

Research article

Confirmation of the Basic Psychological Needs in Exercise Scale (BPNES) with a sample of people who do healthy exercise

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Abstract

This study aimed to cross-validate the psychometric properties of the Basic Psychological Needs in Exercise Scale (BPNES) by Vlachopoulos and Michailidou (2006) in a Spanish context. Two studies were conducted. Confirmatory factor analysis results confirmed the hypothesized three-factor solution. In addition, we documented evidence of reliability, analysed as internal consistency and temporal stability. Future studies should analyse the scale's validity and reliability with different populations and check their experimental effect.

Key words: Self-determination, psychological mediators, autonomy, competence, relatedness, factorial validity, health, fitness.

Introduction

The relative-lack of exercise by people in today's society has been suggested to have serious consequences for a number of health related indices (WHO, 2004). It is in this context that numerous studies (Cruz, 1997; Ewing and Seefeldt, 1989; Pavón and Moreno, 2006) have tried to identify the reasons for physical exercise adherence and dropout. An analysis of these reasons for engaging in exercise has revealed a transfer of values in sport that has taken place in parallel with social, technological, economic and ideological changes during postmodernity. This means that reasons based on traditional and masculine sport with disciplined and competitive training have made way for others, which include post-modern sports values and new ways of doing and experiencing sport. These new reasons are linked to the intrinsic satisfaction of doing sports, which is in line with new social values aimed at improving our quality of life, concern for physical and mental health, satisfying personal needs, fun and motivation. Therefore, the population has new attitudes and interests towards physical activity and sport, although, as Owen and Bauman (1992) stated, a marked decline in exercise is still predominant.

As a result, and given that in the vast majority of conclusions to research (Cruz, 1997; Ewing and Seefeldt, 1989; Pavón and Moreno, 2006), motivation is acknowledged as one of the fundamental factors in continuing or dropping out of physical exercise, it seems logical to concentrate on explaining the role that motivation plays in maintaining a healthy lifestyle, and how exercisers can be influenced to increase their motivation towards healthy and active exercise. To respond to this need, one of the

soundest and most coherent theories to be developed over the last three decades for explaining human motivation is the self-determination theory (SDT) by Deci and Ryan (1985). It analyses the extent to which human behaviour is voluntary or self-determined, in other words, the extent to which people perform their actions at the highest level of reflection and commitment to actions with a sense of choice (Deci and Ryan, 1985). Similarly, this theory describes conditions in which different social and contextual factors will encourage different types of motivation in people (Vallerand and Rousseau, 2001). These different types of motivation are located along a self-determination continuum that ranges from intrinsic motivation (in which the individual participates due to the satisfaction an activity generates) to amotivation (characterised by a lack of interest in exercise and feelings of frustration), and includes external motivation (in which participation is a means to achieve an end that is not inherent). At the same time, within this extrinsic motivation, the individual may consider the activity to be important but not pleasurable (identified regulation), may do it for reasons of guilt (introjected regulation), or simply due to external pressures (external regulation).

One of the mini-theories it is based on is the theory of basic needs. Within the SDT, the concept of basic psychological needs is specified as something innate, universal and essential for health and wellbeing (Deci and Ryan, 2002; Ryan and Deci, 2000). This sub-theory assumes there are three basic needs (competence, autonomy and relatedness) for the development and maintenance of psychological health and personal wellbeing. According to different studies, people experience more physical growth and psychophysical wellbeing from their actions, when they feel more able to: make the decision they feel is most appropriate, without external pressures (autonomy); to perform actions secure in the knowledge that the result will be the one they expect or want (competence); and to feel that they can rely on the collaboration and acceptance from the people they consider important (relatedness) (Vallerand and Rousseau, 2001). This situation will generate more self-determination (intrinsic motivation) towards doing physical exercise and sport in individuals, as defined by Vallerand and Rousseau (2001). All this, in turn, allows people to function effectively and to develop healthily (Edmunds et al., 2007). To the contrary, according to Vallerand and Rousseau (2001), the more these needs are not met, the more people will demonstrate less self-determined forms of motivation (extrinsic motivation and amotivation).

Different studies have tried to measure basic psychological needs using scales that measure each one of the factors (autonomy, competence and relatedness) in an isolated manner. So far, we have only come across three scales that measure the three mediators jointly: the PNSE, the EMMD and the BPNES. The PNSE was developed by Wilson et al. (2006) to measure basic psychological needs in physical exercise in a sample of Canadian university students. It has 18 items (six items for each dimension) and the results of the psychometric tests have acceptable values. The *Escala de Mediadores Motivacionales en el Deporte* (EMMD - the Scale of Motivational Mediators in Sport) was created to measure satisfaction of basic psychological needs in the exercise and sports context. This scale was created by González-Cutre et al. (2007) and consists of 23 items, grouped into three factors: autonomy (eight items), perceived competence (seven items) and relatedness (eight items). Both the construct validity and reliability had acceptable values for use. The Basic Psychological Needs in Exercise Scale (BPNES), created by Vlachopoulos and Michailidou (2006), was developed to determine the specific domain level in which the three basic psychological needs are satisfied with physical exercise. The instrument has 12 items, grouped into three factors: autonomy (four items), competence (four items) and relatedness (four items). This scale was later validated by Vlachopoulos (2007, 2008), Vlachopoulos and Karavani (2009) and Vlachopoulos and Neikou (2007).

Various studies have analyzed the basic psychological needs in relation to gender invariance, and independently of the instrument, found that the structure of the three basic needs is similar in men and women (Adie et al., 2008; Moreno et al., 2008; Sánchez and Núñez, 2007; Vlachopoulos, 2008).

In order to be able to use the three psychological mediators in more complex theoretical models, and considering the importance of confirming and validating the observation measurements with different populations and cultures, two studies were conducted with independent samples. The first study was a preliminary validation of the BPNES scale in the Spanish context with participants who do healthy exercise, by means of internal consistency and temporal stability, as well as construct validity by means of CFA. The second study was carried out to confirm the factorial structure of the BPNES using invariance across gender.

Study 1

The purpose of this study was to perform a preliminary validation of the Basic Psychological Needs in Exercise Scale (BPNES), created by Vlachopoulos and Michailidou (2006), in the Spanish sports context.

Methods

Participants

The study sample consisted of 279 healthy exercises (indoor cycling, body pump, body combat, step, aerodance, pilates, yoga, tai chi, etc.) in fitness centres in the Region of Murcia. 28.9% ($n = 64$) of the entire sample were males and 71.1% were females, aged between 18 and 69

($M = 37.24$, $SD = 10.62$). 6.4% ($n = 18$) of the entire sample exercised once a week, 41.6% ($n = 116$) exercised between two and three days a week, and 52% ($n = 145$) did exercise more than three days a week.

To establish temporal stability, the scale was administered twice with an interval of four weeks to a total of 65 individuals (32 men and 33 women) with an average age of 35.15 ($SD = 11.31$).

Instruments

Basic Psychological Needs in Exercise Scale (BPNES)

The Spanish version of the Basic Psychological Needs in Exercise Scale (Vlachopoulos & Michailidou, 2006) was used. The inventory was made up of 12 items grouped into three factors: autonomy (e.g. "the exercise programme I follow at the facility is in keeping with my interests"), competence (e.g. "I have made great progress as far as the result pursued is concerned), and relatedness (e.g. "I feel very comfortable when I do exercise with other participants"). This questionnaire used a Likert-type scale ranging from 1 (*totally disagree*) to 5 (*totally agree*).

Procedure

We used a direct translation strategy (see Carretero-Dios & Pérez, 2005), so the BPNES items were translated into Spanish and another group of translators later judged their equivalence. After the scale had been translated, we contacted the managers of different fitness and sports centres to inform them about our objectives and to ask them for their voluntary collaboration. We would like to emphasise that all the fitness centres, trainers and exercisers we approached participated voluntarily in the research. Next, the definitive questionnaire was administered under the supervision of the main researcher, who answered all the questions raised during the process. It took approximately 10 minutes to fill in the questionnaire and the instruments were collected individually to check that no item had been left unanswered.

Data analysis

The psychometric properties of the BPNES were analysed to check their validity and reliability. This was done by performing a confirmatory factor analysis (CFA), an internal consistency analysis using Cronbach's alpha and an analysis of the temporary test-retest stability.

Results

Reliability estimation

The internal consistency analysis was performed using Cronbach's alpha coefficient. The results showed an alpha coefficient of 0.73 for the autonomy factor, 0.78 for the competence factor and .87 for the relatedness factor.

The intraclass correlation coefficient (ICC; Vincent, 1995) was used to examine the stability of the scales. The ICC values: between 0.70 and 0.80 show acceptable levels of stability; between 0.80 and 0.89 moderate stability level; and 0.90 or more, high stability (Vincent, 1995). For autonomy, the mean obtained changed from 4.29 ($SD = 0.54$) to 4.22 ($SD = 0.58$) with an ICC

value of 0.87. For competence, the mean was 3.95 ($SD = .62$) and 3.99 ($SD = 0.61$) with an ICC value of 0.92. For relatedness, the mean changed from 4.21 ($SD = 0.78$) to 4.30 ($SD = 0.69$) with an ICC value of 0.89. The results showed moderately high levels of reliability in the test-retest for the first and third subscales, and high for the second subscale of the BPNES.

Confirmatory factor analysis

A confirmatory factor analysis (CFA) was performed to test the psychological mediator model (Figure 1). To assess the model's goodness of fit, based on the contributions made by different authors (Bentler, 1990; McDonald and Marsh, 1990; Mulaik et al., 1989), the following fit indices were considered: χ^2 , $\chi^2/d.f.$, RMSEA (Root Mean Square Error of Approximation), SRMR (Standardized Root Mean Square Residual), and incremental indices CFI (Comparative Fit Index), NFI (Normed Fit Index) and TLI (Tucker Lewis Index). These goodness of fit indices are considered acceptable when $\chi^2/d.f.$ is less than five (Bentler, 1989), the incremental indices (CFI, NFI and TLI) are more than 0.90 (Hu and Bentler, 1995), the error index RMSEA is less than 0.08 (Browne and Cudeck, 1993) and the error index SRMR is less than .05 (Hu & Bentler, 1999). The descriptive analysis of the items showed skewness and kurtosis values of less than 2, which indicated univariate normality of the data (Bollen and Long, 1993). Furthermore, the Mardia coefficient was 186.37, which indicated multivariate normality if we take into account that this coefficient should be less than the formula $p(p + 2)$, where p is the number of variables observed (Bollen, 1989). The presence of normality in the data made it possible to use the maximum likelihood estimation method in the CFA.

The covariance matrix was used among/between the items as a start to the data analysis and different indices were used to check the goodness of fit of the model. As can be seen in Figure 1, the model provided some suitable fit indices ($\chi^2(51, N = 279) = 164.07, p = 0.00$; $\chi^2/d.f. = 3.21$; CFI = 0.91; NFI = 0.91; TLI = 0.90; RMSEA = 0.08; SRMR = 0.07). All the parameters were significant at $p < 0.05$ with a t value of 1.96. Furthermore, the model's discriminant validity was examined, taking into account that the correlation between latent variables, mitigated by the measurement error (± 2 times the measurement error), which was less than 1.0. Consequently, the results obtained in the confirmatory factor analysis demonstrated that the model was suitable.

Study 2

This study aimed to confirm the factorial structure of the BPNES using invariance across gender.

Method

Participants

The study sample consisted of 445 healthy exercises (indoor cycling, body pump, body combat, step, aerodance, pilates, yoga, tai chi, etc.) in fitness centres in the Region of Murcia. 53.7% of them ($n = 239$) were male and 46.3% ($n = 206$) were female, aged between 18 and 77 ($M = 28.47, SD = 13.60$). 16.4% ($n = 73$) of the entire sample exercised once a week, 52.4% ($n = 233$) exercised between two and three days a week, and 31.2% ($n = 139$) did exercise more than three days a week.

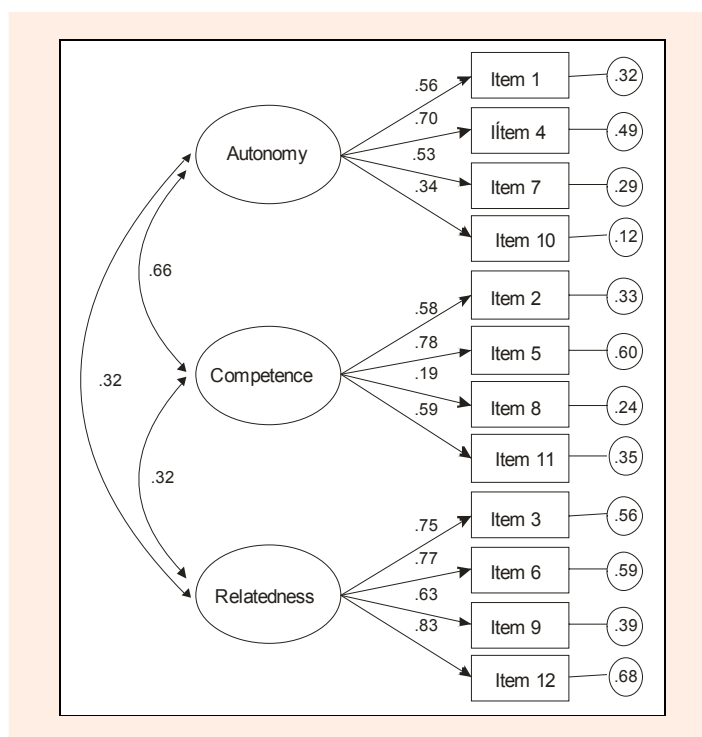


Figure 1. Measurement Model (CFA) of the BPNES. The circles represent the latent constructs and the squares represent the variables measured. All the parameters are standardized and significant in $p < 0.05$. The residual variances are shown in the small circles (Study 1).

Instruments and Procedure

Basic Psychological Needs in Exercise Scale (BPNES)

The scale described in Study 1 was used. The process for collecting data and the instructions given to complete the questionnaire were similar to those described in Study 1.

Data analysis

In order to check the psychometric properties of the BPNES, an invariance analysis across gender and a reliability estimation were performed.

Results

Reliability estimation

The internal consistency analysis was performed using Cronbach's alpha coefficient. The results showed an alpha coefficient of 0.70 for the autonomy factor, 0.76 for the competence factor and 0.85 for the relatedness factor.

Confirmatory factor analysis and invariance test across gender

A CFA was performed to test the psychological mediator model, using the same fit indices described in Study 1. The maximum likelihood estimation method was used because Mardia's coefficient, following the formula proposed by Bollen (1989) mentioned in study 1, was less than the value 120 (multivariate kurtosis = 67.89), so the multivariate normality of the data can be assumed. The data obtained indicated a suitable fit for the scale: χ^2 (51, $N = 445$) = 162.88, $p = 0.00$; $\chi^2/d.f. = 3.19$; CFI = 0.92; IFI = 0.92; TLI = 0.90; RMSEA = 0.07; SRMR = 0.05. Similarly, the model's fit indices obtained for the men (χ^2 (51, $N = 239$) = 96.57, $p = 0.00$; $\chi^2/d.f. = 1.89$; CFI = 0.93; IFI = 0.93; TLI = 0.91; RMSEA = 0.06; SRMR = 0.06), and the women (χ^2 (51, $N = 206$) = 123.66, $p = 0.00$; $\chi^2/d.f. = 2.42$; CFI = 0.90; IFI = 0.90; TLI = 0.90; RMSEA = .08; SRMR = 0.06) were acceptable.

Discussion

The purpose of this study was to perform a preliminary validation of the Basic Psychological Needs in Exercise Scale (BPNES) in the Spanish context. This scale was designed to determine the personal assessment of the specific level of domain in the area of physical exercise through the satisfaction of basic psychological needs (autonomy, competence and relatedness). One of the main reasons for this study was to address the need to develop valid and reliable scales that can help us to understand individuals' behaviour where physical exercise is concerned in order to guarantee and optimise those aspects that promote adherence to programmes related to physical exercise and health among the population. The results obtained after the analysis of the psychometric properties, which included Cronbach's alpha coefficients, the confirmatory factor analysis, the test-retest reliability and the invariance test across gender, were appropriate.

With regard to factorial and construct validity, the BPNES has shown a structure of three oblique factors, coinciding with the findings by Vlachopoulos and Michailidou (2006), which is also coherent with the hier-

archical model of intrinsic and extrinsic motivation proposed by Vallerand (1997). The correlations between the autonomy and competence subscales were high, with a correlation of 0.68 in the structural equation model in the second study, which is consistent with those obtained by Vlachopoulos and Michailidou (2006).

The factor structure of three correlated factors has shown minimal invariance across gender. It is important to highlight this fact, since it is a contextual measure that involves the perception of competence, autonomy and relatedness, so there may be bias in the responses depending on the different variables, such as the level of accomplishment, or the influence of other significant people, which may have a differential influence on men and women.

As far as reliability is concerned, the results have shown suitable internal consistency and temporal stability of the scale, with similar results to the findings by Vlachopoulos and Michailidou (2006) and to the evaluation of these constructs at a contextual level (Vallerand, 1997; 2001). In conclusion, the Spanish version of the BPNES has shown suitable psychometric properties, which partially support its use in the exercise and sport context. Nevertheless, further research is necessary to try to corroborate the results obtained in different populations and using different statistical analyses, since validation is a process that cannot be limited to one study only.

Conclusion

In short, the results obtained provide a new scale for the Spanish context in order to study the basic psychological needs that encourage sport and physical activity in the adult population.

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Key points

- The *Basic Psychological Needs in Exercise Scale* (BPNES) is valid and reliable for measuring basic psychological needs in healthy physical exercise in the Spanish context.
- The factor structure of three correlated factors has shown minimal invariance across gender.

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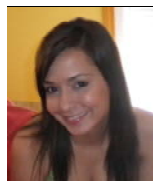
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