumen: El objetivo de esta investigación era desarrollar un instrumento en español, que fuera completo y adecuado psicométricamente, para la medida del estado psicológico de los corredores de maratón durante los días y horas previos a la carrera. En el estudio 1 participaron 1060 corredores aficionados de 18 a 57 años. El análisis factorial exploratorio mostró cinco dimensiones que reflejaban motivación, autoconfianza, ansiedad, percepción del estado físico y apoyo social percibido. En dos estudios posteriores se examinaron las propiedades psicométricas de una versión depurada de esta medida. En el estudio 2 completaron el cuestionario 801 corredores aficionados (17-63 años) de una muestra independiente. El análisis factorial confirmatorio con modelos alternativos apoyó un modelo de seis factores. La consistencia interna fue de .72 a .90. En apoyo de la validez de constructo, la escala de auto-confianza correlacionó positivamente con la percepción del estado físico, la escala de motivación correlacionó positivamente con el apoyo social y la auto-confianza, y la ansiedad correlacionó negativamente con los factores motivación y auto-confianza. En el estudio 3, una muestra independiente de 22 corredores aficionados (28-47 años) cumplimentaron los cuestionarios PODIUM y MOMS. Adicionalmente, otra muestra independiente de 36 corredores aficionados (23-57 años) cumplimentaron el PODIUM y el CSAI-2. En apoyo de la validez concurrente del PODIUM, la escala de motivación correlacionaba con el MOMS, y las escalas de ansiedad y auto-confianza correlacionaban con el CSAI-2.

Palabras clave: evaluación psicológica, maratón, ansiedad, motivación, auto-confianza, apoyo social, forma física.

Abstract: The purpose of this research was to develop a comprehensive and psychometrically adequate measure of recreational marathon runner's psychological state during the few days and hours prior to the race. The questionnaire was developed in Spanish. In Study 1, Participants were 1060 recreational runners aged 18-67 years. Exploratory factor analysis revealed five dimensions reflective of motivation, self-confidence, anxiety, perceived physical fitness, and perceived social support. In two subsequent studies, the psychometric properties of a refined version of this measure were examined. In study 2, an independent sample of 801 recreational runners (aged 17-63 years) completed the questionnaire. Confirmatory factor analysis and alternative model testing supported a six-factor model. Internal consistency was .72 to .90. In support of construct validity, the self-confidence scale correlated positively with perceived physical fitness, motivation scale correlated positively with social support and self-confidence, and anxiety correlated negatively with motivation and self-confidence factors. In study 3, an independent sample of 22 recreational marathon runners (aged 28-47 years) responded to the PODIUM and MOMS. Additionally, another independent sample of 36 recreational runners (23-57 years) responded the to PODIUM and CSAI-2 scales. In support of concurrent validity of PODIUM, the motivation scale correlated with MOMS, and the anxiety and the self-confidence scales correlated with CSAI-2.

Keywords: psychological assessment, marathon, anxiety, motivation, self-confidence, social support, physical fitness.

Resumo: O objectivo deste estudo foi o desenvolvimento de um instrumento em espanhol, que fosse completo e psicometricamente adequado para medir o estado psicológico dos corredores de maratona durante os dias e horas prévias à corrida. No Estudo 1 participaram 1060 corredores amadores de 18-57 anos. A análise fatorial exploratória mostrou cinco dimensões que reflectem motivação, autoconfiança, ansiedade, percepção do estado físico e apoio social percebido. Em dois estudos posteriores foram examinadas as propriedades psicométricas de uma versão refinada desta medida. No Estudo 2 responderam ao questionário 801 corredores amadores (17-63 anos) de uma amostra independente. A análise fatorial confirmatória com modelos alternativos apoiou um modelo de seis factores. A consistência interna foi de .72-.90. Para apoio da validade do constructo, a escala de autoconfiança correlacionou-se positivamente com a escala de percepção de estado físico, a escala de motivação correlacionou-se positivamente com a escala de apoio social e autoconfiança, e os fatores de ansiedade correlacionaram-se negativamente com as escalas de motivação e autoconfiança. No Estudo 3, uma amostra independente de 22 corredores amadores (28-47 anos) completou os questionários PODIUM e MOMS. Complementarmente, uma amostra independente de 36 corredores amadores (23-57 anos) completou o PODIUM e CSAI-2. Em apoio à validade concurrente do PODIUM, a escala de motivação correlacionou-se com o MOMS, e as escalas de ansiedade e autoconfiança correlacionaram-se com o CSAI-2.

Palavras-chave: Avaliação Psicológica, maratona, ansiedade, motivação, auto-confiança, o apoio social, forma física.

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The psychological characteristics of distance runners, and the relationship between the previous psychological state and the resulting performance have been studied from different perspectives – for example, personality (McKelvie, Valliant, & Asu, 1985) athletic identity (Horton & Mack, 2000)1993, anxiety and self-confidence (Gould, Tuffey, Hardy, & Lochbaum, 1993; Martin & Gill, 1991), and cognitive strategies (Ogles, Lynn, Masters, & Hoefel, 1993; Okwumabua, 1985) – during the last decades. As the number of recreational runners and long-distance races grew during the last years, so did the number of psychological supporting teams (e.g., Buceta, López de la Llave, Pérez-Llantada, Vallejo, & Pino, 2002; Day et al., 2014; Giges, 2013; Hays & Katchen, 2006) across the western countries. As a consequence, psychological assessment and counseling are increasingly demanded by runners and race organizers, in order to give them advice during the training period and, particularly, within the last few hours and days prior to the race, and even during and following the event.

Motivation of marathon runners has been widely studied in order to understand toward what goals the runners are intrinsically oriented (e.g., Clough, Shepherd, & Maughan, 1989; Llopis & Llopis, 2006; Masters, Ogles, & Jolton, 1993; Ogles et al., 1993; Scholz, Nagy, Schüz, & Ziegelmann, 2008). In this sense, the Motivations of Marathoners Scales (MOMS) (Masters et al., 1993) has been extensively used in research and adapted to other languages and sports (e.g., LaChausse, 2006; Loughren, 2010; Newcomer, 2009; Ogles & Masters, 2000; Ruiz Juan & Zarauz Sancho, 2011). The MOMS includes physical health motives such as general health orientation and weight concern, social motives such as affiliation and recognition, achievement motives such as competition and personal goal achievement, and psychological motives such as psychological coping, self-esteem, and life meaning.

Due to the large amount of training time sustained over years, marathon runners possibly show a larger commitment to the activity compared with other athletes (Carmack & Martens, 1979). Consequently, research has been also focused on the addiction to running (e.g., Clough et al., 1989; Masters & Lambert, 1989; Pierce, Rohaly, & Fritchley, 1997; Szabo, De la Vega, Ruiz-Barquín, & Rivera, 2013), assuming that commitment to running (see Carmack & Martens, 1979) in distance runners may be followed by negative a addiction to run (Sancho & Ruiz-juan, 2011).

The social network, including family, fellow runners, friends, and co-workers, may have a positive role related to self-esteem, self-actualization, need for affiliation, need of exhibition, and social interaction during training, especially in charity or social-caused marathons (Bennett, Mousley, Kitchin, & Ali-Choudhury, 2007; Fairer-Wessels, 2013). As a consequence, in absence of adequate training, the environ-ment might press towards achievement goals above the runners' potential.

The relationship between anxiety and performance has been analyzed from multidimensional anxiety theory (e.g., Martens, Burton, Vealey, Bump, & Smith, 1990), catastrophe models (Hardy, 1990), reversal theory (Apter, 1982) and zones of optimal functioning models (e.g., Hanin, 2012). Cognitive anxiety, somatic anxiety, self-confidence and performance have been broadly assessed in marathon runners by means of the Competitive State Anxiety Inventory-2 (CSAI-2) questionnaire (Martens et al., 1990). The validity of CSAI-2 was later analyzed and some improvements suggested (Cox, Martens, & Russell, 2003; Terry & Munro, 2008). The former authors defined cognitive anxiety as the mental component of anxiety caused by negative expectations of success or by negative self-evaluation; somatic anxiety as the physiological and affective elements of the anxiety experience that develop directly from autonomic arousal; and self-confidence as one's belief in meeting the challenge of the task to be performed. The authors refer to state self-confidence as highly related to self-efficacy as defined by Bandura (1997), who defined this construct as the belief in one's power to produce given levels of attainment.

Martin & Gill (1991) reported self-confidence to be significantly and positively related to distance running performance, but found no significant relationship between cognitive anxiety and running performance. Later, LaGuardia & Labbé (1993) showed evidence that state and trait anxiety were not related to performance in distance running. More recently, a comprehensive review (Woodman & Hardy, 2003) found evidence of the positive relation of self-confidence with sport performance and the opposite for anxiety. However, research shows that anxiety levels tend to be low in endurance athletes (J. C. Jaenes, Peñaloza, Navarrete, & Bohórquez, 2011, 2012; Thornton, Cronholm, McCray, & Webner, 2008). Recently, the anxiety symptoms have been argued to be facilitative or debilitative, depending on the interpretation made by the athlete (Hanton, Neil, & Mellalieu, 2008). More specifically, self-confidence might influence anxiety interpretation, protecting against its debilitating effects. Under these circumstances, the underlying influence of positive emotions might have been confounded with anxiety (Polman & Borkoles, 2011).

Vealey (2009) mentioned four types of self-confidence: outcome, self-regulatory, performance and physical; the latter is composed of skill execution, skill learning and physical fitness. As a consequence, it is argued that expert athletes, well trained or perceiving a good physical fitness, have higher levels of self-confidence than beginners, non-elite, or non-expert athletes, irrespective of gender.

The hardiness and toughness constructs, and their influence on performance have also been recently reviewed in as-

sociation with performance (Crust, 2008; De la Vega, Rivera, & Ruiz, 2011; Mahoney, Gucciardi, Ntoumanis, & Mallet, 2014). The latest study found that psychological needs satisfaction promotes perceptions of personal control, self-efficacy, and self-value that result in the maintenance of high levels of effort. Toughness has been also related to coping, optimism and pessimism (Nicholls, Polman, Levy, & Backhouse, 2008) Jaenes, Godoy, and Román (2008) developed the Resistant Personality Scale in Marathon Runners to assess the hardy personality on the basis of cognitive control, control of decisions, and control of coping.

All the mentioned variables were summarized in a content analysis study with the aim of characterizing the psychological state of marathon runners prior to the race (Larumbe Zabala, Pérez-Llantada Rueda, & López de la Llave Rodríguez, 2009). The authors found that a positive psychological state in marathon runners was linked to high self-confidence, and related to excitement, motivation, good perceived physical fitness, an absence of threatening consequences and positive social support. A negative state was linked to low self-confidence, and related to poor preparation and planning, uncertainty about outcome, fear, negative thoughts anticipating physical suffering, elevated cognitive anxiety, and extra pressure from the social environment.

In summary, many constructs can be considered to evaluate the psychological state of marathon runners. Self-confidence, anxiety and perceived physical fitness are closely related to the imminent event. However, motivation is commonly assessed as a long-term variable. It would also be desirable to know, independently from the variety of motives, how motivated the runner is in the short-term prior to the run.

Further, the motives of recreational runners are diverse and may change over time. Distance runners tend to increase their weekly mileage and adjust their goals even when they started for health or leisure reasons, giving more relevance to competition as a motive as their level improves (Barrell, Chamberlain, Evans, Holt, & Mackean, 1989; Masters & Ogles, 1995). As a consequence, psychological assessment in this context should serve for a broad spectrum of runners.

Psychological intervention of support teams, as described by sport psychology consultants (e.g., Buceta et al., 2002; Day et al., 2014), takes place at the expo within the few days or hours before the race, while runners await their bibs, and hundreds of runners have to be assessed in a short period of time. Using multiple questionnaires is time-consuming and it is not a common practice in many psyching team models (e.g., Day et al., 2014). Providing a psychometrically supported measure of a combination of dimensions that have been already successfully identified would be very useful in these applied contexts.

Therefore, the goal of this study is to develop an instrument for the assessment of recreational marathon runners

that will contain the most relevant dimensions from previously used questionnaires in this field, all in a single test. The present study describes the procedure of development and psychometric analysis of a questionnaire called PODIUM, which consists of six scales to assess the following dimensions: Motivation, self-confidence, cognitive anxiety, somatic anxiety, perceived physical fitness, and perceived social support.

Study 1: development of items and data reduction

The aim of this study was to create a pool of items that best represented the constructs found in the literature review. First, we developed a long version of the questionnaire; second, we performed a Principal Components Analysis (PCA) in order to produce a refined version after exploring patterns emerging from the data. We used Visual Analogue Scales format (VAS) (e.g., Aitken, 1969; Wewers & Lowe, 1990) to reduce the need to read long sentences, according to the population characteristics (Larumbe Zabala et al., 2009), and simplify answers and have good sensibility (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011; Tiplady, Jackson, Maskrey, & Swift, 1998).

Method

Participants

A sample of 1060 recreational marathon runners (aged M=36.4 years, SD=9.1, 987 males and 73 females) participated in this study. From them, 307 reported running no previous marathons; 318 had run one or two times; 333 had run three to ten times; 102 had run more than ten marathons. All of them were voluntarily recruited during the three expo days prior to the Madrid Marathon.

Procedure

Ethical approval was sought and granted by the institution of the authors for the present and subsequent studies. During the three days prior to the race, runners were contacted at the expo while they were requesting their bibs, and were asked to respond to a questionnaire. Runners were provided with all relevant information relating to the nature and methodology of the study and voluntarily accepted to participate. Participants were informed that there were no right or wrong answers and were encouraged to respond candidly. Complete confidentiality was assured. Ten minutes after the participants completed the test, licensed sport psychologists counseled them on the basis of their answers. The same research and intervention approach was used for all studies in this manuscript.

Measures

Questionnaire and survey. A pool of 40 items in VAS format (Aitken, 1969), as listed in Table 1, showing antonymous adjectives or expressions at the end of each 100mm line was created. Each VAS represented the content of one of the possible constructs that were found relevant after the literature review (see theoretical constructs defined in Table 1). Six judges, qualified experts in sport psychology and endurance running, assessed the items and suggested corrections. Half of items were reversed. Then the items were randomly sorted to get four equivalent forms, A, B, C and D. The VAS were interpreted as described elsewhere (Aitken, 1969), measuring the distance of the mark in each line with a ruler, and taking it as the score of each particular item. The reversed items were measured starting from the opposite extreme. Identification (name, bib number), demographic data (sex, age), running experience (number of marathons attempted and finished) and specific goals for the race were also added as an additional survey.

Table 1. List of 40 prospective items that initially composed the questionnaire.

Item No.	Left side of VAS	Right side of VAS	Theoretical construct
1	SIN PREPARAR MENTALMENTE	MENTALMENTE PREPARADO	Toughness
2	INCOMPETENTE	COMPETENTE	Self-confidence
3	SIN RECONOCIMIENTO	RECONOCIDO	Social support
4	FUERTE MENTALMENTE	SIN FUERZA MENTAL	Toughness
5	INDIFERENTE	INTERESADO	Motivation
6	RESISTENTE	FRÁGIL	Toughness
7	SIN MIEDO	CON MIEDO	Cog. Anxiety
8	DESMORALIZADO	CON MORAL	Motivation
9	CON DUDAS	SEGURO	Self-confidence
10	DESANIMADO	ANIMADO	Motivation
11	INSEGURO	CONVENCIDO	Self-confidence
12	DESPREOCUPADO	PREOCUPADO	Cog. Anxiety
13	EXPERTO	INEXPERTO	Toughness
14	INCENTIVADO	DESALENTADO	Motivation
15	PROTEGIDO	DESPROTEGIDO	Social support
16	MOTIVADO	DESMOTIVADO	Motivation
17	EN PLENA FORMA	BAJO DE FORMA	Physical fitness
18	SIN CAPACIDAD DE SUFRIMIENTO	CON CAPACIDAD DE SUFRIMIENTO	Toughness
19	EXCITADO	SOSEGADO	Som. Anxiety
20	DÉBIL	FUERTE	Physical fitness
21	INCOMPRENDIDO	COMPRENDIDO	Social support
22	PREPARADO	SIN PREPARACIÓN	Physical fitness
23	SOLO	ACOMPAÑADO	Social support
24	DESENTRENADO	ENTRENADO	Physical fitness
25	CON AMBICIÓN	SIN AMBICIÓN	Motivation
26	ILUSIONADO	SIN ILUSIÓN	Motivation
27	CON AYUDA	SIN AYUDA	Social support
28	TRANQUILO	NERVIOSO	Som. Anxiety
29	CON GANAS	SIN GANAS	Motivation
30	APOYADO POR OTRAS PERSONAS	SIN APOYO DE OTRAS PERSONAS	Social support
31	CONFIADO	SIN CONFIANZA	Self-confidence
32	ESPERANZADO	SIN ESPERANZA	Self-confidence
33	CON ENERGÍA	CANSADO	Physical fitness

Item No.	Left side of VAS	Right side of VAS	Theoretical construct
34	TENSO	RELAJADO	Som. Anxiety
35	SIN COMPROMISO	COMPROMETIDO	Motivation
36	AGOBIADO	CALMADO	Cog. Anxiety
37	PRESIONADO	LIBERADO	Cog. Anxiety
38	SIN OBJETIVOS	CON OBJETIVOS	Motivation
39	SERENO	INQUIETO	Cog. Anxiety
40	POCO VALORADO	RESPETADO POR LOS DEMÁS	Social support

Statistical analysis

Seven PCA with Varimax rotation were successively performed to identify a smaller number of underlying components. At each round, items not loading in any factor above 0.35, loading in more than one factor, or producing a one-item factor were sequentially deleted. Internal consistency is reported as a measure of reliability. STATA 12.1 for Mac (StataCorp) was used for the analysis of every study in this paper.

Results and Discussion

From the original 40 items, 16 were deleted after seven rounds of PCA with Varimax rotation. At round one, we found nine factors; item 9 was deleted because it weighed in three factors, and item 15 was also deleted because it formed a one-item factor. At round two, we found eight factors; all items (25, 13, 3, 38, and 35) from factors 7 and 8 had weights >0.40 in two or more factors and were consequently deleted. At round three, we found seven factors; item 37 weighed in three factors and item 33 weighed >0.40 in two factors, and were accordingly deleted. At round four, we found six factors; items 6, 4, and 40 were deleted because they weighed >0.40 in two factors. At round five, we found six factors; some items (31, 5, and 2) from factor 2 were deleted because they weighed >0.40 in two factors. At round six, we found five factors; item 1 did not score sufficiently (<0.35) in any factor and was deleted.

Table 2 summarizes PCA with the Varimax rotation of the PODIUM scores. The analysis yielded five factors with eigenvalues greater than 1. This solution explained 54.51% of the variance. Factor names were assigned appropriate to the contributing items and Chronbach's alpha was calculated: Anxiety (.82), Motivation (.75), Self-Confidence (.75), Perceived Physical Fitness (.81), and Perceived Social Support (.66).

Table 2. Results of Principal Components Factor Analysis with Varimax rotation of Study 1 dataset after round 7 (n=1060).

Item	Component					Uni.
	1	2	3	4	5	
28 TRANQUILO	**0.792**	-0.025	-0.022	0.016	0.040	0.370
39 SERENO	**0.759**	0.056	0.034	0.076	-0.013	0.414
34 TENSO	**0.747**	-0.050	-0.169	-0.114	0.115	0.384
36 AGOBIADO	**0.663**	0.075	-0.301	0.017	-0.010	0.464
12 DESPREOCUPADO	**0.642**	0.074	0.049	-0.015	0.025	0.579
7 SIN MIEDO	**0.618**	0.147	-0.132	0.070	-0.022	0.574
19 EXCITADO	**0.597**	-0.154	0.056	-0.009	-0.105	0.606
16 MOTIVADO	0.030	**0.717**	-0.137	0.177	0.094	0.426
32 ESPERANZADO	0.068	**0.650**	-0.145	0.185	0.040	0.517
29 CON GANAS	0.025	**0.649**	-0.176	0.110	0.047	0.532
14 INCENTIVADO	0.028	**0.639**	-0.190	0.129	0.194	0.501
26 ILUSIONADO	-0.050	**0.622**	-0.170	0.061	0.082	0.571
10 DESANIMADO	-0.056	-0.291	**0.699**	-0.091	-0.030	0.396
18 SIN CAPACIDAD DE SUFRIMIENTO	0.037	-0.088	**0.604**	0.022	-0.040	0.579
8 DESMORALIZADO	-0.111	-0.272	**0.638**	-0.195	-0.050	0.401
20 DÉBIL	-0.109	-0.194	**0.622**	-0.294	-0.123	0.462

Item	Component					Uni.
	1	2	3	4	5	
11 INSEGURO	-0.261	-0.237	**0.494**	-0.225	-0.151	0.558
24 DESENTRENADO	-0.062	0.101	-0.283	**0.823**	0.089	0.221
17 EN PLENA FORMA	0.039	0.267	-0.068	**0.788**	0.128	0.285
22 PREPARADO	0.015	0.292	-0.125	**0.760**	0.059	0.317
27 CON AYUDA	-0.057	0.105	0.038	0.090	**0.792**	0.349
23 SOLO	-0.006	0.022	-0.212	0.012	**0.703**	0.460
30 APOYADO POR OTRAS PERSONAS	-0.017	0.247	0.036	0.069	**0.688**	0.400
21 INCOMPRENDIDO	0.167	0.023	-0.271	0.217	**0.483**	0.553

Note: Absolute coefficients values >.35 are in bold; Uni. = Uniqueness.

Considering the number of indicators and factors, the sample size (n=1060) was appropriate to obtain an adequate stable factor solution (MacCallum, Widaman, Zhang, & Hong, 1999). The characteristics and diversity of the sample (age, level) of recreational runners were also appropriate for the aim of this study, although women were underrepresented due to their lesser participation. This limitation would require consideration in further validation studies. The PCA helped reduce the length of the questionnaire to an adequate number of items for the target population, according to the literature (e.g., Larumbe Zabala et al., 2009). However, although anxiety was expected to comprise two dimensions according to Martens et al. (1990), our model identified anxiety as a single dimension. The dimensionality of this factor is reevaluated in Study 2.

Study 2: Confirmatory Factor Analysis, Construct Validity, and Internal Consistency

In the second study, we propose to conduct a Confirmatory Factor Analysis (CFA) of the questionnaire using a different dataset from the one that was used in Study 1 in order to evaluate the construct validity. The internal consistency of the scales will also be confirmed.

Method

Participants

A sample of 801 recreational runners (754 males and 47 females), contacted during the three expo days of Madrid Marathon, participated in this study. The average age was 36.8 years (SD=8.2). Their experience as marathon runners was the following: 230 reported no experience in marathons; 240 had run one or two; 254 had run three to ten; and 77 had run more than ten marathons. None of these runners participated in Study 1.

Measures

Questionnaire and survey. The 24-item version derived from Study 1 was used. Identification, demographic data, running experience, and specific goals for the race were also included as described in Study 1.

Statistical Analysis

The Mardia's coefficients were used to assess the assumption of multivariate normality. Since these tests indicated non-normality for skewness (63.95, p<0.001) and kurtosis (773, p<0.001), the CFA was performed using the bootstrap robust estimation method to produce the covariance matrix, and the Tucker-Lewis index (TLI), comparative fit index (CFI), standardized root mean squared residual (SRMR), and root mean square error of approximation (RMSEA) fit indices were employed to verify the model adequacy (Kline, 2011). Fit indices, modification indices, and residuals were examined to improve the model. Five and six-factor models were also tested in order to examine the dimensionality of the Anxiety factor. Internal consistency was used as a measure of reliability.

Results and Discussion

First, the model was specified following the factorial solution provided in Study 1 and later modified to split the Anxiety factor into Somatic Anxiety (items 19, 28 and 34) and Cognitive Anxiety (items 7, 12, 36 and 39). As shown in Table 3, the model improved by χ^2=107.41 (p<0.001) when Anxiety was split into two factors.

Table 3. Confirmatory Factor Analysis: Fit indices for the adjusted models (n=801).

| Model	χ^2(df)	p	RMSEA	CFI	LFI	SRMR
Five factors						
24 items	999.27(242)***	0.000	0.063***	0.921	0.910	0.063
23 items	892.92(220)***	0.000	0.062***	0.927	0.916	0.060
22 items	760.80(199)***	0.000	0.059***	0.935	0.924	0.057
21 items	723.52(179)***	0.000	0.062***	0.936	0.925	0.059
20 items	642.62(160)***	0.000	0.061***	0.941	0.930	0.058
Six factors						
24 items	891.86(237)***	0.000	0.059**	0.932	0.921	0.054
23 items	785.16(215)***	0.000	0.058*	0.938	0.928	0.049
22 items	652.70(194)***	0.000	0.054*	0.947	0.937	0.046
21 items	611.54(174)***	0.000	0.056	0.949	0.938	0.046
20 items	546.82(155)***	0.000	0.056	0.952	0.941	0.046

Note: Items 21, 10, 18 and 7 (as numbered originally) were eliminated successively.

* p<.05; ** p<.01; *** p<.001.

Second, after the examination of modification indices and coefficients, four items were found to improve the model if modified. Items 21 (incomprendido), 10 (desanimado), 18 (sin capacidad de sufrimiento), and 7 (sin miedo) were successively removed. The goodness of fit of each model is shown in Table 3. The chi-square values indicated that none of the tested models fitted perfectly, although chi-square values reduced after modification. Since chi-square will be inflated with large sample sizes, approximate fit indices were also analyzed as suggested in the literature (Kline, 2011). The RMSEA was close to 0.05, and the upper bound of confidence interval was <0.65 for models with 22 or less items; $P_{close\text{-}fit\ Ho}$>0.05 was determined for 6-factor models and fewer than 22 items. The CFI values were close to .95, but only the 6-factor-24-item model was above this threshold and combined with SRMR=0.046. The TLI was also >.90 in all models, although only the latter was close to .95. Altogether, these results meet relatively good fit criteria (Hu & Bentler, 1999) for the 6-factor-20-item model.

Standardized parameter estimates are depicted in Figure 1. Factor loadings range from .58 to .89. Large and significant correlations are found between anxiety factors (.97) and between motivation and self-confidence (.83). Perceived physical fitness also highly correlates to self-confidence and motivation. Anxiety factors are inversely correlated with motivation, self-confidence, perceived social support, and perceived physical fitness.

Figure 1. Confirmatory factor analysis: parameter estimates of the 6-factor-20-items measurement model (completely standardized solution), n=801.
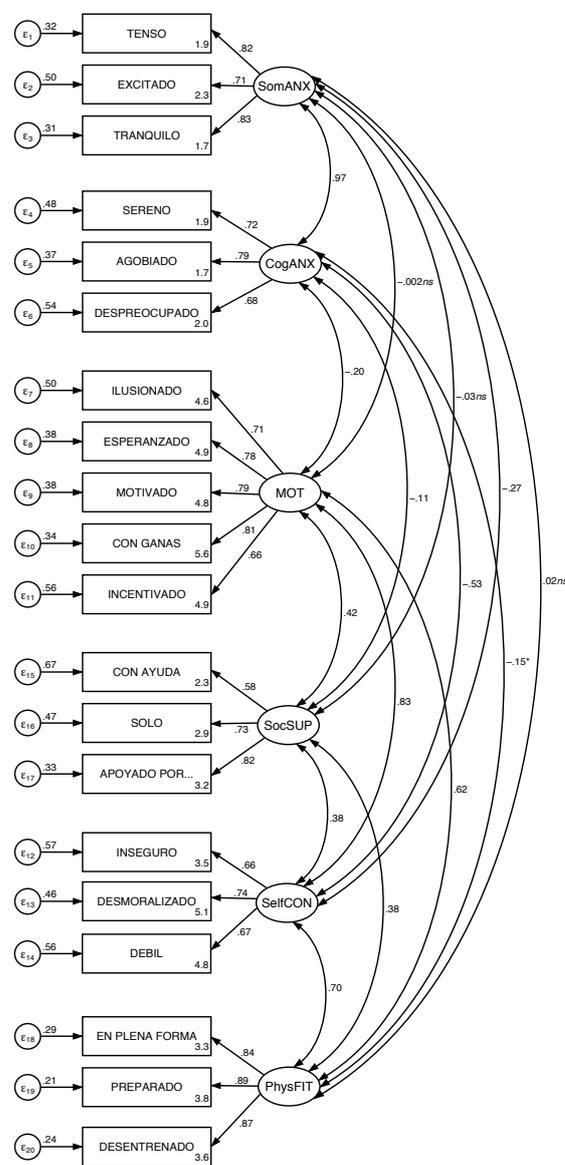
Note: All freely estimated parameter estimates are statistically significant (p<.001) or indicated otherwise. * p<.05; *ns*=statistically not significant at *a*=0.05

Similarly to Study 1, Cronbach's alphas indicating internal consistency for the six scales of the PODIUM questionnaire were considered adequate (Tavakol & Dennick, 2011), ranging from .72 to .90: Somatic Anxiety (.83), Cognitive Anxiety (.77), Motivation (.86), Self-confidence (.72), Perceived Physical Fitness (.90), and Social Support (.74).

We found that motivation and self-confidence factors showed the highest scores, followed by fitness perception

and social support, and anxiety factors showed low scores: Motivation median=78 (IRQ=70, 86); Self-confidence median=73 (IRQ=63, 83); Perceived Physical Fitness median=70 (IRQ=57, 80); Social Support median=67 (IRQ=57, 80); Somatic Anxiety median=43 (IRQ=30, 57); Cognitive Anxiety median=40 (IRQ=27, 50).

Study 3: Concurrent Validation

The purpose of this study was to explore the concurrent validity of the questionnaire. Following the APA Standards for Educational and Psychological Tests (AERA, APA, & NCME, 1999), evidence of concurrent validity was examined by computing the correlation between the new test and established inventories designed to measure the same constructs. To test motivation, we used the Spanish adaptation of MOMS (Ruiz Juan & Zarauz Sancho, 2011), and to test somatic anxiety, cognitive anxiety, and self-confidence, we used the Spanish revised version of CSAI-2 (Andrade, Lois, & Arce, 2007).

Methods

Participants and Procedure

Two independent samples of voluntary recreational marathon runners, distinct from the previously used samples, were recruited after contacting resistance training coaches and race organizers. The first sample (11 M, 11 F, mean age 36.9 years [SD=4.7], 2 inexpert and 20 experienced marathoners [M=2.9, SD=1.1]) responded three times: 60 days, 30 days, and one week before participating in the Chicago Marathon. MOMS (Ruiz Juan & Zarauz Sancho, 2011) was administered only the first time, while PODIUM was administered three times. The second sample (27 M and 9 F, mean age 37.9 years [SD=9.2] years, experienced marathoners [M=4.2, SD=6.3]) responded to PODIUM and CSAI-2R (Andrade et al., 2007) during the previous day to compete in a half-marathon race. The race was programmed as the last competition test of the group, one month prior to competing the Berlin Marathon.

Measures

PODIUM Questionnaire. The final version of the questionnaire (composed of 20 items) was used, as derived from Study 2.

Motivation of marathoners scales (MOMS) (Masters et al., 1993). Motivation was assessed using the Spanish adaptation (Ruiz Juan & Zarauz Sancho, 2011) of these scales with 34 Likert-type items asking different reasons for running. A score of 1 indicates that the item is "not a reason" for running; a score of 7 indicates that the item is a "very important reason."

CSAI-2 (Martens et al., 1990). To measure anxiety and self-confidence as explained above, we used the most recent Spanish adaptation (Andrade et al., 2007) of the revised version (Cox et al., 2003)and then to use CFA to validate the revised structure using a second data set. The first data set (calibration sample, which contains 15 items that are answered on a four-point Likert scale of agreement ranging from 1 (not at all) to 4 (very much so).

Results and Discussion

In the first sample, see Table 4, the large and significant correlations of the first column in 'health orientation,' 'psychological coping,' and 'self-esteem and life meaning' subscales indicated high concurrent validity of PODUM motivation scale with MOMS. However, one month later, these correlations decreased in five subscales and increased in 'competition and personal goal achievement.' Three months later, when the race was imminent, the correlations were not statistically significant.

Table 4. Correlations between MOMS subscales and three successive PODIUM motivation scale assessments (n=22).

MOMS subscale	Remaining days to race		
	Two months	One month	One week
Health orientation	.51*	.32	-.06
Weight concern	.21	.09	.07
Competition and personal goal achievement	.15	.57**	.09
Recognition	.03	.02	-.32
Affiliation	.12	.28	.15
Psychological coping	.65**	.34	-.14
Self-esteem and life meaning	.62**	.42*	-.07

* $p<.05$; ** $p<.01$

Table 5. Correlation coefficients of PODIUM and CSAI-2R (n=36).

	PODIUM						CSAI-2R		
	1	2	3	4	5	6	7	8	9
1. Somatic anxiety	—								
2. Cognitive anxiety	.82*	—							
3. Motivation	.00	-.21	—						
4. Social support	.10	-.04	.23	—					
5. Self-confidence	-.11	-.19	.79*	.22	—				
6. Physical fitness	.32	.34	.64*	.08	.73*	—			
7. CSAI-somatic	.70*	.79*	-.14	-.17	.04	.37	—		
8. CSAI-cognitive	.47*	.64*	-.15	-.19	-.04	.20	.78*	—	
9. CSAI-self-conf.	-.13	-.11	.55*	.21	.71*	.57*	.08	-.17	—

* $p<.01$.

The analysis of the second sample determined high concurrent validity of PODIUM anxiety and self-confidence scales with CSAI-2 subscales. As shown in table 5, significant correlations between CSAI and PODIUM were .71 in somatic anxiety, .64 in cognitive anxiety and .69 in self-confidence. Consistently with Study 2, significant correlations (positive and negative) were also found between the PODIUM factors.

The motivation scale showed high concurrent validity when correlated with a validated questionnaire for the assessment of long-term motivation orientations. Not surprisingly, the stability of the relationship was poor since the tests are measuring two different conceptions of motivation. These results showed how sources of motivation, even at a slow pace, are subject to change over time and are influenced by experience (Masters & Ogles, 1995; Newcomer, 2009). The high sensitivity to changes in the motivational state of the PODIUM motivation scale might be a positive indicator of its validity.

Anxiety and self-confidence scales were largely correlated with their equivalents from a validated inventory. In support of construct validity derived from Study 2, significant correlations were found, meaning that both types of anxiety are correlated, and a high self-confidence is related with high motivation and perception of physical fitness. Although significant inverse correlations were also expected with anxiety scales, these values (-.11 and -.19) were not significant due to the small statistical power achieved (1-b=.54). A minimum sample size of 66 participants is suggested for further concurrent validity studies.

For practical and ethical reasons, we have not been able to explore the concurrent validity of perceived social support and physical fitness scales. As mentioned in the procedures of Study 1, in our applied research model, we include feedback and counseling for the athletes in exchange for their collaboration. Consequently, the assessment can only be extended with one questionnaire in order to get a report on time.

General discussion

After the EFA of Study 1, we reduced the number of indicators and found consistent support for a five-factor model, which included anxiety, motivation, self-confidence, perceived physical fitness and perceived social support. The length of the questionnaire was reduced almost by a half, making it more usable. Despite that both state anxiety factors, cognitive and somatic, are hypothesized to be independent, Morris, Davis, and Hutchings (1981) noted that they likely covary in stressful situations, because these situations contain elements related to the arousal of each. Although the theoretical frame of this research included both types of anxiety, the findings in Study 1 reduced them to a single component. However, findings in Study 2 indicated that the factor structure improved the model fit when both types of anxiety were considered,

giving support to the multidimensional model. Additionally, four items that offered inconsistency in different scales were removed, resulting in a 20-item depurated version. The internal consistency of the scales was found adequate, showing homogeneity within each dimension.

In additional support of construct validity, factors correlated as expected from previous research. We found a positive relationship between motivation and self-confidence (Bandura, 1977), self-confidence and the physical fitness (Bandura, 1977), and motivation and the perceived social support (Barrell et al., 1989; Bennett et al., 2007). It was also expected that high levels of anxiety correlated with low levels of self-confidence (LaGuardia & Labbé, 1993; Martin & Gill, 1991). As mentioned before, cognitive and somatic anxiety were also correlated (Martens et al., 1990; Morris et al., 1981).

Having said that, our work has some limitations. At the time of our fieldwork, the collected samples overrepresented males. However, testing invariance to gender with low statistical power would be inappropriate (MacCallum et al., 1999). Sampling in future studies might benefit from the increasing number of female participants in marathon races, or alternatively re-sampling methods might be applied.

Since the number of modifications within the CFA was significant, we consider that the accepted model needs to be replicated. Unfortunately, samples 3 and 4 did not have enough statistical power to perform CFA (MacCallum et al., 1999) and we left this for future studies.

Although we performed two concurrent validity studies, showing evidence that motivation, self-confidence and anxiety scales measure the same constructs as other established tests do – even when larger samples would be necessary –, the perceived social support and perceived physical fitness have not been examined in these studies. The concurrent validity would be benefited from additional cross validation results. Besides, criterion validity will require further studies (e.g., analyze how the questionnaire can predict different profiles of runners attending to their psychological state on the mentioned variables, plus physiological and performance measurements).

From its conception, the PODIUM was oriented to recreational marathon runners. Due to the similarities between different endurance sports, we encourage researchers to analyze the applicability of this test to ultra-marathoners, cyclists, triathletes, and similar recreational endurance athletes. Moreover, the measuring capability over elite or professional athletes should also be addressed.

Due to the nature of the VAS scales, the study of each item as an independent measurement, in both applied and research contexts, can bring in new applications, especially for its idiographic use. However, the development of references for the interpretation of scores is desirable, and should be accomplished in the future. In our experience, further research should also focus on the identification and understanding of different re-

sponse profiles linked to particular situations with potential risk of failure, like the presence of recent injuries, the existence of an excessive external pressure, or the excessive self-confidence in combination with achievement-only goals, among others.

Additionally, physiological and performance data should be concurrently considered to extend the scrutiny of concurrent validity of Podium in future research. Identifying models linking psychological constructs and endurance running performance has shown inconsistency (Okwumabua, 1985; Tate, Petruzzello, & Lox, 1995), possibly due to an indirect rather than direct relationship. Thus, physiological-fitness indicators, training variables, the occurrence of injuries, experience as a runner, gender and age, among other possible factors, should possibly adjust these complex models. Further studies should compare the scoring differences based on demographic variables such as sex, age, and experience, among other factors, examining the data provided by the survey.

Practical Applications

Our four studies presented a potentially useful instrument that could help practitioners perform assessments of recreational endurance runners in both, individual or collective sets. Although not perfect, the instrument has shown acceptable fit to theoretical models, good reliability and concurrent validity with other tests. When further confirmation studies are conducted, a variety of standard references, profiles, and applications will be developed.

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