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## Portuguese Validation of the Grit-S scale for the sport context

### Validación Portuguesa de la escala Grit-S para el contexto del deporte

### Validação portuguesa da escala Grit-S para o contexto do desporto

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#### RESUMEN

El grit implica una actitud apasionada y persistente, ser capaz de mantener el enfoque y la determinación incluso frente a obstáculos y fracasos. La perseverancia en el esfuerzo contribuye al logro de la maestría y la consistencia en los intereses promueve el compromiso con la práctica deliberada en prol de la excelencia. El objetivo del presente estudio fue validar la Escala Portuguesa Grit-S en el contexto del deporte. La muestra estuvo compuesta por 446 atletas federados (328 hombres y 190 mujeres; edad  $M = 17,60$  años;  $SD = 6,27$ ). Después de eliminar un ítem de la Grit-S, el análisis factorial confirmatorio mostró que la escala de estructura de dos factores es aceptable en la muestra portuguesa. El modelo de medición comprobó su invariabilidad en función del género. Asimismo, encontramos una correlación negativa significativa entre la consistencia de los intereses y la perseverancia en el esfuerzo. En conclusión, la versión portuguesa de la escala reducida del Grit (Grit-S), adaptada para el contexto deportivo, presentó dos factores con propiedades psicométricas adecuadas para ser aplicados en este contexto. Por lo tanto, puede ser aplicable y útil en contextos deportivos de habla portuguesa por parte de entrenadores y psicólogos.

**Palabras clave:** validez, cuestionario, consistencia en el interés, perseverancia en el esfuerzo, contexto deportivo.

#### ABSTRACT

Grit involves a passion and persistent attitude and being able to sustain focus and determination even in the face of obstacles and failures. Perseverance in effort contributes to the achievement of mastery and consistency in interests promotes the commitment to deliberate practice in pursuit of excellence. The goal of the study was to validate the Portuguese Short Grit Scale specifically within the context of sports. The researchers gathered a sample of 446 federated athletes (328 males and 190 females;  $M$  age = 17,60 years;  $SD = 6,27$ ). After removing one item from the Grit-S, the confirmatory factor analysis indicated that the two-factor structure of the scale is appropriate in the Portuguese context. The measurement model was found to be invariant in function of gender. Additionally, we found a significant negative correlation between consistency of interests and persistence. This suggests that the adapted Portuguese Short Grit Scale is a reliable and valid tool that can be used by coaches and sport psychologists to assess grit among portuguese athletes.

**Keywords:** validity, questionnaire, consistency of interests, perseverance of effort, sport context.

## RESUMO

O grit envolve paixão e uma atitude persistente, bem como a capacidade de manter o foco e a determinação apesar dos obstáculos e das falhas. A perseverança no esforço contribui para a conquista da mestria e a consistência nos interesses promove o compromisso com a prática deliberada em prol da excelência. O objetivo deste estudo foi validar a versão reduzida da escala portuguesa de Grit (Grit-S) no contexto do desporto. A amostra foi constituída por 446 atletas federados (328 homens e 190 mulheres; idade  $M = 17,60$  anos;  $DP = 6,27$ . O modelo de medida revelou ser invariante em função do sexo. Encontramos uma correlação negativa significativa entre a consistência de interesses e a perseverança no esforço. Em suma, a versão portuguesa da escala de Grit (Grit-S) adaptada para o contexto desportivo, apresentou dois fatores com propriedades psicométricas adequadas- possibilitando a sua aplicação em contextos desportivos de língua portuguesa, por treinadores e psicólogos do desporto.

**Palavras chave:** validade, questionário, consistência nos interesses, perseverança no esforço; contexto desportivo.

## INTRODUCTION

The grit construct has been the subject of great interest in recent years due to its determinant character in terms of performance in achievement contexts, thus motivating a significant exploration at the level of empirical research.

Duckworth et al., (2007) showed the existence of this personal quality shared by successful individuals. Indeed, grit may explain the quality that sets these highly successful individuals apart from everyone else (Duckworth et al., 2007). Grit is what allows individuals to fight for their goals strictly and persistently, overcoming the adversities and failures inherent to the path while maintaining the perseverance and passion for long-term goals (Duckworth et al., 2007).

In this way, Peterson and Seligman (2004) defined grit as the voluntary continuation of goal-directed action, even in the face of obstacles or discouragement.

In simple terms, grit involves having a strong determination and willingness to continue the effort despite boredom or discouragement. Gritty individuals don't give up easily and maintain their focus and persistence in order to achieve their desired outcomes (Duckworth et al., 2007).

According to Cr  de et al., (2017), the two dimensions that constitute *grit*, are the core ingredients of success, assuming that perseverance of effort contributes to the achievement of mastery - despite failures and setbacks - and consistency in interests promotes the commitment to deliberate practice in pursuit of mastery.

The perseverance of effort is associated with a persistent work to achieve certain goals, surpassing obstacles and challenges in the absence of immediate feedback. The consistency of interests, on the other hand, covers the commitment with a certain domain, being a characteristic of individuals who persist in a certain path or career for long periods of time (Os  rio and Cruz, 2013).

According to Constantin et al., (2008) grit favors sustained involvement in a given activity, maintenance of effort towards the goal as well as renewal of commitment and intensification of effort in the face of obstacles and in the absence of reward.

In fact, despite the difficulties and unfavorable judgments, grit remains a continuous energy throughout time. For this reason, people with grit are more flexible, self-reflective and interpret problems in an abstract way, which is reflected in a superior ability to deal with stress and actively persist in the task (Bailly et al., 2012).

The concept of grit involves persistence, consistency and resilience - integrative concepts of perseverance that convey, in essence, empowering personality traits (Akbagi and Ummet, 2017).

In this sense, gritty individuals are able to sustain focus and are also more likely to respond positively to feedback from coaches and teammates. High levels of grit may help protect athletes from negative self-evaluations and when receiving ego-involving feedback, as their focus is on skill improvement and maintaining their passion for the sport (Moles et al., 2017).

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Indeed, numerous studies have provided support for the significance of grit in various domains. For instance, Hernández et al., (2020) and Hodge et al. (2018) found that grit is associated with positive outcomes and increased productivity. In the context of sports, From et al., (2020) conducted a study with elite athletes and discovered that they scored higher on measures of grit compared to a control group. Additionally, research conducted by Martin et al., (2015) demonstrated a positive relationship between grit and engagement in sports.

The research findings indicate that higher levels of grit are associated with a number of psychological factors in sports. Specifically, this concerns a reduction in burnout levels (DeCouto et al., 2019), perceived life stressors (Ford et al., 2017), maladaptive perfectionism (Fawver et al., 2020) and lower levels of sport-specific anxiety (Symonds et al., 2018). As reported by Crane et al., (2020), lower levels of grit have been found to be associated with higher scores on general anxiety disorder measures.

Several factors have been found to contribute to success in various domains: deliberate practice and a good mentor (Ericsson et al., 2007; Ericsson & Pool, 2016), mindset (Dweck et al., 1995), beliefs in one's own attributes (Duckworth et al., 2007) and passion (Vallerand, 2010; Jachimowicz et al., 2018; Sigmundsson et al., 2020). Kannangara et al., (2018), highlights positive and significant associations between grit and psychological well-being and a growth-oriented mindset

It is worth mentioning that there have been inconsistencies in the assessment of the grit construct and the lack of confirmatory factor analyses to establish discriminant validity (Credé et al., 2017).

The main goal of your study was to fill a gap in the existing literature by examining the use of the grit scale in the sports context. Specifically, we aimed to investigate the factorial structure and measurement invariance, as well as the psychometric properties of the Grit-S scale in the Portuguese language and sports context.

From this point of view, we aimed to validate the use of the Grit-S scale as a tool for coaches and sport psychologists. Our study's findings can help to enhance the understanding of grit- as consistency of interests and perseverance in effort- and its role in sports performance and success.

### *The Grit Scale and The Grit Scale- Short version*

Based on the theoretical conceptualization of grit, the researchers developed a brief and independent measurement scale, with a view to its evaluation: The Grit Scale (Duckworth et al., 2007). The original Grit Scale, which measures individual differences in grit through self-report questionnaires, consisted of 12 items. These items were divided into two subscales: one measuring consistency of interest, and the other measuring perseverance of effort. However, the model fit statistics for the data, specifically the comparative fit index (CFI) and the root mean square error of approximation (RMSEA), were not ideal, indicating that improvements and modifications to the scale were necessary.

In order to optimize the original Grit Scale, a short version of the scale (Grit-S) was updated resulting in an eight-item scale (Duckworth and Quinn, 2009). In this sense, a subscale called "consistency of interests" was evaluated using four items, and the internal consistency of these items was found to be adequate. The alpha values, which indicate internal consistency, ranged from 0.73 to 0.79. Another subscale called "perseverance of effort" was also evaluated, and its alpha values ranged from 0.60 to 0.78, indicating acceptable internal consistency as well.

Additionally, the scale as a whole demonstrated good fit, as evidenced by various fit indices. For example, the RMSEA (Root Mean Square Error of Approximation) was found to be 0.061, with a 90% confidence interval ranging from 0.050 to 0.073. A lower RMSEA value indicates better fit. The Comparative Fit Index (CFI) was reported to be 0.95, which is considered a good fit.

The authors of the study (Duckworth and Quinn, 2009) compared this scale to a longer version and found that the shorter version had superior psychometric properties. These properties included better internal consistency, test-retest stability, and convergent and discriminant validity. In other words, the shorter version of the scale was more reliable, showed consistency over time, and effectively measured what it intended to measure in relation to other constructs.

Factor analyses conducted on both forms of the measure (presumably the "consistency of interests" and "perseverance of effort" subscales) have provided

support for the intended two-factor structure (Duckworth and Eskreis-Winkler, 2015).

While the items related to passion and persistence are typically scored separately, the original intention of the authors of the scale was to measure a single compound trait. Specifically, the reference to Duckworth and Quinn (2009) indicates that they believed the passion and persistence items should be combined to assess this overarching trait. In this sense, the studies recommend that Grit-S as an economical measure of perseverance and passion for long-term goals.

It's worth noting that the concept of grit still has controversial aspects in its contours, especially in terms of its empirical approach, which therefore require more research. Some studies defend the importance of exploring the two factors that make up the grit, separately, instead of considering a higher order factor (Credé, Tynan, and Harms, 2017). According to a meta-analysis conducted by Credé et al., (2017), the use of a general grit score might have limitations when it comes to predicting performance

Several studies conducted in different countries have examined the validity of the Grit-S (Grit Scale) and have confirmed its use based on the single compound trait (Li, Zhao, et al., 2018; Arco-Tirado et al., 2018; Marentes-Castillo et al., 2019; Sulla et al., 2018; Ponikiewska, 2017; Schmidt et al., 2017).

The findings of the study conducted by Shaban (2020) focused on validating the Grit-S for Egyptian athletes supported the validity of the two-factor structure of the Grit scale. The study also indicated that both the long version of the scale with 12 items and the short version with 8 items were suitable for assessing grit in the sport context.

More recently, the scale was also validated in Portugal, with university students, highlighting the validity of the two-factor model to produce a single score (Frontini et al., 2022).

While grit has been studied previously in Portugal (e.g., Frontini et al., 2021) and adapted for the academic context (e.g., Frontini et al., 2022), the Grit-S has not been adapted and validated for the Portuguese population in the context of sport. Thus, we aimed to translate and validate the Grit-S for the Portuguese context (Duckworth and Quinn, 2009).

It seems that the Grit-S (Grit Scale-Short version) has not been adapted and validated specifically for the Portuguese population in the context of sports. While previous studies in Portugal have examined grit, such as the work conducted by Frontini et al., (2021) and by Frontini et al., (2022) adapting it for the academic context, there is a gap when it comes to the validation of the Grit-S for Portuguese athletes.

To address this gap, the aim of your study, was to translate and validate the Grit-S scale for the Portuguese sport context, using the original version of the scale created by Duckworth and Quinn (2009).

## MATERIAL AND METHODS

### *Research Design*

To classify the research design, the system proposed by Ato et al., (2013) for research in the area of Psychology was used. By following an instrumental research design, we will be able to systematically evaluate the psychometric properties of the measurement instrument adapted for the Portuguese sports context, providing valuable insights into its quality and effectiveness.

### *Participants*

In this study, we recruited a total of 446 federated athletes (328 males and 190 females; M age = 17.60 years; SD = 6.27) of collective modalities, namely, football (37%), basketball (32%), rugby (12%), futsal (11%), handball (4%) and hockey (4%). The athletes were from different levels of competition (district, regional, national and international).

The A-priori sample size calculator for Structural Equation Analysis (Soper, 2022) was utilized to determine the minimum number of participants required for your study. The following parameters were taken into account: predicted effect size of 0.25, desired statistical power of 0.95, probability level of 0.05, number of latent variables as 3, and number of observed variables as 8. According to the calculations, the minimum sample size recommended was approximately 361 participants. In the present study, this minimum requirement was adhered to, ensuring that the suggested sample size was met.

All participants accepted voluntarily to participate in the study under the guarantee of anonymity of their responses. All athletes (and their parents when

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appropriate) were instructed about the purpose and procedures of the study before giving their consent. The questionnaires were self-administered and completion took approximately 10 minutes. Data collection was conducted between April 2022 and June 2022.

Data collection for our study was conducted in accordance with ethical guidelines, as outlined by the Declaration of Helsinki ((WMA 2000, Bošnjak 2001, Tyebkhan 20039, the Norms of Ethics in Research in Sciences of Sports and Exercise (Harriss et al., 2019), and the approval from the Ethics Council for Research at the Faculty of Human Kinetics (CEIFMH) (reference number: 4/2021).

### *Instruments*

#### *Grit-S*

We used the translated Grit-S (Duckworth and Quinn, 2009) Portuguese version to measure “perseverance of effort” (item example: “I finish whatever I begin”) and “consistency of interests” (item example: “New ideas and projects sometimes distract me from previous ones”). The instrument integrates two 1st order factors: Consistency of Interest (items: 5,6,1,2) and Perseverance of Effort (items: 9,12,11,10) and a 2nd order factor called GRIT. Items are answered using a Likert-type scale with five response alternatives: a) Very similar to me, b) Quite similar to me c) A little similar to me, d) Not very.

### *Procedures*

The Grit-S scale was translated to Portuguese and then back-translated to English to minimize discrepancies between the original and the translated version (Banville, Desrosiers, and Genet-Volet, 2000). The Grit-S was first translated into Portuguese by two of the researchers in cooperation with an experienced Portuguese sport psychologist. Next, to test the equivalence of the items, back-translation into English was carried out by two natives of Portugal that are fluent in English. To verify the accuracy of the items, a bilingual expert was asked to assess differences in meaning between the original items and the back-translated items. The comparison of the two forms led to the conclusion that the two instruments were conceptually equivalent.

### *Statistical Analysis*

#### *Confirmatory Factor Analysis*

Confirmatory factor analysis was performed using the AMOS 27.0 software, using the maximum likelihood method, in accordance with the guidelines and recommendations of several authors (e.g., Byrne, 2016; Hair et al., 2019). The fit of the model was assessed using various adjustment indices, including the ones you mentioned: Standardized Root Mean Square Error of Approximation (SRMR), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA) with the respective confidence interval (90% CI).

In the current study, the researchers utilized cutoff values for specific indices based on recommendations from various authors. These cutoff values were drawn from the works of Byrne (2016), Hair et al., (2019), and Marsh et al., (2004):  $SRMR \leq .08$ , CFI and TLI  $\geq .90$  and  $RMSEA \leq .08$ .

To assess convergent validity, the average variance extracted (AVE) was calculated. AVE values equal to or greater than 0.50 indicate that a substantial amount of variance in the items is captured by their respective factors.

Additionally, the study examined discriminant validity, which assesses the distinctiveness of the factors from one another. This was done by comparing the squared correlation between the factors with the average variance extracted (AVE) value of each factor, as well as the composite reliability (CR) to assess the internal consistency of the factors, adopting  $CR \geq .70$  as a cutoff value, (Hair et al., 2019).

Internal reliability was analyzed through Cronbach's alpha, with values above 0.70 indicating good reliability (Kline, 2000) and composite reliability (which should also be above 0.70; Fornell and Larcker, 1981).

To ensure cross-validation and maintain consistency across different samples, the given dataset was split into two random samples: a calibration sample with 216 observations and a validation sample with 230 observations, as recommended by Byrne (2016).

#### *Multigroup Analysis*

Multigroup analysis is a statistical technique used to examine whether the structure of measurement models

remains consistent across different groups that possess distinct characteristics (Sass, 2011). According to Byrne (2016) and Cheung and Rensvold (2002), for there to be invariance it is necessary to verify two criteria:

a) the measurement model must be adjusted to each group;

b) to perform a multigroup analysis, the following types of invariance must be analyzed: configural invariance (i.e., unconstrained model); metric invariance (i.e., equality of factor weights); scalar invariance (i.e., strong invariance) and residual invariance (i.e., residual invariance of items/strictness in invariance).

According to Cheung and Rensvold (2002), the assumptions of invariance are verified through the differences between the  $\chi^2$  or CFI test, in the latter case being  $\Delta CFI \leq .01$ . The analysis was conducted using AMOS 27.0.

## RESULTS

### *Preliminary Analysis*

When conducting a preliminary analysis of our data, we found that there were no outliers or missing values, which is a good start. However, we noticed that the value of Mardia's coefficients of multivariate kurtosis exceeded the recommended value for a normal distribution ( $>5.0$ ). In this sense, the Bollen-Stine Bootstrap procedure was applied (2000 samples) for subsequent analyzes (Nevitt and Hancock, 2001).

### *Confirmatory Factor Analysis*

Regarding the adjustment of the measurement model data (Table 1), the initially proposed model (i.e., two factors/eight items) did not adjust to the data, since the cutoff values adopted in the methodology were not reached. Thus, analyzing the modification indices revealed strong associations between the measurement errors of items 2 and 7, which should be correlated. However, item 2 presented a factorial weight below .40 (recommended value in the literature) as suggested by several authors (e.g., Hair et al., 2019), which is why the item was removed.

The procedure resulted in a well-fitted model, as indicated by the data presented in Table 2. However, there was one exception concerning the absolute

RMSEA index. In the calibration, validation, and female samples, this index exceeded the threshold of .08.

Subsequently, and taking into account these circumstances, an alternative model should be considered, as long as its theoretical integrity, parsimony, and adjustment to the data are maintained (Kline, 2016).

In order to establish the validity and reliability of the final model, it is necessary to test it on a different sample from the same population. In this regard, the model obtained from the analysis conducted on the calibration sample, which includes one factor and seven items, was evaluated using an independent sample known as the validation sample, drawn from the same population.

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According to the results in Figure 1, there is a significant negative correlation between the consistency of interest dimension and persistence ( $r = -.59$ ).

In this sample, the items presented a factorial weight in the respective factor (all statistically significant  $p < .05$ ) ranging from .51 to .76 for the consistency of interest's dimension and between .66 to .88 for the persistence dimension. With regards to internal consistency, in both factors, the values of composite reliability (CR), showed excellent internal consistency: consistency of interests (.70) and persistence (.85).

In terms of convergent validity, there was a minor issue with the consistency of the factor of interest. The Average Variance Extracted (AVE) value, which is a measure of the amount of variance captured by the construct, was found to be less than .50 ( $AVE = .37$ ); as for the persistence factor, it revealed an adequate convergent validity ( $AVE = .65$ ). As far as discriminant validity is concerned, there were no problems, since the square of the correlation between the factors ( $r^2 = .35$ ) was lower than the AVE value of both factors

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**Table 1**

*Adjustment indices of the rewritten GRIT-S measurement model in the calibration, validation, male and female gender*

Measurement Model	$\chi^2$	df	$\chi^2/df$	B-S p	SRMR	TLI	CFI	RMSEA	RMSEA-90%
Global Model (- Item 2)	46.02	13	3.54	.001	.050	.948	.968	.076	.053 - .100
Model AC	44.84	13	3.45	.001	.067	.904	.941	.100	.074-.142
Model AV	37.97	13	2.92	.005	.058	.921	.951	.090	.058-.126
Model Male Sex	33.47	13	2.57	.008	.048	.957	.973	.069	.041-.099
Model Female Sex	31.90	13	2.45	.015	.075	.900	.932	.111	.063-.161

Legend: Model AC= calibration sample; Model AV= validation sample;  $\chi^2$  = qui-square; df= degrees of freedom;  $\chi^2/df$  = standardized qui-square; B-S p=bootstrap bollen-stine; SRMR = standardized root mean square residual; TLI = tucker lewis-index; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = Confidence Interval

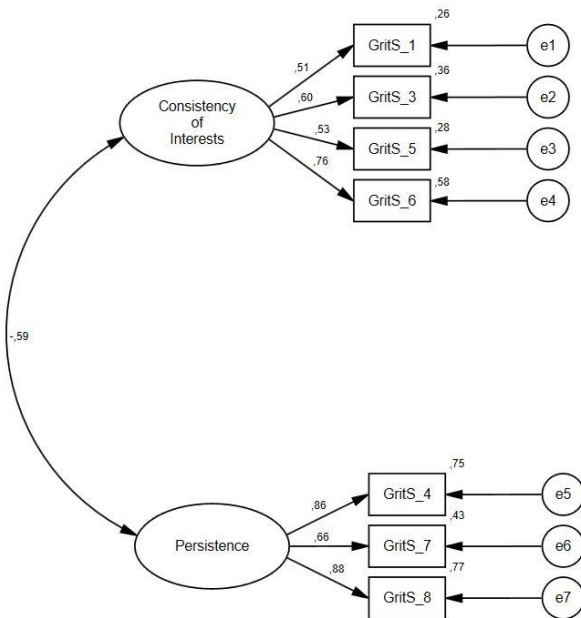
**Table 2**

*Invariance adjustment indices of the respecified GRIT-S measurement model between samples and gender*

Models	$\chi^2$	df	$\Delta \chi^2$	$\Delta df$	P	CFI	$\Delta CFI$
<b>AC – AV</b>							
CI	82.633	26	-	-	-	.946	-
MI	87.578	31	4.945	5	.423	.946	.000
SI	91.190	34	8.557	8	.381	.945	.001
RI	101.229	41	18.596	15	.233	.942	.005
<b>Masculine - Feminine</b>							
CI	65.448	26	-	-	-	.962	-
MI	78.315	31	12.868	6	.025	.954	.008
SI	79.870	34	14.423	9	.071	.956	.006
RI	103.671	41	38.224	115	.035	.940	.022

Table 2 provides evidence that the measurement model proved to be invariant depending on the sample and gender, according to the procedures adopted in the methodology ( $\Delta CFI \leq .01$ ), with the exception of the residual invariance criterion in the analysis between genders.

**Figure 1**  
*GRIT-S Standardized individual parameters*



Legend: AC= Calibration Sample; AV= Validation Sample;  $\chi^2$  = qui-square; df = degrees of freedom;  $\Delta\chi^2$  = differences in the qui-square value;  $\Delta df$  = difference in the degrees of freedom; CFI = comparative fit index;  $\Delta CFI$  = differences in the comparative fit index; CI= configural invariance; MI= metric invariance; SI= scale invariance; RI= residual invariance

## DISCUSSION

Our objective was to examine the factorial composition and consistency across different groups, as well as the reliability and validity of the Grit-S questionnaire within the Portuguese context, specifically within the realm of sports.

While previous research has validated the Grit-S scale in various settings and countries, such as the academic context in Portugal (Frontini, 2022) and the sports context with Egyptian athletes (Shaban, 2020), it is important to note that a psychometric validation and adaptation for the Portuguese population, specifically within the sports domain, had not been conducted prior to this study.

We translated the scale to Portuguese and proceeded with a factor analysis, being that the model proposed initially (i.e., two factors/eight items) did not fit the data. Thus, the model was adjusted according to the removal of item 2 since it was presenting a factorial

weight below .40 (e.g., Hair et al., 2019). The item 2 concerns the affirmation “the setbacks don’t discourage me”. In our view this item is about courage, not about perseverance. Athletes can have lot of perseverance in sport but are doing activities of own choice, activities that they love and, in tis contexts, courage is not central to explain each of the main constructs of grit. Of course, research must address the relations between grit and courage just because they are autonomous concepts.

Following the aforementioned procedure, the model demonstrated a satisfactory overall fit to the data, except for one specific measure, namely the absolute Root Mean Square Error of Approximation (RMSEA) index, since it was greater than .08 in the calibration, validation and female samples. This result can be justified by the fact that in small samples the RMSEA tends to be greater than .08. Furthermore, we can consider the literature that ponders this issue, namely,



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Hair et al., (2019) who defends that the question of what is a “good” RMSEA value is debatable.

Although previous research had sometimes pointed to a cutoff value of .05 or .08, more recent research points to the fact that drawing an absolute cutoff for RMSEA is inadvisable (Chin et al., 2003). An empirical examination of several measures found that the RMSEA was best suited to use in a confirmatory or competing models’ strategy as samples become larger (Hahn et al., 2002).

Following the analysis conducted on the calibration sample, the final model consisting of two factors and seven items was subsequently tested on a separate and independent validation sample from the same population.

Through the methodology employed in the study, it was found that the measurement model exhibited invariance across different samples and gender groups, as indicated by the criteria set forth ( $\Delta CFI \leq .01$ ). This finding aligns with prior research conducted by Duckworth and Quinn (2009), and serves as a valuable replication, demonstrating that the instrument can be utilized without the need for adjustments, making it suitable for both genders.

However, despite the fact that the residual invariance criterion was not verified in the analysis between genders, it should be noted that this is not indicative of a lack of invariance in the model, according to some authors who defend that it is not frequent to analyze this criterion - arguing that it is too restrictive (Byrne, 2016).

As previously indicated, this study confirms the presence of a two-factor structure within the Grit-S scale, namely "consistency of interests" (items 1, 3, 5, 6) and "perseverance of effort" (items 4, 7, 8). These factors have been shown to be applicable and valid within the sports context, aligning well with the reference values proposed by Hair and colleagues (2019). The correlated two-factor model observed in this study is consistent with findings from prior validation studies conducted in different countries, including Marentes-Castillo et al., (2019) and Frontini et al., (2022).

The hypothesized higher global factor was not included, as a good fit of the model entails only two first order factors. We detected, also, a significant negative correlation between the dimension consistency of interests and persistence ( $r = -.59$ ).

Interestingly, the hierarchical model of grit, which posits perseverance and consistency as first-order latent factors, was not supported in our sample of athletes. Additionally, the findings of Datu et al. (2016) also indicated that the scores obtained from this measurement model did not demonstrate a satisfactory fit.

The utilization of item response theory (IRT) approaches in studying grit has yielded conflicting evidence regarding its dimensionality. On one hand, a study conducted by Areepattamannil and Khine (2018) supported its one-dimensionality. On the other hand, several other studies (Tyumeneva et al., 2019; Gonzalez et al., 2020; Constantin et al., 2011; Jordan et al., 2015; Meriac et al., 2015; Wolters and Hussain, 2015) provided evidence for its multidimensionality. Furthermore, Tedesqui and Young (2017) discovered a statistically significant but weak correlation between perseverance and consistency.

Furthermore, another study who adapts the short grit scale to the Portuguese academic context, identifies negative scores in the sub-scales of both factors (item 2; item 3 - consistency of interests; item 5; item 6 - perseverance of effort) demonstrating few links between the two factors (Frontini et al., 2022).

We found a negative correlation between them, and it is important to discuss why these relations are negative.

In fact, with young athletes, considering their psychosocial development, athletic identity must be coordinated with other identities, adaptability is key and profiles with high perseverance and low consistency may occur. Regarding our results, the athletes showed high levels of consistency of interests ( $M = 3.40$ ) comparing to the levels of perseverance of effort that are moderate ( $M = 2.16$ ). This suggests that while the dispositional consistency of one’s interests may help athletes remain committed to their sport of choice, the tendency to work hard towards long-term goals in sports could compete with others essential activities for their psychological and social growth (e.g. school, university, career, family, social life, etc.), diminishing their perception regarding the possibilities to persist for a large period of time in said activity.

In this case, it could be a possible explanation for the negative correlation of consistency and persistence triggered by our study.

Considering that our sample of athletes presented a  $M$  age = 17,60 years,  $SD = 6,27$ , the path in this developmental period requires athletes to move over many years from sampling several different sports, to specializing in one or two of these sports. Investing later in one of these sports suggests that the levels of athletes' persistence and athletes' consistency could present a large variability in the way they manifest.

In terms of statistical significance, the literature inferred that both the expert and advanced athletic groups had higher levels of persistence than their basic/intermediate counterparts (Tedesqui and Young, 2017). This factor may suggest that our sample, represented by federated athletes with a low competitive level, had less ability to persevere through challenges on long-term goals, although having a superior tendency to be consistent in the interests aligned with the sport activity.

It is imperative to have in mind the specific characteristics of the context of sport and the differences with other contexts when it comes to perceive the functionality of consistency of interest and perseverance of effort. There are clear inconsistencies in how grit is measured in sport contexts. In line with that, five main issues were raised in a review developed by Cormier et al., (2021): inconsistencies in the Grit Scales used; contradictions in whether grit is best measured as a higher-order construct or by its subscales; uncertainty in whether grit should be conceptualized and measured as a domain-general or sport-specific construct; the overuse of cross-sectional, self-reported, and quantitative methods when exploring how grit operates in athletes; and mixed psychometric evidence.

The sport context is considered a very complex domain presenting certain psychosocial characteristics and specificities that particularly influence the consistency and persistence of athletes. Thus, we must consider the differential roles attributed between consistency and perseverance in sports, having in mind that consistency represents the direction, while persistence represents the duration of an individual's efforts toward a goal. While the duration would be related to how long an individual pursues a goal (e.g., short vs. a long period of time), the direction would be related to whether someone chooses to devote their time to one domain as opposed to exploring multiple domains.

The literature proposes that consistency in one's interests is a "necessary but insufficient" variable that leads to discrepancies in accrued amounts of practice in attaining competitive levels, especially considering that attractive alternative activities to one's main sport (Young and Medic, 2008), interest in other activities, and conflict of interest have been cited among the major reasons for youth sport attrition (Rottensteiner et al., 2013).

According to Ericsson et al., (1993) the individuals differ in their capacity to engage in hard work because engagement in deliberate technical and tactical training, entails a high degree of cognitive and physical effort, requiring individuals to delay the need for immediate gratification (Côté et al., 2003). Presumably, athletes who have higher persistence are better equipped to power through the challenging conditions of the sport practice.

Duckworth (2016) argues that grit, unlike some personality traits, is malleable across the individual life cycle, being situationally determined, in the sense that it interacts with situational characteristics in determining success and performance.

According to our considerations, we can gather that the expression of consistency and perseverance in the sport domain can converge in the same direction, associating positively, acting neutrally, showing independence from each other, as well as acting in the opposite direction, as demonstrated in our study.

In our point of view, the consistency of interests, according to their degree of intensity, could affect the levels of perseverance in athletes. It is possible that the same could also happen in the opposite direction regarding perseverance, which in this case may show an exaggerated expression and, thus, decrease the levels of consistency, given the interest shown in the sport of choice.

Although we view perseverance as a human strength, clearly there are circumstances in which is maladaptive. Datu (2021) suggests that in circumstances where failure is unavoidable, exhibiting passion and persistence may not necessarily lead to tangible signs of success. Instead, persisting in the face of inevitable failure might even result in irreparable harm or losses. Consequently, blindly persevering (Baumeister et al., 2003) is not an optimal strategy when confronted with tasks that cannot realistically be accomplished. This kind of persistence (opposed to

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adaptability) can have a negative correlation with consistency.

In this sense, it's important to explore the paradoxical nature of costly persistence in the sport domain. Some undertakings are indeed impossible and doomed, and persistence merely increases the total costs in effort, time, and other resources that are expended fruitlessly. When outcomes are uncontrollable or goals are impossible to reach, it is adaptive to give up. Thus, the key to success is not persistence as such but the ability to know when to persist and when to quit, and then to persist when it is advisable.

To address the inconsistencies found in previous studies, it would be beneficial for researchers to conduct additional investigations specifically focused on the sport context, exploring the antecedents and consequences of grit. Moreover, conducting further analyses to address the measurement issues raised in the aforementioned studies could help in resolving these inconsistencies and reaching a consensus. It is crucial for the existing grit framework (Duckworth et al., 2007) to be continuously revised by incorporating research that considers the overall framework within the contexts of sport and youth.

### Strengths, limitations and future research

This was the first study examining the structure of a new measure of athletes' perception of grit in a sample of Portuguese athletes. A great asset was the heterogeneity of the sample regarding the athletes ages, the distinct modalities and the level of competition, that ensures a larger representation of this specific population linked with a better approach of the particularities presents on the sport context in a global form.

To ensure the plausibility of this structure, future research should be conducted to test Grit-S in other samples (e.g., athletes who practice individual sports, samples of adolescents and athletes who practice other type of sports that were not included in this sample). It's worth noting that the specificity of the sample, composed of several sports with heterogeneous characteristics, inhibited the possibility of studying the invariance of the model depending on the modalities. Also, it would be important to test this scale in samples with a more homogeneous distribution of the gender and age of the athletes, in order to analyze differences among these variables.

Given the inconsistency in the use/scoring of the scale and subscales, and the wide variety of samples used in examinations of grit in sport (e.g. youth versus elite athletes), it is suggested that future efforts be made towards thoroughly evaluating the psychometric properties of the Grit-S: domain-general, domain-specific, the subscales, across various populations (e.g. athlete levels and sport types), time (e.g. one month to one year test-retest reliability estimates), and raters (e.g. inter-rater reliability of coaches, consistency between coach and athlete).

The cross-sectional nature of the study does not inform us whether athletes' grit dimensions oscillate over time in accordance with different events that take place in sporting season or throughout a sport career. Thinking of a future research direction, it would be interesting to study the invariance of the sample in variables that was not included in this study.

On the other hand, the need to adapt the factorial structure of the scale, which involved the removal of one of the items belonging to the perseverance of effort factor, did not allow keeping the items in accordance with the original scale.

The role of these two dimensions of grit in sport is crucial. In fact, this study provided a distinctive utility to researchers and practitioners (e.g., psychologists, sport coaches) since from a practical point of view, it can be employed as an assessment tool of consistency of interests and perseverance of effort, providing an important help to identify features of the athletes that could affect their involvement in sport.

This measure can be a potential contribution to alert coaches about the impact of these variables in the behavior of the athletes helping them to promote passion and consistency to an adequate level. Moreover, research in this field may have a positive impact, leading to concrete actions to promote the athletes' grit dimensions particularly when dealing with critical situations as injuries or situations in which the athlete feels fear of failure or not being well succeeded. This seems to be crucial for the mental health of athletes.

Future directions include the amelioration of the Grit-S for athletes, as well as the implementation of novel interventions by coaches and psychologists that may improve athlete grit.

## CONCLUSION

In this study, our goal was to translate and validate the Grit-S scale for the Portuguese population to be applied with athletes from different collective modalities. With this particular population, we have established the presence of a two-factor structure, namely "consistency of interests" and "perseverance of effort." Additionally, we have provided suitable adjustment values for the factorial structure of the scale. Furthermore, our findings indicate that the scale demonstrates gender invariance, meaning it can be applied equally effectively to both males and females.

**Institutional Review Board Statement:** This study adhered to the ethical guidelines outlined in the Declaration of Helsinki. Prior to data collection, ethical approval was obtained from the Ethical Committee of the Faculty of Human Kinetics, with the reference number N.º 4/2021.

**Data Availability:** Materials described in the manuscript, including all relevant raw data, will be freely available to any researcher wishing to use them for non-commercial purposes, without breaching participant confidentiality

**Conflicts of Interest:** The authors declare no conflict of interest.

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