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Basic Psychological Needs in Spanish Athletes: validation of the "Basic Needs Satisfaction in Sport Scale"

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Abstract

In view of the growing interest in the satisfaction of basic psychological needs in the area of physical activity and sport, different instruments are being used to evaluate the degree of satisfaction or frustration of these needs. One such instrument is the (BNSSS), which is also relevant in that it acknowledges three factors, hitherto not evaluated, in the autonomy dimension (choice, volition and internal perceived *locus* of causality). In Spain, the BNSSS has only been validated for team sports, which is why the primary objective of this study was to validate it for use in any sport (individual or team). The study featured the participation of 795 athletes, 50.8% of whom were men and 49.2% women, with a mean age of 18.36 years (*SD*: 6.06). The EQS 6.3 program was used to perform a confirmatory factor analysis, factorial invariance for the gender, age, competitive level and sport type variables, as well as composite reliability between factors. Good model fit was observed, with comparative fit indexes (CFI) and non-normed fit indexes (NNFI) of .97, and a root mean square error of approximation (RMSEA) of 0.06. Factorial invariance was observed for the proposed subgroups and the composite reliably indexes were above .70. Therefore, the measurement instrument has good psychometric properties that make it possible to assess the satisfaction of basic psychological needs in the Spanish sports setting.

Keywords: competence, autonomy, relatedness, sport, invariance properties.

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Introduction

The self-determination theory (SDT) is a macrotheory that addresses numerous questions such as personality development, self-regulation, psychological needs, the impact of social environment on motivation and its effect on behaviour and well-being (Deci & Ryan, 2008). Moreover, SDT holds a particular interest in the sports setting (Pelletier et al., 2013).

One of the core constructs of STD is the basic psychological needs (BSN) theory (BSN; Ryan & Deci, 2000), which asserts the existence of three psychological needs regarded as essential to a person's psychological development: competence, autonomy and relatedness, which must be satisfied in order to achieve optimal psychological development and personal well-being; failure to satisfy them generates frustration and may lead to different psychopathologies (Chen et al., 2015). The competence need comprises an individual's capacity to feel effective with a behaviour or to perform tasks with different levels of difficulty (Deci, 1971). The autonomy need refers to the autonomy that a person has in order to feel that they control their own behaviour or do things of their own accord (DeCharms, 1968). Finally, the relatedness need refers to the feeling or the sensation of being connected, supported or loved by others (Ryan, 1995). According to Ryan & Deci (2000), these needs are applicable to all individuals irrespective of their age, gender or culture.

Different studies have identified numerous benefits produced by satisfaction of the BPN, since this generates more self-determined regulations (Ryan & Deci, 2000), it is related to well-being (Moreno-Murcia & Sánchez-Latorre, 2016) and to other positive consequences (satisfaction with one's life, development of integrity, psychological vitality, positive mood, etc.) in several dimensions of life, such as work (Van den Broeck et al., 2016), education (Méndez-Giménez & Pallasá-Manteca, 2018) and physical exercise (Oliva et al., 2011). On the other hand, the extent to which these needs are frustrated tends to be related to negative consequences (burnout, anxiety, depression, stress, etc.), related to diminished health and well-being (Ryan & Deci, 2002).

The growing interest in the study of the BPN in the physical activity and sport setting (Jowett et al., 2016; Moreno-Murcia et al., 2011) gave rise to the need to design instruments capable of evaluating the degree of satisfaction or frustration of these needs and thus ascertain their influence on and in sport. In the physical activity and exercise context, Vlachopoulos and Michailidou (2006) designed the first tool called Basic Psychological Needs in Exercise Scale which made it possible to measure the degree of satisfaction of needs in a group of members of a fitness club. It was comprised of 12 items equally distributed across three dimensions that corresponded to the three psychological needs. This instrument presented good psychometric properties, presenting Cronbach's values α of .81 for competence, .84 for autonomy and .92 for relatedness, with a good model fit: the comparative fit index (CFI) and non-normed fit index (NNFI) were above .95, the Standardized Root Mean Residual (SRMR) value was below .10 (0.03), as was the Root Mean Square Error of Approximation (RMSEA) value, which was 0.05, inside the RMSEA 90% Confidence Interval (CI).

In the same year, Wilson et al. (2006), using a sample comprised of university athletes, developed the Psychological Need Satisfaction in Exercise Scale, comprised of 18 items, six for each need. In terms of psychometric properties, this questionnaire was a very reliable tool since it presented Cronbach's values of .91 for competence, .91 for autonomy and .90 for relatedness. The χ^2 value (688.03; χ^2/df = 5.21) presented a suitable data fit, as did its CFI and Incremental Fit Index (IFI) values, which were close to .95.

Since these scales focused on physical activity for health, the need to develop tools related to the evaluation of psychological needs in the context of sports performance or of goal-accomplishment emerged. To cover this area, Ng et al. (2011) developed a specific instrument for competitive sport: the Basic Needs Satisfaction in Sport Scale (BNSSS), comprised of 20 items: five items for competence; 10 items for the autonomy dimension, which, taking the study by Reeve et al. (2003) as reference, were split into four items for choice, three for the volition subscale and three items for the internal perceived locus of causality (IPLOC); and finally, five items for the relatedness need. The skill presented the following Cronbach's a values for each subscale: .77 for competence; .82 for autonomy-choice; .61 for autonomy-volition; .76 for autonomy-IPLOC and .87 for relatedness. It also presented the following values: χ^2 = 341.70 (p < .01), NNFI =.96, CFI =.97, SMRS =0.07 and RMSEA =.06, (0.4-0.7 of the RMSEA 90% CI). For these reasons it is regarded as generally possessing good psychometric properties of factorial validity and reliability.

On the basis of this last instrument, this study was designed in order to have a measurement tool in Spain that can evaluate the satisfaction of BPN in athletes and is valid for all types of sport, since hitherto there has only been one Spanish version of this instrument applicable to team sports. Hodge et al. (2008) assert that the BPN

are universal and are applicable to all types of sports, although the sample used in their study was comprised of players from a rugby team. This is because sport psychology research requires adapted and validated context-specific instruments and the first step tends to involve team sports on account of ready access to samples. Since some authors have reported that athletes who participate in different types of sport present different psychological profiles and traits (Nia & Besharat, 2010), the main objective of this study was to verify that the Spanish validation of the BNSSS could be used in any type of sport, since validity and reliability data were hitherto only available in team sports (De Francisco et al., 2018). Moreover, specific objectives include replicating the preceding version's factorial structure and checking factorial invariance by gender, age, level and sport type, as well as verifying reliability.

Methodology

Participants
The intentional sampling method was used, and the sample comprised 795 participants from different individual sports (*n*: 350) and in team sports (*n*: 445). 50.8% were males and 49.2% were females. The age of the study participants ranged from 13 years to 56 years (*M*: 18.36; SD: 6.06). 65.8% of the athletes were minors and 34.2% were adults. 74.8% of the athletes competed in local/regional and autonomous community categories, and the remaining 25.2% competed at national and/or international level. The participants' mean number of weekly training sessions was 3.60 (*SD*: 3.48) with an average duration of 102.34 minutes per session (*SD*: 42.49). Moreover, all the athletes who participated in this research were registered with the respective sport federation and engaged actively in the sport (training and competition) at least nine months of the year. Finally, it should be mentioned that none of the participants had sustained a recent injury, which was a study exclusion criterion..

Materials and Instruments
The Spanish version of the BNSSS produced by De Francisco et al. (2018) was used. It is comprised of 20 items, five for measuring competence, 10 for autonomy (four items for autonomy-choice, three items for autonomy-volition and a further three for the internal perceived locus of causality - autonomy-locus) and five

items for relatedness. It presents a Likert-type response scale ranging from (1) "Not at all true" to (7) "Very true". The highest numerical value refers to the highest response value, except the fifth item ("In sport, I feel that I am being forced to do things that I don't want to do"; autonomy-volition) which is formulated inversely (a higher numerical value indicates a lower degree of satisfaction).

Moreover, the case report form also contained questions about sociodemographic aspects related to gender and age, as well as training records (type of sport, years of training, training duration, number of weekly training sessions and competitive level).

First of all, the University's Ethics Committee authorisation was requested and obtained with the approval code CE041601. Subsequently, a search for the types of sport in the area was performed and the participants and/or management of sports clubs were contacted to arrange an appointment and to be able to administer the questionnaire. Meetings were arranged at the different sites or premises where each athlete or team did their sports 15 minutes before a training session. Before they completed the questionnaire, the participants were informed about the objective of the study and how to answer the questionnaire and they also signed an informed consent (in the case of minors, this form was signed by the legal sports guardians) providing their approval to participate in the research.

Data analysis
The database was verified to check for possible out-of-range answers or atypical cases, in the course of which 47 missing values were detected and imputed using the median (0.3% of the total data), since when missing values are replaced, the median is a more robust data summary statistic than the mean (Pérez-López, 2004). A database with 795 cases was eventually obtained and was used to calculate the descriptive statistics with the IBM SPSS 21 statistics application.

In view of the previous studies performed about factorial structure in the original version (Ng et al., 2011) and in the Spanish version (De Francisco et al., 2018), a confirmatory factor analysis (CFA) was performed with the EQS 6.3 program (Bentler, 2006), developed for the purpose of performing multivariate analysis methods and structural equation models. The measurement model fit evaluation was performed by calculating the quotient between χ^2 and its degrees of freedom, RMSEA, of which values below 0.08 are indicative of good fit, NNFI, in which the indexes should be above 0.90, and

CFI, in which values above 0.95 are recommended in order to obtain a satisfactory data-model fit (Levy & Varela, 2006).

An invariance analysis was also performed on the basis of three nested models to verify equality of the model between men and women, between minors and adults, elite and low competitive profile and between individual and team sport types. Invariance is traditionally evaluated by calculating the differences obtained in the χ^2 tests. Nevertheless, for this study, the criterion of Cheung and Rensvold (2002) was also used. These authors suggest evaluating the difference in CFI values, where differences above 0.01 between models are regarded as indicative of non-invariance.

The composite reliability index was used to analyse reliability, because this type of analysis takes the existence of multi-dimensionality into account (Dunn et al., 2014), contrary to Cronbach's. In terms of interpretation, index values above 0.7 in descriptive cases or above 0.9 in selective tests are regarded as acceptable (Prieto & Delgado, 2010).

Results

Initial description of the responses

Table 1 displays the descriptive statistics for each item and dimensions. The means were between 4.83 (*SD*: 1.71; item 9, autonomy-choice, which in turn presents the greatest variability) and 6.53 (*SD*: 0.99; item 8, autonomy-volition, which presents the lowest *SD* value). In the dimensions, the highest mean was found in autonomy-volition (*M*: 6.18; *SD*: 0.91) and the autonomy-choice mean proved to be the lowest (*M*: 5.15; SD: 1.26). In terms of data distribution, all the items present a negative asymmetry, with items 8 (autonomy-volition) and 19 (relatedness) presenting the highest values (-2.76 and -2.30, respectively). Finally, the Kurtosis indexes are mainly positive, with item 8 reaching the highest value (8.46, autonomy-volition), followed by items 19 (5.66, relatedness) and one (3.66, relatedness).

Confirmatory factor analysis (CFA)

A CFA was performed based on the factorial structure defined by Ng et al. (2011), as can be seen in Figure 1. Moreover, since the results obtained for the sample did not meet the conditions of normality, the estimation of the parameters of this analysis was performed with asymptotic generalised least squares (AGLS), one of the most commonly used asymptotically distribution-free (ADF) methods used. The use of this method is based on the fact that the results are not altered in cases in which the normality assumption is violated. Finally, since ordinal variables were available, a polychoric correlation matrix was used with the rationale that this type of correlations presents a series of latent variables on which the observable variables or items are constructed.

The factorial loads were statistically significant (Table 2), with values ranging from .442 (item 5, autonomy-volition) to .964 (item 19, relatedness). Finally, all the correlations between factors were also negative (Table 3). The greatest coefficient of correlation was found between autonomy-locus and autonomy-volition (r_{xy}: .982); and the smallest one between autonomy-choice and relatedness (r_{xy}: .741).

Finally, the model fit indexes pointed to a good data fit: the quotient between the χ^2 (544.99) value and its degrees of freedom (160) was 3.40, the RMSEA value was .05 (90% CI; .050-.060), the NNFI was .96 and the CFI was .97

Invariance of the measurement model: gender, age, competitive level and type of sport

An invariance analysis was performed in order to check that the model's general fit was applicable, by means of hierarchically nested models, to the different subgroups of which the research was comprised. The analysis presented the following structure: the 0 model (configuration model) is a base model without restrictions in the estimation of parameters in the different groups with regard to which the subsequent comparisons were made. In this type of models, the indicators that define the measurement structure have the same configurations among the selected groups. Model 1 specified, besides factorial structures, equality or invariance of the factorial loads between groups; and model 2 added the correlations and the variances of the factors.

In order to obtain evidence of gender-related invariance, the group of men (n: 404) and the group of women (*n*: 391) were taken. The difference in the CFI values

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Table 1
Descriptive statistics of items and dimensions

Ítems	Dimensions	Mean	Standard deviation	Asymmetry	Kurtosis
1. In sport, I have a close relationship with other people.	RL	6,17	1,19	-1,85	3,66
2. In sport, I feel I am pursuing goals that are my own.	AUT_{LC}	5,70	1,34	-1,20	1,04
3. I feel I participate in my sport willingly.	AUT	6,14	1,16	-1,76	3,52
4. In sport, I get opportunities to make choices.	AUT_{EL}	5,40	1,48	-0,97	0,54
5. In sport, I feel that I am being forced to do things that I don't want to do.	AUT	5,87	1,63	-1,52	1,38
6. I can overcome challenges in my sport.	CM	5,82	1,22	-1,37	2,23
7. I show concern for others in my sport.	RL	5,61	1,56	-1,28	1,06
8. I choose to participate in my sport according to my own free will.	AUT	6,53	0,99	-2,76	8,46
9. In my sport, I have a say in how things are done.	AUT_{EL}	4,83	1,71	-0,67	-0,31
10. There are people in my sport who care about me.	RL	6,08	1,26	-1,76	3,13
11. I am skilled at sport.	CM	5,88	1,20	-1,19	1,33
12. I feel I am good at sport.	CM	5,58	1,27	-0,94	0,72
13. In sport, I can take part in the decision making process.	AUT_{EL}	5,04	1,59	-0,69	-0,16
14. I get opportunities to feel that I am good at sport.	CM	5,60	1,25	-0,89	0,57
15. In sport, I really have a sense of wanting to be there.	AUT_{LC}	5,88	1,30	-1,34	1,53
16. In sport, I feel I am doing what I want to be doing.	AUT_{LC}	6,19	1,14	-1,79	3,51
17. I have the ability to perform well in sport.	CM	5,73	1,22	-1,11	1,19
18. In sport, there are people who I can trust.	RL	6,23	1,14	-1,84	3,37
19. I have close relationships with people in sport.	RL	6,38	1,08	-2,30	5,66
20. In sport, I get opportunities to make decisions.	AUT_{EL}	5,34	1,54	-0,90	0,23
1. Competence		5,72	1,00	-1,04	1,30
2. Autonomy choice		5,15	1,26	-0,76	0,42
3. Autonomy volition		6,18	0,91	-1,41	2,14
4. Autonomy internal perceived locus of causality		5,92	1,03	-1,27	1,63
5. Relatedness		6,09	0,94	-1,48	2,20

Note: RL = Relatedness; AUT_{LC} = Autonomy Internal perceived locus of causality; AUT_{VL} = Autonomy Volition; CM = Competence; AUT_{EL} = Autonomy choice.

Figure 1
Original five-factor structure
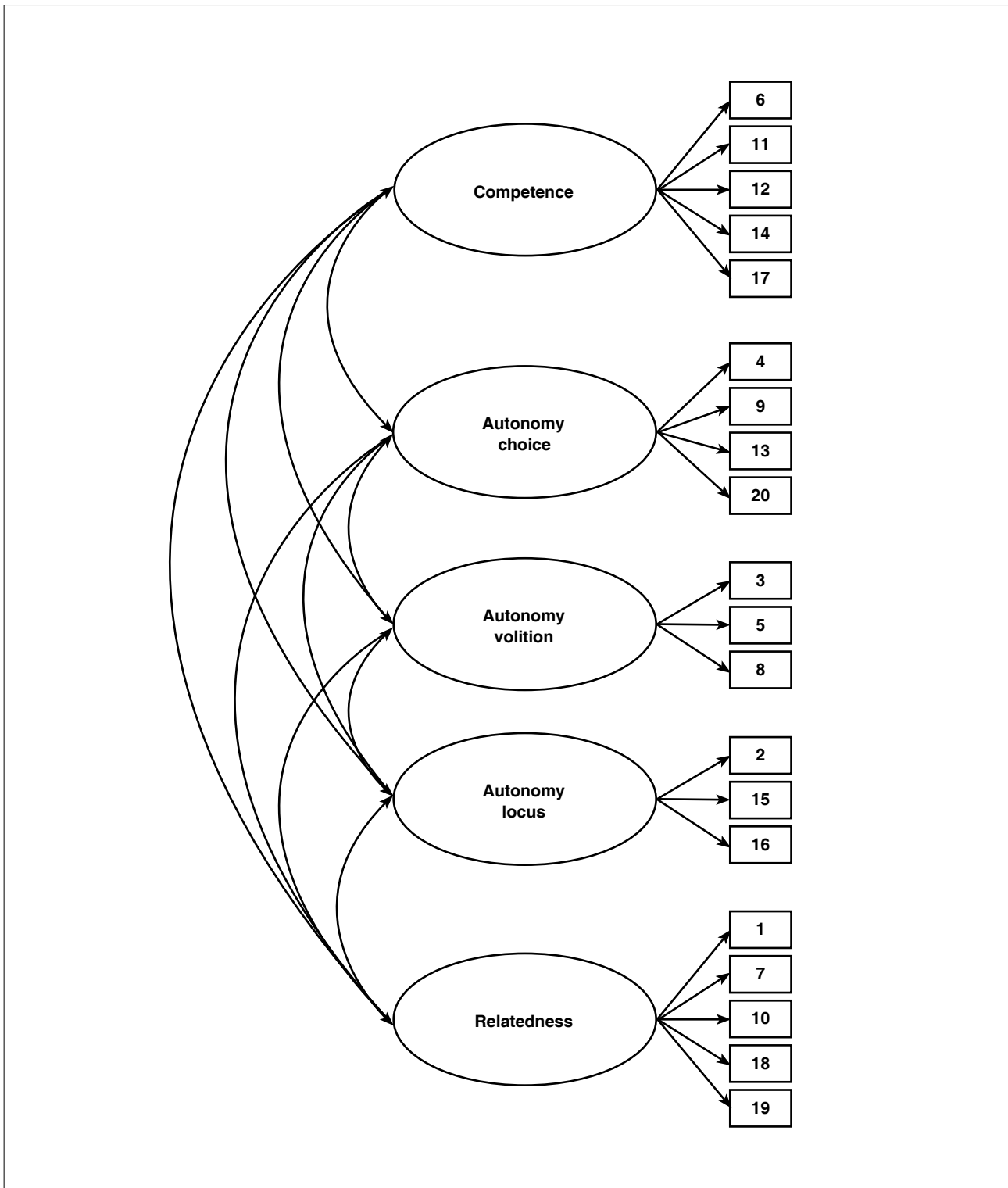
between model 0 and 1 was less than 0.01 (ΔCFI < -0.001), a result regarded as evidence favourable to equality or invariance. Similar results were observed for the difference of the comparison between models 0 and 2 (ΔCFI= -0.001).

With regard to invariance for age, two groups were formed, one consisting of minors (*n*: 523) and another group of adults (*n*: 272). The difference in the CFI values was below 0.01 for the comparisons of model 0 and 1, and subsequently 2 (ΔCFI = -0.001 and -0.002,

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Table 2
Factorial loads, errors and variance

Item	λ	δ	R²
1	,808	,589	,653
2	,809	,588	,654
3	,878	,478	,772
4	,835	,550	,698
5	,442	,897	,195
6	,857	,515	,735
7	,699	,715	,488
8	,877	,480	,769
9	,753	,658	,567
10	,906	,424	,820
11	,926	,378	,857
12	,883	,470	,779
13	,904	,429	,816
14	,921	,389	,848
15	,890	,456	,792
16	,938	,347	,880
17	,938	,346	,880
18	,918	,397	,842
19	,964	,266	,929
20	,902	,432	,814

Note: λ = factorial loads; δ = error; R2 = variance

Table 3
Correlations between dimensions and composite reliability

Dimensions	Competence	Aut. choice	Aut. *locus*	Aut. volition	Relatedness
Competence	,93				
Aut. choice	,80	,95			
Aut. volition	,86	,75	,82		
Aut. *locus*	,92	,78	,98	,95	
Relatedness	,77	,74	,81	,83	,96

Note. Aut.: autonomy; composite reliability index on diagonal

respectively), thus offering evidence of invariance of the model between the groups of adults and minors.

As for competitive level, the sample was divided into two groups, non-elite athletes (*n*: 592) versus elite competitive athletes (*n*: 203). For this model, CFI differences below 0.01 were found for model 0 with regard to 1 (ΔCFI = -0.001) and 0 with regard to 2 (ΔCFI < -0.001), thus confirming the invariance between athletes that engage in sport at different competitive levels.

Finally, the sample was divided into athletes who competed in individual sports (*n*: 350) and in team sports (*n*: 445). The differences in the CFI values were also below 0.01 for both model 1 (ΔCFI = 0.001) and model 2 (ΔCFI = 0.002) when they were compared to model 0. This points to factorial invariance between individual and team sports.

Reliability analysis

Table 3 displays the results obtained for composite reliability as well as the correlations between factors. For this model, the greatest index of reliability was found for the relatedness dimension (.96) and the lowest index was found for autonomy-volition (.82), the latter being above the limit of .70.

Discussion

The results indicate that the structure of the original version of the questionnaire and its Spanish version was replicated, presenting a good overall fit similar to those obtained in the preceding versions. Mention need only be made of the low factorial load for item 5, which nevertheless was above .40(*"In sport, I feel that I am being forced to do things that I don't want to do"*; autonomy-volition) in both Spanish versions. With regard to factorial structure, there are no data in other cultures/languages, barring a Portuguese version (Do Nascimiento, 2015), which failed to maintain the five-dimension structure addressed by Ng et al. (2011). This author grouped, once again, autonomy in a single dimension, without maintaining the distinctive characteristic of the BNSFS, and only 12 items of the 20 original items translated presented suitable factorial loads.

With regard to the mean scores observed, it should be mentioned that, as occurs with the team sport version (De Francisco et al., 2018), the lowest score was recorded in item 9 (autonomy-choice) and the highest one in item 8 (autonomy-volition). This result could be accounted for by culture, since some items seem to be more important than others in the same context depending on the provenance of the sample (Chen et al., 2015).

Moreover, all the items presented negative asymmetry, as in the two previous versions, demonstrating that the distribution frequency presents more values below the mean than above it, irrespective of language, or in other words that the answers are distributed below the mean. It should also be noted that in both Spanish versions, item 8 (*I choose to participate in my sport according to my own free will; autonomy-volition*) presents the highest mean, asymmetry and Kurtosis values. Therefore, most of the participants obtained a high score in this item, meaning that in Spanish culture doing sports is conceived purely as a matter of free will, without sensations of pressure (Gómez et al., 2009).

With regard to invariance, a triple-nested model analysis was performed for the gender, age, competitive level and type of sport variables. Applying the criterion indicated by Cheung and Rensvold (2002), with regard to invariance there are no differences between

Table 4
Model invariance in gender age, competitive level and type of sport

		χ^2	df	p	NNFI	CFI	RMSEA	RMSEA 90% IC	$\Delta\chi^2$	Δgl	ΔCFI
Gender	Modelo 0	904,68	320	<0,01	0,979	0,982	0,068	0,063-0,073	--	--	--
	Modelo 1	927,87	331	<0,01	0,979	0,982	0,067	0,062-0,072	23,19	11	*0,001
	Modelo 2	961,48	341	<0,01	0,979	0,981	0,068	0,063-0,073	56,08	21	-0,001
Age	Modelo 0	916,66	320	<0,01	0,978	0,981	0,069	0,063-0,074	--	--	--
	Modelo 1	966,46	331	<0,01	0,977	0,980	0,070	0,064-0,075	49,80	11	-0,001
	Modelo 2	999,96	341	<0,01	0,977	0,979	0,070	0,065-0,075	150,02	21	-0,002
Competitive level	Modelo 0	1437,64	320	<0,01	0,996	0,997	0,094	0,089-0,099	--	--	--
	Modelo 1	1596,08	331	<0,01	0.996	0,996	0,098	0,093-0,103	158,44	11	-0,001
	Modelo 2	1831,90	341	<0,01	0,995	0,996	0,105	0,100-0,110	394,26	21	*0,001
Type of sport	Modelo 0	959,34	320	<0,01	0,979	0,982	0.071	0,066-0,076	--	--	--
	Modelo 1	1013,36	331	<0,01	0.979	0,981	0,072	0,067-0,077	54,02	11	-0,001
	Modelo 2	1085,40	341	<0,01	0,977	0,980	0,074	0,069-0,079	126,06	21	-0,002

Note: χ^2 = chi-squares; *df* = degrees of freedom; *p*= p value; NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; IC = confidence interval; Δ= difference between values; Model 0 = confidence model; Model 1 = invariant factorial loads; Model 2 = factorial loads and variances/invariance factor covariances, *< 0.001

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any of the groups in relation to factorial structure (factorial loads, correlations between factors, factor variances). These results constitute evidence that the resulting tool is valid for evaluating the degree of satisfaction of BPN, irrespective of the group answering the questionnaire, gender, age, competitive level (elite or non-elite), or whether an individual or team sport is involved. The validation by De Francisco et al. (2018) yielded the same results in terms of gender, age and competitive level, although these authors did not verify invariance with regard to type of sport, since they only had participants who engaged in team sports.

This research made it possible to verify that the Spanish version may be applied, without any variations, to any type of sport. With regard to results on invariance in other countries, Do Nascimiento (2015) only checked factorial invariance by gender. The analysis of invariance is regarded as particularly interesting in view of its applicability to comparative studies, since if a tool does not fulfil the established invariance criteria, any conclusions subsequently drawn in a study comparing different sample groups may be rendered invalid.

The composite reliability index presented good values for each dimension, which validates this tool, thus confirming the absence of errors in the measurement performed. Moreover, and as occurs with the original version and the Spanish version for team sports, the lowest value is obtained for autonomy-volition, 0.61 and 0.60, respectively. Possibly, and since, as Reeve et al. (2003) assert, this is the dimension that requires particular attention, since it is a broader concept of self-regulation and may present significant differences. As in their research, this dimension presents lower values.

Conclusion

The results of this study allow us to confirm that the Spanish version of the BNSSS has good psychometric properties, maintaining the five-dimension factorial structure addressed by Ng et al. (2011) to evaluate the satisfaction of BPN in federation sports in Spain, constituting a breakthrough in sport psychology in that it develops a measurement tool for all types of sport, taking into account the three-factor division in the autonomy dimension.

Agradecimientos

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