

Original Article (short paper)

Psychometric properties of the Questionnaire of Attitudes towards Doping in Fitness (QAD-Fit)

Ana Sofia R. Tavares^{1,2}, Sidónio Serpa¹, António Rosado¹

¹Universidade de Lisboa, Faculdade de Motricidade Humana, Cruz Quebrada, Lisboa, Portugal; ²H&TRC, Health & Technology Research Center, ESTeSL, Escola Superior de Tecnologia da Saúde de Lisboa, Instituto Politécnico de Lisboa, Lisboa, Portugal

Abstract — Aim: The purpose of this study was to test the psychometric proprieties of the Questionnaire of Attitudes towards Doping in Fitness (QAD-Fit), originally developed by Serpa and colleagues and adapted to Portuguese gym/fitness context. **Methods:** A cross-sectional survey utilizing a web self-administered questionnaire was used. The sample was composed of 453 gym/fitness center practitioners, aged between sixteen and seventy-nine years old ($M = 35.64$; $SD = 13.08$), enrolled in several gym activities. **Results:** The confirmatory factorial analysis provided support to the four-factor structure proposed. All factors displayed good internal consistency, convergent validity, and discriminant validity. The multi-group analysis revealed cross-validity and the model's invariance. The correlation between QAD-Fit and the Doping-related Theory of Planned Behavior Measures (DRTPBM) revealed evidence of its concurrent validity. **Conclusion:** The findings of this research revealed that QAD-Fit is a psychometrically valid and reliable instrument to assess attitudes towards doping consumption in gym and fitness settings.

Keywords: attitudes towards doping, gym/fitness practitioners, confirmatory factor analysis.

Introduction

Within recreational sports, people using fitness centers come from a very wide range of demographics and backgrounds. Performance-enhancing substances (PES – e.g., stimulants, anabolic-androgenic steroids (AAS), erythropoietin, human growth hormone, and diuretics) are used by this kind of practitioners for many reasons and motives¹. A recent systematic review² concluded that gym/fitness practitioners use PES, especially AAS, due to aesthetic reasons, generally driven by their dissatisfaction with physical appearance, followed by low self-esteem and the wish to become more attractive and desirable. The same study points out that the main motivation to use this kind of substances was to increase muscle mass and strength, to improve physical performance, to recover faster from previous training sessions, to prevent injuries and to manage body size/weight. Alongside these reasons and motivations for the use of PES, perceived social pressure and peers influence on subjective norms, play an important influence towards a positive attitude towards PES use in gym users².

Taking into account that attitudes can be used to predict doping behavior³, anti-doping research should include, alongside with physiological and chemical approaches, sociological, behavioral and ethical studies of athletes' attitudes and beliefs towards the use of PES, since it seems to involve a set of essentially volitional behaviors^{4,5}. However, the choice of using PES is regulated by a complex system of dynamic relations between social cognition and behavior, influenced by a range of circumstances, situations, and individual characteristics, that

must be considered within the theoretical framework describing the pattern of these relations⁶. In this sense, though some psychological integrative models (eg., Sports Drug Control Model, Trans-contextual Model, Life Cycle Model) have been pointed out to clarify the use of PES in sport^{7,8}, the Theory of Planned Behavior (TPB) is one of the most frequently used framework to explain athletes doping intentions and behavior⁹, since it offers descriptions and definitions that are more understanding about the specified construct and includes a discriminant validity of the constructs^{10,11}. According to the TPB, behavioral intention of the actions to assume or refuse a healthy behavior¹² is determined by the individual's attitude towards the behavior, subjective norms and perceived the behavioral control (PBC)¹³.

Since individual's attitude towards the behavior reflects the evaluation of the consequences of engaging in the target behavior, attitudes are often used as a proxy for doping behavior, with the assumption that those who use PES will show greater leniency towards doping than those who do not^{5,14,15}. To assess attitudes towards doping, a valid and reliable instrument is required¹⁵. However, Morente-Sánchez, Femia-Marzo and Zabala⁴ stated that just a few studies used validated tools to assess attitudes towards doping, while the majority of researchers used ad hoc measurements without psychometric testing, which compromise the reliability and validity of the findings. In this way, ad hoc measures, developed and used for single research, without demonstrated reliability and validity should be avoided, since test scores are interpreted as the individual's attitude and inferences are made for a specific population¹⁵.

In order to address this gap, several direct measures (self-report questionnaire) of attitudes and thus behaviors have been proposed in doping research¹⁴. The Performance Enhancement Attitude Scale (PEAS) is an example of a self-reported explicit measure of a generalized doping attitude¹⁵. However, PEAS is used in doping research as other validated psychometric assessments, which measure an effective implicit doping attitude (eg., Doping Implicit Association Test, Doping Brief Implicit Association Test and Pictorial Doping Brief Implicit Association Test) only in terms of elite sport⁶. Serpa, Leitão, Marcolino, Faria, Ramadas and Reis¹⁶ proposed a multidimensional model of attitudes towards doping in sports – “Questionnaire of Attitudes towards Doping in Sports” (QADS) based on the TPB. The goal was to create an instrument which measures the factors that influence the formation of young people's attitudes and, consequently, a better understanding of the triggering of doping behaviors¹⁷.

The Questionnaire of Attitudes towards Doping in Sports has four dimensions associated with doping behavior: (1) attitudes towards doping consumption; (2) beliefs, meaning the subject's beliefs regarding the effect of doping in order to improve performance; (3) intentions about the circumstances in which individuals think they would or would not take doping; and (4) subjective norms, that is, the subject's perception of what people who are significant to him think about the consumption of doping substances. It comprises 31 items, scored on a 7-point Likert type scale¹⁷. Several authors validated this instrument in different populations¹⁷. For example, Opendacker, Vanden Auweele and Serpa¹⁸ studied a sample of young Belgian athletes with ages ranging from 14 to 18 years, and added 3 items to the factor subjective norms, because of the small number of items included in this factor. So the QADS used consisted of 34 items with 15 items belonging to the concepts of intentions, 7 items to attitudes, 7 items to subjective norms and 5 items to beliefs, showing a satisfactory internal consistency.

To date, and to our knowledge, QADS showed exploratory validity evidence and satisfactory reliability results in almost all the different populations tested¹⁷, but a more refined analysis was not performed, namely, a confirmatory factorial analysis. Therefore, the aim of this study was to analyze the psychometric proprieties of the QADS, terminologically adapted to the target population in this study – gym/fitness center practitioners and was designated as “Questionnaire of Attitudes towards Doping in Fitness” (QAD-Fit), in order to provide a psychometrically valid and reliable instrument. More specifically, we intended to analyze the factor structure as it was proposed by the QADS' authors. Furthermore, into a more refined analysis, we (i) tested the model to determine its internal consistency and convergent validity; (ii) tested the invariance of the structure with a cross-validation strategy; and (iii) explored the concurrent validity with a sample of Portuguese gym/fitness center practitioners.

Having a valid and reliable instrument that can provide measures of the factors that influence the formation of gym/fitness center practitioners' attitudes is essential, to better understand the triggering of doping behaviors in this specific population.

Method

Participants and data collection

A convenience sample of 453 Portuguese gym/fitness center practitioners, aged between sixteen and seventy-nine years old ($M = 35.64$; $SD = 13.08$), participated in this research. The sample size required for this study that uses a structural equation model (SEM) was calculated by A-priori sample size calculator for SEM (Soper, 2017)¹⁹. Participants were involved in several gym activities (e.g., 57% cardio fitness, 56.5% bodybuilding, 27.8% stretching, 27.2% localized). From those, 277 were female and 175 males.

Prior to data collection, the study was reviewed by the University Ethics Board. Upon approval (N° 38/2017), participants were recruited by Gyms and Fitness center clubs that were invited and accepted to participate (by institutional e-mail / Facebook) and through a social network (Facebook).

The survey Web link directed potential subjects to an informed consent page, providing additional information regarding the study and detailing methods used to maintain confidentiality and anonymity. Then, an electronic version of the “Questionnaire of Attitudes towards Doping in Fitness” (QAD-Fit) and the Portuguese version of the Doping-related Theory of Planned Behavior Measures²⁰ (for concurrent validity purpose) were completed via the same online link. The questionnaires took approximately 10 minutes to complete. No individually identifiable data were collected, Internet provider addresses were not logged, and data transfer was encrypted.

Measures

The “Questionnaire of Attitudes towards Doping in Sports” (QADS) is an originally Portuguese questionnaire that was developed by Serpa, Leitão, Marcolino, Faria, Ramadas, Reis¹⁶ and is based on the theory of planned behavior¹². It includes four dimensions to evaluate attitudes (7 items), beliefs (5 items), intentions (15 items) and subjective norms (7 items), and its 34 items are scored on a seven-point Likert-type scale ranging from (1) *totally disagree* to (7) *totally agree*. The items 2, 4, 5, 11, 13, 19, 25, 30 and 32, must be reversed¹⁶. A higher score would mean a more positive attitude towards doping consumption. The QADS was used within the sport context. Therefore, in the present study, we changed some of the items, in order to better describe the fitness context instead of the sport environment. For example, we replaced the word athlete by practitioner (items 1, 2, 5) and we rephrased sentences, replacing sport expressions to fitness expressions, in order to focus the practitioner in the fitness context. In this study and after this adaptations, we designated the instrument as “Questionnaire of Attitudes towards Doping in Fitness” (QAD-Fit) (Appendix). Finally, the QAD-Fit was tested with 30 participants (pilot study) to ensure that the questionnaire was perfectly clear and understandable, which was confirmed immediately by means of an interview with each participant.

Doping-related Theory of Planned Behavior Measures (DRTPBM)²⁰ was translated to Portuguese, adapted and validated for this study, to be used for concurrent validity proposes, since that is known to accurately measure almost the same constructs as QAD-Fit. Once approval was obtained from the original scale author, the translation of the DRTPBM was performed, according to Beaton, Bombardier, Guillemin, Ferraz and Bosi²¹, using a five-stage process. In this way, a brief description of the psychometric validation of this scale will be presented in this article. The original version²⁰ has four subscales, attitudes (6 items); subjective norms (2 items); perceived behavioral control (3 items); and behavioral intentions (3 items). According to Lucidi, Zelli, Mallia, Grano, Russo and Violani²⁰, this scale was conceptualized through TPB, with reference to the motives or goals that adolescents typically report for doping use, such as seeking to improve performance and /or physical appearance. Items were answered on a five – point Likert scale.

Data Analysis

Data Analysis was performed using SPSS (version 22.0) and AMOS 22.0 (SPSS Inc. Chicago IL). A confirmatory factor analysis (CFA) was performed to assess the psychometric proprieties of the QAD-Fit instrument. The maximum likelihood (ML) method was used. Following the discovery of unsatisfactory fit, modification indices and standardized estimates were examined to evaluate for alternative models or probable item removals. To retain an item, a factor load equal to or greater than .50 within a single factor was used²².

Univariate skewness and kurtosis of items were examined, as well as multivariate normal distribution using Mardia's (1970) coefficient of multivariate kurtosis²³.

Internal consistency (reliability) of the constructs was assessed through composite reliability, and we followed the recommendation of Fornel and Larcker²⁴ to calculate composite reliability (CR), in which it is recommended that values $\geq .7$ indicate a proper value of CR.

Convergent validity was evaluated through the average variance extracted (AVE), whereby the values of AVE $\geq .5$ are appropriate indicators of convergent validity²⁵.

Discriminant validity was established when the AVE for each construct went beyond the squared correlations between that construct and any other²⁵. In order to identify QAD-Fit' factorial invariance, cross validation procedures were used with a multi-group analysis strategy²⁶⁻²⁸.

Assessment of model fit was based on multiple indicators^{29,30}, namely: chi-square (X^2) statistical test, the ratio of qui-square to its degree of freedom (X^2/df), comparative-of-fit-index (CFI), goodness-of-fit index (GFI), parsimony comparative of-fit index (PCFI), parsimony goodness-of-fit index (PGFI), and root mean square error of approximation (RMSEA). Research practices using these indices state that values for the X^2/df should be less than 3, PCF and PGFI above .60, while values above .95 for the CFI and GFI, and below .06 for the RMSEA represent a good fit³¹⁻³⁴.

To study the adequacy of model replication, a multi-group confirmatory factor analysis (MGCFAs) using four steps was

conducted with the calibration sample ($n = 231$) and the second sample, as validation sample ($n = 222$), in which we compared four nested models³⁵. First, to test configural invariance (i.e., participants from different groups conceptualize the constructs in the same way), we tested the model by constraining the factorial structure to be the same across groups³⁶. Second, to test metric invariance (i.e., if different groups respond to the items in the same way), we tested the model by constraining all factor loadings to be the same across groups³⁶. Third, to test the scalar invariance (i.e., observed scores are related to the latent scores), we tested the model by constraining the intercepts of items to be the same across groups³⁶. Factorial invariance was accepted when the models did not differ significantly ($p > .05$), according to the qui-square statistic difference^{22,37}. However, the qui-square difference statistic is known to reject models even when violations are minor, particularly when the sample size is large³⁸. Therefore, we also considered Cheung and Rensvold³⁹ suggestion that a difference of CFI of less than or equal to .01 is an indication that the constrained parameters are invariant.

Concurrent validity was analyzed by Pearson's correlation coefficients between the QAD-Fit's and the Doping – related TPB Measures' dimensions²⁰, as well as their total score values⁴⁰.

Results

Preliminary analysis

The results confirm the univariate normality assumptions, taking into account that absolute values of skewness and kurtosis are below 3 and 7, respectively⁴¹ (See Table 1). Yet, Mardia's coefficient indicated a lack of multivariate Gaussian distribution (Coefficient = 63.210)⁴². To deal with this, a bootstrapping procedure of Bollen and Stine⁴³ was applied to adjust the p -value of the chi-square statistic.

Table 1. Factor descriptive statistics for QAD-Fit

Factor	M	SD	Min	Max	Skewness	Kurtosis
Intentions	2.18	1.66	1.00	7.00	1.39	.76
Attitudes	2.99	1.47	1.00	7.00	.67	-.07
Subjective norms	1.66	1.08	1.00	6.00	1.79	2.36
Beliefs	3.43	1.40	1.00	7.00	.01	-.59
Global	2.57	1.15	1.00	6.75	.99	.47

Note. M = Mean; SD = Standard Deviation; Min = Minimum; Max = Maximum.

Evaluation of Model Fit

At first, not all estimated factor loadings exceeded the cut-off point of .50²², ranging from .26 to .92. The goodness-of-fit indices produced for this first-order measurement model indicated poor fit ($X^2 = 502.162$, B-S $p < .03$; $X^2 / df = 3.44$, PCFI = .81, PGFI = .69, CFI = .94, RMSEA = .073, 90% CI [.066 – .081]) showing that the hypothesized measurement model is inconsistent

with observed data and it is interpreted as evidence against the adequacy of the model.

Due to the lack of support from CFA performed, post hoc model adjustments were conducted in an effort to develop a better fitting model. The results in the original model (first-order-model) indicated that not all items loaded significantly on its construct. In the interest of scientific parsimony, all scale items that showed unacceptable factor loadings were removed⁴⁴. The number of items eliminated from the model was as small as possible and we tried to leave at least three per factor, in accordance with the recommendation of O'Rourke and Hatcher⁴⁵. Furthermore, the examination of the modification indices (MI) suggested some error correlations that improved the fit of the model. A large error covariance between items 13 and 25 remained present (MI = 11.560, EPC = .28), suggesting that allowing the two errors to correlate would significantly improve model fit. Examining items 13 ("Selling PES should be punished") and 25 ("Instructors who give PES to their practitioners should be punished"), it was clear that they had a higher degree of overlap. According to Byrne⁴⁴, given the redundancy between both items, we decided to correlate the two errors involved.

The indices of fit indicated a noteworthy improvement of the hypothesized first-order model, as reported in Table 2.

After these procedures, the model adjusted to the data. The results demonstrated an acceptable fit ($X^2 = 204.383$, B-S $p < .03$; $X^2 / df = 2.107$, PCFI = .79, PGFI = .67, CFI = .98, RMSEA = .049, 90% CI [.040 – .059]). Composite reliability values ranged from .74 (Beliefs) to .97 (Intentions), indicating that the constructs were internally consistent. Evidence for convergent validity was obtained, since AVE values ranged from .50 (Beliefs) to .87 (Intentions), being greater than the recommended standard of .50²⁴.

Furthermore, all constructs were considered to exhibit discriminant validity, because all AVE values exceeded the appropriate square factor correlations. Overall, the measurement model was within the required criteria and showed good psychometric proprieties.

Table 2. QAD-Fit Re-specified first-Order Model-Factor Loading, Z-values, Composite Reliability (CR) and Average Variance Extracted (AVE).

QAD-Fit factors/ items	Loadings	Lower	Upper	p	Z-value	CR	AVE
ITENT							
Item 20	.961	.944	.974	.001	–		
Item 24	.944	.926	.959	.002	45.904		
Item 18	.942	.917	.959	.002	45.248	.971	.871
Item 3	.879	.845	.906	.002	34.054		
Item 16	.939	.920	.954	.001	44.577		
ATTITU							
Item 30	.796	.732	.853	.001	–		
Item 25	.663	.596	.724	.001	13.685		
Item 32	.808	.753	.854	.001	16.733	.836	.507
Item 5	.652	.573	.722	.001	13.513		
Item 13	.577	.499	.640	.001	11.708		

(To be continued)

Table 2. QAD-Fit Re-specified first-Order Model-Factor Loading, Z-values, Composite Reliability (CR) and Average Variance Extracted (AVE).

QAD-Fit factors/ items	Loadings	Lower	Upper	p	Z-value	CR	AVE
SN							
Item 22	.676	.587	.751	.002	–		
Item 34	.821	.768	.865	.002	15.628	.858	.672
Item 31	.940	.876	.977	.002	16.855		
BEL							
Item 17	.594	.530	.661	.001	–		
Item 21	.713	.651	.785	.001	10.678	.743	.495
Item 28	.788	.711	.840	.001	11.009		

Note: ITENT = Intentions; ATTITU = Attitudes; SN = Subjective norms; BEL = Beliefs.

The data analysis proceeded in an attempt to fit a model with four first-order factors and a second-order-factor. Consequently, we hypothesized that the first order factors are explained by a higher order factor, which in the case of QAD-Fit is a second-order factor designated "behavioral predisposition towards doping". The second-order measured model (Figure 1) showed an overall acceptable fit to the data ($X^2 = 208.246$, B-S $p < .03$; $X^2 / df = 2.103$, PCFI = .81, PGFI = .69, CFI = .98, RMSEA = .049, 90% [CI = .040 – .059]).

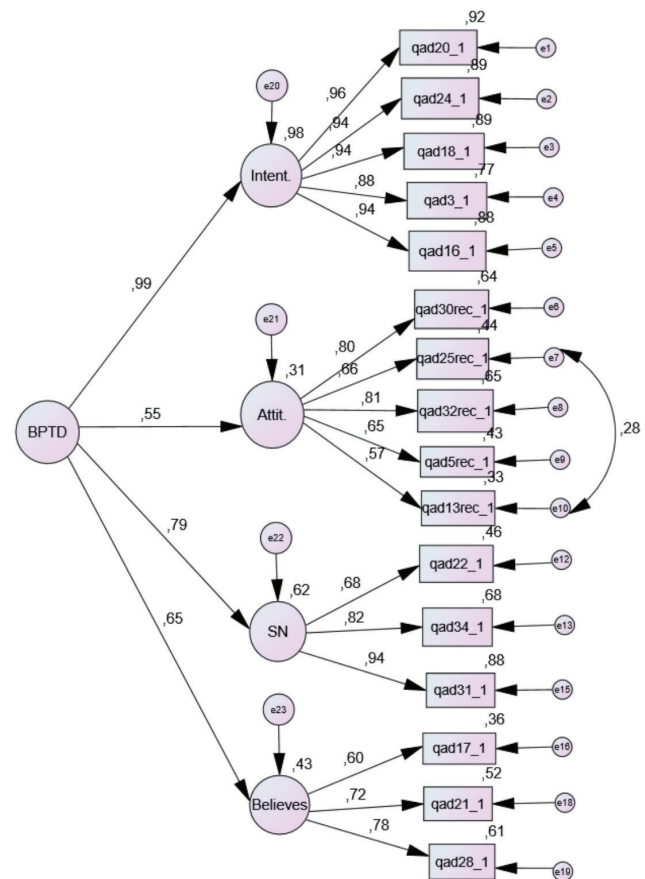


Figure 1. Re-specified second-order model of the QAD-Fit Multidimensional behavioral predisposition towards doping scale.

Cross-validity

In order to study the adequacy of model replication, cross-validation procedures were used²⁸. More specifically, a cross-validation technique using a multi-group analysis with two equivalent samples in their characteristics (n calibration sample = 231; n validation sample = 222) and then a technique of parameter-invariance to verify the equivalence between the two groups²⁶. As exposed in Table 3, the fit of the unconstrained model [Model A (full configural invariance): $X^2(220) = 417.005$ (B-S $p < .03$); PCFI = .885; CFI = .966; RMSEA = .045] was acceptable. The fit of this model provides the baseline value against which all subsequently specified invariance models are

compared⁴⁴. The models with constrained factor loadings [Model B (full metric invariance): $X^2(223) = 420.658$ (B-S $p < .03$); PCFI = .897; CFI = .966; RMSEA = .044], and with constrained intercepts [Model C (full scalar invariance): $X^2(239) = 444.369$ (B-S $p < .03$); PCFI = .960; CFI = .964; RMSEA = .044], showed a satisfactory fit. The X^2 statistic showed no significant differences between Model A and Model B [X^2 dif (3) = 3.653; $p = .301$] and also no significant differences between Model A and Model C [X^2 dif (19) = 27.364; $p = .096$]. There were no differences in the CFI values for all model comparisons. Thus, the results demonstrated the model's invariance in both samples, indicating that the factorial structure of the scale was stable in the two independent samples³⁹.

Table 3. Results of the Multi-Group Analysis across the Unconstrained Model and the Constrained Models of the QAD-Fit (Calibration sample: $n = 231$; Validation sample: $n = 222$)

Multi-Group models	X^2	df	ΔX^2	Δdf	B-S p	CFI	PCFI	RMSEA
Model A	417.005	220	-	-	-	.966	.885	.045
Model B	420.658	223	3.653*	3	< .03	.966	.897	.044
Model C	444.369	239	27.363*	19	< .03	.964	.960	.044

Note. X^2 = chi-square; df = degrees of freedom; ΔX^2 = chi-square difference; Δdf = degrees of freedom difference; B-S p = Bolen-Stine p -value; CFI = comparative fit index; PCFI = parsimony comparative fit index; GFI = goodness of fit index; PGFI = parsimony goodness of fit index; RMSEA = root mean square error of approximation.

* p -value > .05.

Concurrent validity

Assessing concurrent validity involves comparing a new test with an existing test (of the same nature) to verify if they produce similar results. If both tests produce similar results, then the new test is said to have concurrent validity. In this case, we used the Portuguese version of the Doping-related TPB Measures²⁰ to compare with the "Questionnaire of Attitudes towards Doping in Fitness" (QAD-Fit).

In accordance with the previously mentioned, the Doping-related TPB Measures²⁰ was translated, adapted and validated in Portuguese for concurrent validity purposes.

Once approval was obtained from the original author, the translation of the Doping-related TPB Measures²⁰ was performed, according to Beaton, Bombardier, Guillemin, Ferraz, Bosi²¹ guidelines.

The procedures adopted were similar to those used in QAD-Fit (participants, data collection and data analysis).

The results obtained for the CFA of the Portuguese version of the Doping-related TPB Measures, indicated that not all items loaded significantly on its construct, according to the original model (4 factors)²⁰. Due to the lack of support from CFA performed, post hoc model adjustments were conducted in an effort to develop a better fitting model. After these procedures, we obtained a first-order model with only three factors (attitudes, subjective norms and behavior intentions) and 11 items, adjusted to the data (Table 4). The factor perceived behavior control was removed from the analysis considering that the items don't meet AFC criteria. Lucidi, Zelli, Mallia, Grano, Russo, Violani²⁰, in

their validation of the scale, founded also poor but satisfactory indicators of reliability for this factor.

Our results demonstrated an acceptable fit ($X^2 = 110.697$; $p = .000$; $X^2 / df = 2.77$; PCFI = .72; PGFI = .58; CFI = .99; RMSEA = .06, 90% CI [.049 – .077]). Composite reliability values ranged from .80 (Subjective Norms) to .96 (Intentions), indicating that the constructs were internally consistent. Evidence for convergent validity was obtained, since AVE values ranged from .66 (Subjective Norms) to .90 (Intentions), being greater than the recommended standard of .50²⁴.

Furthermore, all constructs were considered to exhibit discriminant validity, because all AVE values exceeded the appropriate square factor correlations. Overall, the measurement model was within the required criteria and showed good psychometric properties.

The data analysis proceeded in an attempt to fit a second-order-factor model. The second-order measured model showed, as expected, an overall acceptable fit to the data ($X^2 = 110.697$; $p = .000$; $X^2 / df = 2.77$; PCFI = .72; PGFI = .58; CFI = .99; RMSEA = .06, 90% CI [.049 – .077]).

In order to study the adequacy of model replication, cross-validation procedures were used²⁸, using a multi-group analysis with two equivalent samples in their characteristics (n calibration sample = 231; n validation sample = 222) and then a technique of parameter-invariance to verify the equivalence between the two groups²⁶. The fit of the unconstrained model [Model A: $X^2(80) = 168.525$; PCFI = .716; PGFI = .570; CFI = .984; GFI = .940; RMSEA = .050] was acceptable. The fit of this model provides the baseline value against which all subsequently specified

invariance models are compared⁴⁴. The models with constrained factor loadings [Model B ($X^2(88) = 174.468$; PCFI = .788; PGFI = .625; CFI = .984; GFI = .938; RMSEA = .047], and with constrained variances/covariances [Model C: $X^2(91) = 178.016$; PCFI = .814; PGFI = .646; CFI = .984; GFI = .937; RMSEA = .046], showed a satisfactory fit. The X^2 statistic showed no significant differences between Model A and Model B [X^2 dif (8) = 5.943; $p = .654$] and also no significant differences between Model A and Model C [X^2 dif (11) = 9.491; $p = .577$]. There were no differences in the CFI values for all model comparisons. Thus, the results demonstrated the model's invariance in both samples, indicating that the factorial structure of the scale was stable in the two independent samples.

Table 4. Portuguese version of DRTPBM Re-specified first Order Model-Factor Loading, Z-values, Composite Reliability (CR) and Average Variance Extracted (AVE).

DRTPBM factors/items	Loadings	Z-value	CR	AVE
BITENT				
Item 1	.870	23.434		
Item 2	.999	30.029	.963	.898
Item 3	.969	28.277		
ATTITU				
Item 1	.731	17.877		
Item 2	.806	20.587		
Item 3	.902	24.612	.943	.734
Item 4	.960	27.496		
Item 5	.873	23.315		
Item 6	.851	22.350		
SN				
Item 1	.846	19.054	.795	.660
Item 2	.777	17.325		

Note: BITENT = Behavior Intentions; ATTITU = Attitudes; SN = Subjective norms.

By studying the concurrent validity based on the interrelations between the scores of the two questionnaires, we obtained the results presented in Table 5, related to the correlations between QAD-Fit and the Portuguese version of the Doping-related TPB Measures. Results reveal that the two scales were positively correlated. The attitudes towards doping scores were also positively related to behavioral intentions, attitudes, and subjective norms and total Portuguese version of the Doping related TPB Measures scores.

Table 5. Correlation Matrix between QAD-Fit and Portuguese version of DRTPBM.

Scales	QAD-Fit- A	QAD-Fit-SN	QAD-Fit-I	QAD-Fit- B	QAD-Fit- TS
DRTPBM- A	.535**	.499**	.657**	.535**	.659**
DRTPBM- SN	.536**	.471**	.615**	.510**	.618**
DRTPBM- BI	.463**	.573**	.666**	.502**	.668**
DRTPBM- TS	.570**	.576**	.724**	.577**	.727**

Note: QAD-Fit- A = Attitudes; QAD-Fit-SN = Subjective Norms; QAD-Fit-I = Intentions; QAD-Fit- B = Beliefs; QAD-Fit- TS = Total score; DRTPBM- A = Attitudes; DRTPBM- SN = Subjective Norms; DRTPBM- BI = Behavior Intentions; DRTPBM- TS = Total score.

** *Bolen-Stine* $p < .01$.

Discussion

The purpose of this study was to test the factorial validity of the "Questionnaire of Attitudes towards Doping in Fitness" (QAD-Fit), originally developed by Serpa, Leitão, Marcolino, Faria, Ramadas, Reis¹⁶, in a Portuguese gym/fitness practitioner's population.

The confirmatory factorial analysis performed on QAD-Fit with a sample of 453 gym/fitness practitioners confirmed the factorial structure (four-factor) similar to the original version¹⁶. However, some items revealed unacceptable factor loadings on their different constructs and were eliminated. The differences between the two forms are minimal and shorten the questionnaire. In this way, the scale modifications resulted in a shortened questionnaire containing 16 items, representing the original four factors¹⁶. A short questionnaire is preferable in terms of gym/fitness settings, considering the practical conditions of application.

The factor analysis using the re-specified model showed an acceptable fit of the data and confirmed the four first-order constructs, as well as a second-order construct. The model showed composite reliability, convergent and discriminant validity.

Furthermore, the model invariance in the two independent samples was supported, indicating the comparisons are valid and differences/similarities between groups can be meaningfully interpreted³⁶ (cross-validity). According to Mâroco³⁷, this is a pivotal step when evaluating the psychometric properties of a scale, and this procedure has been reported when validating scales in recent studies conducted in the sports scenario (e.g. Correia, Rosado and Serpa⁴⁶; Martins, Rosado, Ferreira and Biscaia⁴⁷). Therefore, the use of model invariance in the two independent samples on the present study could be considered strong and an important finding to highlight about the QAD-Fit, representing a contribution to the measure of the attitudes towards PES consumption in this specific population (gym users), since the study by Serpa, Leitão, Marcolino, Faria, Ramadas, Reis¹⁶ did not consider this validation procedure.

QAD-Fit's concurrent validity has been ascertained with the Portuguese version of DRTPBM and, as expected, scores showed appropriate concurrent validity with measures of attitudes, subjective norms and behavioral intentions²⁰, providing additional support for its construct validity.

All dimensions of the QAD-Fit showed a statistically significant relationship with the second-order construct (behavioral predisposition towards doping), with the strongest predictor being Intentions. This factor concerns reasons leading to take or not take PES, followed by subjective norms, that is, the subject's perception of what significant people (instructors, colleagues, relatives) think about the consumption of PES and in third place comes beliefs, which relates to the subject's views regarding the effect of PES in order to achieve goals and to improve the performance and physical appearance, and the last factor is attitudes towards PES consumption, that is, the evaluative component of such behavior by the subject, reinforcing the idea that the understanding of attitudes towards doping will possibly be one of the first steps to consider in the study of the associated psychological factors¹⁷. The study and measures

of attitudes through QAD-Fit use, complemented with other tools (e.g., interviews⁴⁸, Implicit Association Test (IAT)⁴⁹ or biochemical tests^{4,50} could contribute to effective and ecologically valid intervention strategies for gym/fitness practitioners, towards doping prevention.

Limitations

Finally, although results provide support to QAD-Fit psychometric characteristics, there are limitations that need to be acknowledged. First, further replications with the resulting model must be done in the future and with other populations, since post hoc procedures were used, which refined the measurement instrument (though this approach does not compromise the integrity of the *prior* model⁵¹). Second, this study is a cross-sectional survey, and, as such, its findings do not inform about the concretization of the behavior of doping consumption in those who showed positive attitudes to doping. Future research will benefit from longitudinal designs for attaining predictive validity of the QAD-Fit version and mixed-method approaches might be particularly conducive to the study of a set of circumstances and contradictions which could possibly characterize one's experience with PES use in the context of gym/fitness settings⁷.

Conclusions

The findings of this present research revealed that QAD-Fit is a psychometrically valid and reliable instrument for researchers, fitness center instructors, physicians and psychologists, who want to assess attitudes towards doping consumption in gym/fitness settings, thus filling the identified gap in this area of knowledge⁴. At the same time, this scale could be considered a possible solid measurement tool for further studies on the doping attitude, which could allow direct comparisons and meta-analyses of independent studies, thus serving the scientific community involving doping research.

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Corresponding author

Ana Sofia Tavares
 Institution: H&TRC- Health & Technology Research Center, ESTeSL- Escola Superior de Tecnologia da Saúde de Lisboa, Instituto Politécnico de Lisboa.
 Av. D. João II, Lote 4.69.01 | 1990-096 Lisboa, Portugal
 Email: ana.tavares@estesl.ipl.pt

Manuscript received on November 20, 2018
Manuscript accepted on March 10, 2019



Motriz. The Journal of Physical Education. UNESP. Rio Claro, SP, Brazil
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