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Short Sport Grit Scale: Psychometric Properties of a Turkish Version of the Short Grit Scale for Athletes

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Abstract

Given that athletes frequently encounter setbacks, injuries, and psychological pressures, the ability to sustain effort and interest over the long term is considered critical for success. However, despite the growing importance of grit in sports, research in Turkey has been limited by the absence of culturally adapted instruments. Developing a valid and reliable Turkish measure is therefore essential for advancing sport psychology research and providing practitioners with tools to better understand athlete resilience. This study aimed to adapt the Short Grit Scale into Turkish for use with athletes and to examine its psychometric properties. The concept of grit, defined as perseverance and passion for long-term goals, has become increasingly relevant in sports psychology, yet there has been a lack of valid and reliable instruments tailored for Turkish athletes. A total of 222 athletes (122 males, 100 females) representing diverse sports disciplines voluntarily participated in the study. The scale adaptation process included linguistic equivalence, item revision based on expert opinions, and evaluation through exploratory and confirmatory factor analyses. The two-factor structure (Consistency of Interest and Perseverance of Effort) showed acceptable model fit indices (CFA: $\chi^2/df = 1.69$, CFI = 0.967, RMSEA = 0.056). Reliability analysis indicated satisfactory internal consistency (Cronbach's α: .71 and .76). Measurement invariance across gender was confirmed at configural, metric, and scalar levels. Test-retest reliability over a 20-day interval was $r = .89$ ($p < .001$), supporting the scale's temporal stability. The Turkish version of the Short Sport Grit Scale is a valid and reliable tool for assessing grit among athletes.
Keywords: Sport, Grit, Athletes, Measurement, Invariance

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INTRODUCTION

In sports, elite performance is characterized by extraordinary ability and skills. Athletes spend a lot of time exercising and practicing improving their skills and push their limits of performance. Many scholars have researched the qualifications and skills which distinguish elite and non-elite athletes. Some of these qualifications are physical properties such as strength, stamina, maximum oxygen capacity (Lorenz et al., 2013), technical ability (Boccia et al., 2019; Bracko, 2001; Figueiredo et al., 2009), physical fitness (Deprez et al., 2015; Franchini et al., 2005), personality characteristics (Fulkerson et al., 1999; Stoll et al., 2008), stress management strategies (Bentley et al., 2008) and mental ability (Sotoodeh et al., 2012). Moreover, scholars researched training history profiles of athletes to better understand which activities can contribute to the improvement of elite level performance (Ford and Williams, 2012; Ford et al., 2009; Ward et al., 2007; Williams et al., 2012).

In this research, although there is an elite level performance profile, it can be said that there is limited research about the impact of an important personality characteristics like perseverance on sports. In this research, although there is an elite level performance profile, it can be said that there are limited studies exploring the impact of important personality characteristic such as perseverance on athletic performance. A compilation made by Cox (2002) highlighted the lack of persistence-related constructs in earlier sport psychology models, supporting the rationale for integrating grit into athlete assessment frameworks. In another study conducted in recent years, Zakrajsek et al. (2019) emphasized different psychological features instead of persistence in sports. This limitation is thought to stem from the absence of valid and reliable tools for measuring perseverance in sports.

Grit, characterized by perseverance and passion for long-term goals, plays a pivotal role in sports psychology and the broader athletic domain, especially for professional athletes navigating the multifaceted challenges of their careers (Lund et al., 2019). Fundamentally, the Short Grit Scale measures the construct of grit, which includes an individual's sustained interest and perseverance in pursuing long-term goals despite challenges or setbacks. Grit encompasses two primary components: perseverance of effort, referring to the ability to maintain dedication despite setbacks, and consistency of interests, reflecting the capacity to sustain enthusiasm over time (Liu, 2022; Zhao et al., 2024). These elements intertwine to enable athletes to pursue their aspirations with unwavering resolve, even when confronted with adversity (Meng et al., 2025). Grit is closely linked to meaning, wherein individuals attribute personal significance to their objectives, fueling their determination to overcome obstacles encountered during goal attainment (Christopoulou et al., 2018). The development of grit is intricately associated with a growth mindset, where individuals perceive challenges as opportunities for enhancement, rather than fixed limitations, further solidifying their commitment to persistent effort (Schimschal et al., 2020).

The importance of grit in sports extends beyond mere talent or innate ability, serving as a critical determinant of success in demanding athletic pursuits. Athletes with high levels of grit demonstrate a remarkable capacity to maintain focus, motivation, and resilience in the face of intense competition, rigorous training regimens, and inevitable setbacks (Terry et al., 2024).

Grit enables athletes to push beyond their perceived limits, persevere through physical and mental fatigue, and sustain their commitment to improvement, even when progress seems slow or elusive. Recent empirical evidence further validates these conceptual insights. For instance, Fruchart and Rulence-Pâques (2025) proposed a refined four-factor sport-specific grit model, emphasizing the necessity of domain-specific tools in elite athlete assessment. Likewise, Gao et al. (2024) demonstrated that grit measures maintain factorial invariance across gender and cultural subgroups, enhancing their applicability across diverse athlete populations. Additionally, Mendizabal (2024) confirmed a strong predictive relationship between grit, mental toughness, and sports resilience, highlighting grit's substantial contribution to psychological readiness and adaptive functioning in competitive sports. It fosters a proactive approach to problem-solving, thereby enabling athletes to identify and address weaknesses, adapt to changing circumstances, and learn from both victories and defeats. Therefore, the aim of the current research is to examine the psychometric properties of a revised form of the short grit scale in the sample of athletes from the specific sports.

Personality psychology studies differences between individuals and how these differences affect their lives (Roberts et al., 2011). A personality trait that has recently attracted attention is the concept of perseverance. In the current literature, perseverance means that human beings must work continuously to accomplish their goals and achieve success thanks to the will given to them. Success, possible through an individual's strong will and standing behind the decisions s/he makes, is achieved through perseverance. Perseverance means extreme willingness and determination to overcome any obstacles against long-term goals (Duckworth et al., 2007). Due to strong desire and determination, continuing with patience will bring the individual to her/his goal (Sarıçam et al., 2016).

According to this definition, perseverance involves stubbornly working against difficulties while maintaining effort and interest in the activity over the years despite disappointment, setbacks and obstacles (Duckworth et al., 2007). Although some individuals may change their goals or course after frustration or boredom, determined individuals have the courage to constantly strive towards their goals, even without immediate feedback or result.

Theoretically, grit emerges as a concept believed to predict perseverance of effort and consistency of interest beyond talent. Through numerous studies conducted by Duckworth and Quinn (2009) across different populations, grit was found to be associated with individuals' selection status after being included in certain selection programs (military exams, postgraduate exams, etc.). Determined adults were more likely to continue postgraduate education (Master's and Doctorate), and less likely to drop out of military training programs. They were also more likely to remain in their jobs and maintain their marriages (Eskreis-Winkler et al., 2014). Moreover, highly determined individuals spent more time on deliberate practice than the less determined ones (Duckworth et al., 2011; Duckworth, 2016). Therefore, it can be implied that many issues within the current research can be explained by the level of perseverance.

According to Duckworth (as cited in Perkins and Gough, 2013, p. 16), perseverance reflects the tendency of people to pursue 'consistency of interest' or 'persistence of effort' in specific

tasks/goals over extended periods, regardless of encountered failures or difficulties. According to many researchers, perseverance is considered either a specific or a general structure. Perseverance refers to the tendency of individuals to behave, think, and feel in ways that remain relatively stable over time and across situations. In this context, the concept of perseverance is thought to be related to the nature of the sport and the characteristics of the athlete. However, the lack of a valid and reliable measurement tool specific to sports restricts research on perseverance. To this point, the aim of this research is to adapt the short grit scale into sports environments and to examine the psychometric properties of the scale.

METHOD

Research Model

This study employed a methodological research model aimed at the adaptation and validation of a psychological measurement tool. Specifically, the Short Grit Scale was adapted for the athletic population to create a context-specific version, referred to as the Short Sport Grit Scale. The research process focused on examining the psychometric properties of the adapted scale through a series of statistical analyses, including Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and measurement invariance testing across gender. Additionally, reliability analyses, composite reliability, convergent validity, and discriminant validity were assessed to ensure the scale's applicability and robustness within the target sample. The overall approach aligns with the principles of methodological research, which emphasizes the development and refinement of measurement instruments for use in specific populations or contexts.

Research groups

A total of 222 Turkish athletes (122 males; MAge=21,43±2,01, 100 females; MAge = 21,10±1,98) voluntarily participated in the study. Participants were actively competing at amateur or semi-professional levels in various sports disciplines, including karate, taekwondo, volleyball, football, and basketball (see Table 1.). Besides, inclusion criteria were: (1) being an adult, (2) voluntarily participation, and (3) currently being active in organized training and competitions. The sample sizes for scale development/adaptation studies have been categorized as: excellent- up to 1000; very good- up to 500; good- 200–500 (Karagöz, 2018).

Table 1. Descriptive characteristics (n = 222)

	Mean	**sd**
Age	21.28	2.01
Experience	9.14	3.60
Gender	**N**	**%**
Female	100	45
Male	122	55

Data Collection Tools

Descriptive Information Form

The information about the research group was obtained through the personal information form developed by the researchers. There are questions such as gender, age, and sports experience in the personal information form.

Short Grit Scale

Short Grit Scale was developed by Duckworth and Quinn (2009) and adapted to the Turkish population by Sarıçam et al. (2016). The scale comprises two sub-dimensions: "Consistency of Interest" (Items 1, 3, 5, 6) and "Perseverance of Effort" (Items 2, 4, 7, 8), which reflect the two essential components of grit theory proposed by Duckworth and Quinn (2009). The correlation coefficient between the Turkish and English forms in the Linguistic equivalence study of the Turkish version of the Short Grit Scale was found as .89 ($p<.00$). As a result of exploratory factor analysis, Kaiser Mayer Olkin (KMO) sample fit value was found to be .83 and Barlett Sphericity test result was detected as $\chi2= 503,877$ ($p<.001$, sd=24). As a result of confirmatory factor analysis, fit index values of the 8-item 2-dimensional model were ($\chi2/sd=2.06$, RMSEA=.046, CFI=.95, GFI=.94, AGFI=.93, SRMR=.047); the factor loadings ranged between .42, and .77. Cronbach alpha internal consistency reliability coefficients were calculated as; .83 for the whole scale, .80 for the consistency of interest sub-dimension, .71 for persistence of effort sub-dimension. In a similar scale validation study have a correlation with $r=.68$ $p<.01$ level of significance between the Motivational Consistency Scale and Short Grid Scale. Test-retest reliability co-efficient was calculated as .69; corrected item total correlation co-efficient ranged between .42, and .77.

Ethics Approval

The study was approved by the Ethics Committee of Akdeniz University (Approval No. 62646, dated 31.03.2021), while permission for analysis of validity and reliability was obtained from the original owner of the scale via e-mail (Duckworth and Quinn, 2009). Before the study, the athletes were informed about the purpose and content of the study via an informed consent form. After obtaining written permission from all athletes, eligible athletes filled in the Information Form and the Short Sport Grit Scale.

Collection of Data

In this study, which aimed to create a new version of the Short Grit Scale that can be applied to the athlete's population, no additional procedure was applied for the rating of the scale (1 = not at all like me, 7 = exactly like me). The scale is structured as a 7-point Likert type response format, allowing participants to rate each item based on their level of agreement. Since our research population is Turkish athletes, the Turkish form of the Short Grit Scale, previously adapted to Turkish by Sarıçam et al. (2016), was used. It was later observed that a similar procedure was performed on the 12-item perseverance scale by Cormier et al. (2019), who were included in our research process during literature research. However, there was no detailed psychometric examination of the sports version of the scale. A sport-specific adaptation process was discussed by Cormier et al. (2019), but their version lacked comprehensive psychometric validation within athletic populations. In our adaptation, we

intentionally avoided adding the phrase "in sport" repeatedly, as the athletes were already embedded within a sports environment rendering the expression redundant. Instead, the phrase "…as an athlete" was systematically appended to each item of the original scale to reinforce contextual relevance without compromising linguistic clarity. Furthermore, following Cormier et al.'s (2019) suggestion, the word "project" was replaced with "target" to better reflect goal-oriented language in sport. In the sport version of the scale (namely, Short Sport Grit), the phrase "...as an athlete" is added to each item of the original version of the scale for participants. Also, as suggested by Cormier et al. (2019), the word "project" was replaced by the word "target". Psychometric properties of the final Short Sport Grit Scale and measurement invariance between genders were applied to the athletes. Among the 8 items, Items 1, 3, 5, and 6 are reverse-coded, as they are phrased negatively. These items were recorded during analysis to ensure accurate scoring. Higher scores on the scale indicate greater grit. Subscale scores can also be computed separately for each factor.

Analysis of Data

After the revisions made in the scale items, EFA and CFA were applied to examine the construct validity of the scale. Multiple group analysis was conducted to determine whether the measurement model was invariant among groups with different characteristics (Byrne, 2010; Chen, 2007; Cheung and Rensvold, 2002; Sass, 2011). First, we examined whether the measurement model fits the data for each group well. Second, structuring, metric, scalar and residual invariance analyses were performed. In addition, additional analyses were performed to reveal the values of composite reliability, convergent and discriminant validity in the validity and reliability study of the perseverance scale. SPSS package program and AMOS package program were used in the data analysis process.

FINDINGS

Table 2. Explanatory Factor Analysis (EFA)

Item	S	Factor Loading	Explained Variance (%)	Cronbach Alpha
Item 1	3.27 (1.02)	.601	33.340	.71
Item 3	3.28 (1.02)	.725		
Item 5	3.56 (1.19)	.784		
Item 6	3.32 (1.19)	.784		
Item 2	4.18 (0.96)	.645	23.623	.76
Item 4	3.79 (0.97)	.773		
Item 7	4.33 (0.88)	.797		
Item 8	4.24 (0.87)	.820		

Kaiser-Meyer-Olkin: .74; **p<.001***

The adequacy of the Kaiser-Meyer-Olkin (KMO) sample number (.74) and the Barlett sphericity test (X2 (28)= 415,356, p<0.001) values obtained indicate that these data and sufficient factorizability. Accordingly, item factor loadings ranged between medium (.60) and very good (.82).

Confirmatory Factor Analysis (CFA)

Table 3. Model fit indices for confirmatory factor analysis

Model	X^2	df	X^2/df	CFI	RMSEA	SRMR
	32.2	19	1.69	.967	.056	.055

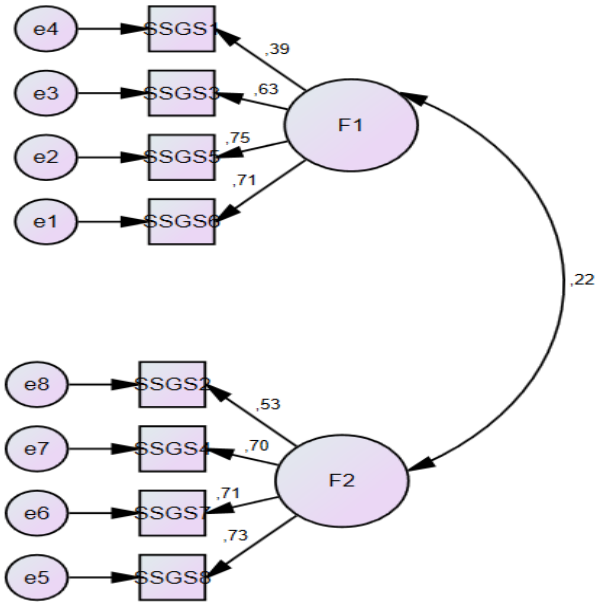

Fig. 1. Confirmatory factor analysis of Turkish version of The Short Grit Scale for athletes

As seen in figure 1, the standardized factor loadings for the consistency of interest sub-dimension ranged from .39 to.75, while those for the perseverance of effort sub-dimension ranged from .53 to .73, all of which were statistically acceptable. Error variances were within reasonable limits, indicating adequate item reliability. The correlation between the two latent factors was .22, suggesting discriminant validity. Model fit indices (X2/df: 1.694, CFI: 0.967, RMSA: 0.056, SRMR: 0.055) demonstrated that the two-factor structure provided a good fit to the data.

Reliability Analysis

When Table 4 is examined, it is seen that the Cronbach's Alpha coefficients of both factors are over .70. As stated by Tabachnick and Fidell (2013), a Cronbach's Alpha value of .70 and above is considered within acceptable limits for reliability.

Table 4. Descriptive Statistics, composite reliability, convergent and discriminant validity, and correlation matrix

	X	S	CR	AVE	F1	F2
F1	3.36	.81	.91	.58	1	**.174****
F2	4.14	.70	.88	.53	**.174****	1

X = Mean; S = Standard Deviations; CR = Composite Reliability; AVE = Average Variance Extracted; r = correlation
** **p < 0.01**

AVE value was examined within the context of convergent validity. It is seen that AVE values for both factors are .58 and .53 respectively. In this context, it can be said that both sub-dimensions have convergent validity (.58 and .53). In addition, when Table 4 is examined, it is seen that the AVE values of the factors are greater than the correlation values between the factors. Regarding composite reliability, all subscales showed scores abound the recommended (CR> .70) for both scales, suggesting that the items measure the same structure.

Measurement Invariance

Table 5. Measurement invariance analysis between gender

Model	X2	df	CFI	RMSEA	SRMR	Model Comparison	ΔX^2	ΔCFI	ΔRMSEA	ΔSRMR	Decision
Original	43.26	21	.950	.046	.047	-	-	-	-	-	-
Sport	32.118	19	.967	.560	.550	-	-	-	-	-	-
Configural Invariance	59.058	34	.948	.050	.079	-	-	-	-	-	-
Metric Invariance	61.858	28	.956	.043	.077	**Configural vs metric**	2.80	0.008	0.007	.002	Equivalence
Structural/ Scaler Invariance	62.204	25	.962	.038	.078	**Metric vs scalar**	0.35	0.006	0.005	.001	Equivalence
Stric/ Residual Invariance	74.292	17	.952	.40	.079	**Scalar vs Residual**	12.09	0.01	0.002	.001	Equivalence

Multi-group analysis revealed that the Short Sport Grit Scale did not vary between gender, as the assumptions of invariance adopted in the methodology were respected. Specifically, the results are: i) the perseverance model in sport fits the data (see Table 5) and ii) Both models display metric, scalar, and residual invariance which are structured across genders. In addition, ΔCFI, ΔRMSEA and ΔSRMR showed invariance according to measurement invariance recommendations, as seen in Table 5. The data showed no difference between genders, which means that all interpersonal behaviour is perceived equally in both male and female athletes.

Test-retest technique was used to determine whether the scale has consistent measurements over time. For this purpose, 50 athletes who had not participated in this study before were determined as samples and scale was applied with 20 days intervals. The correlation coefficient ($r=0.89$, $p<0.001$) between the two applications indicates that the scale is invariant with time.

DISCUSSION and CONCLUSION

The aim of this study is to adapt the short grit scale to sports environments and to examine its psychometric properties. Factor loadings obtained within the scope of the research aim were interpreted using Tabachnick and Fidell's (2013) criteria. This finding aligns with the evaluation of factor loadings, where values of .71 and abound are excellent, .63-.70 very good, .55-.62 good, .33-.45 medium, and .32 or below bad (Tabachnick and Fidell, 2013). Accordingly, item factor loadings ranged from medium (.60) to very good (.82). It is seen that the Cronbach's Alpha coefficients of both factors are above .70. As stated by Tabachnick and Fidell (2013), a Cronbach's Alpha value of .70 and above is within acceptable limits for reliability.

Convergent validity was analyzed for AVE using the .50 cut-off point (Fornell and Larcker, 1981). It is seen that AVE values for both factors are above the recommended threshold. In this context, it can be said that it has convergent validity (.58 and .53) in both sub-dimensions. Also, according to Fornell and Larcker (1981), it is stated that an AVE value higher than the correlation coefficient between factors is evidence of discriminant validity. In this context, it is seen that the AVE values of the factors are greater than the correlation values between the factors. Regarding composite reliability, all subscales showed scores above the recommended (CR>.70) for both scales, suggesting that the items measure the same structure. In order to provide convergent validity, this finding aligns with "Combined Reliability (CR) value should be abound .70 (Fornell and Larcker, 1981) and greater than the Average Variance Extracted (AVE) value" (Hair et al., 2006).

Multiple group analysis was conducted to determine whether the measurement model was invariant among groups with different characteristics (Byrne, 2010; Chen, 2007; Cheung and Rensvold, 2002; Sass, 2011). Multi-group analysis revealed that the Short Sport Grit Scale was invariant across gender, as the assumptions of invariance adopted in the methodology were met. Specifically, the results indicated that (i) the perseverance model in sport fits the data and (ii) both models display metric, scalar, and residual invariance which are structured across genders. Based on these results, researchers can use this scale across genders and make meaningful comparisons. In adapting instruments across linguistic and cultural boundaries, it is critical to ensure that the scale's content maintains its interpretability for respondents within the new context (Scielzo et al., 2023). Exploratory factor analysis, reliability analysis, and discriminant validity assessments can guide modifications to enhance psychometric properties, potentially involving item revisions or removals to achieve satisfactory reliability coefficients (Baczyńska et al., 2016).

Based on these results, researchers can use this scale across genders and compare results between groups. In adapting instruments across linguistic and cultural boundaries, it is critical to ensure that the scale's content maintains its interpretability for respondents within the new context (Scielzo et al., 2023). Exploratory factor analysis, reliability analysis, and discriminant validity assessments can guide modifications to enhance psychometric properties, potentially involving item revisions or removals to achieve satisfactory reliability coefficients (Baczyńska et al., 2016).

Scales that demonstrate high split-half reliability, indicative of internal consistency, are valuable tools in research, though internal consistency should not be used as a substitute for retest reliability (McCrae et al., 2010; Rust and Golombok, 1986). Full criterion validation across diverse cultures may be an unrealistic goal given the difficulty in establishing a universally applicable “gold standard”, but quantitative analyses can play a part in establishing construct validity across cultures (Prince, 2008). The availability of valid tools for assessing the workforce is essential to measure the actual competencies as well as to identify areas in need of development (Holanda et al., 2019). Researchers emphasize the importance of assessing validity and reliability for measurement accuracy (Zenner et al., 2005). When measurement models are evaluated, researchers should consider various fit indices, factor loadings, and correlations between constructs (Elias et al., 2022). In the evaluation of construct

validity, it is expected that instruments measuring conceptually similar constructs will exhibit stronger correlations, whereas those measuring related but distinct constructs will demonstrate weaker correlations (Vagnetti et al., 2024).

In addition, ΔCFI, ΔRMSEA and ΔSRMR showed invariance according to measurement invariance recommendations, as seen in Table 5. The data showed no difference between genders, indicating that all interpersonal behaviour is perceived equally in both male and female athletes. The following criteria were used to evaluate the relevant values: Structuring invariance ΔCFI less than .01 (Cheung and Rensvold, 2002; Chen, 2007); metric invariance ΔSRMR less than .030 and ΔRMSEA less than .015 (Chen, 2007); scalar invariance ΔSRMR less than .010 and ΔRMSEA is expected to be less than .015 (Chen, 2007).

Recent psychometric research stresses that adaptation of instruments must account for conceptual and functional equivalence, not just linguistic similarity, especially in high-performance contexts such as sports (Fruchart and Rulence-Pâques, 2025). Fruchart and Rulence-Pâques (2025) emphasized that even minor cultural shifts in item interpretation can affect factor structures, requiring researchers to iteratively assess fit and reliability across samples. In this regard, Gao et al. (2024) developed and validated a sport-specific grit measure for collegiate athletes and confirmed cross-group measurement invariance, strengthening its psychometric generalizability. These studies support the notion that psychometric adaptation is a dynamic and context-sensitive process, where iterative qualitative and quantitative validation is essential. Mixed-method approaches such as cognitive interviews, item response theory modelling, and longitudinal invariance testing are increasingly recommended to enhance ecological validity (Mendizabal, 2024).

The test-retest technique was used to determine whether the scale has consistent measurements over time. For this purpose, 50 athletes who had not participated in this study before were selected as samples and scale was administered at 20-day intervals. The correlation coefficient ($r= 0.89$, $p<0.001$) between the two applications indicates that the scale is invariant with time. As a result of the correlation analysis, it was determined that there was a high level of correlation between the measurements, and it was concluded that the scale has test-retest reliability. Moreover, the interpretation of grit scores should be approached with consideration for the athlete's age and developmental stage, as these factors can significantly influence the manifestation and measurement of psychological constructs (Cumming et al., 2007). For a holistic assessment of an athlete's psychological disposition, integrating grit measurements with established tools like the Sport Mental Training Questionnaire, which meticulously assesses crucial mental preparation skills, can provide a more comprehensive understanding of factors contributing to superior athletic performance (Behnke et al., 2017). Furthermore, considering the influence of stress and physical well-being on athletic performance, as highlighted by Seggar et al. (1997), it is essential to acknowledge the interplay between psychological resilience and physiological factors in sports.

The findings obtained from the validity and reliability studies of the Short Sport Grit Scale show that it can be used to measure the perseverance levels of the athletes in a valid and reliable way. As a result of the studies, meaningful results have been obtained regarding the validity

and reliability of the Short Sport Grit Scale, however it is recommended that researchers re-examine these properties within their own samples. The final adapted Short Sport Grit Scale consists of 8 items, organized into two distinct factors. The psychometric findings support the conclusion that this 8-item scale is valid and reliable for use with Turkish athletes. From a practical standpoint, the adapted scale may be useful for coaches, sport psychologists, and researchers who want to determine athletes' grit levels. Future studies might explore the predictive validity of the Short Sport Grit Scale in relation to athletic performance, motivation, and well-being. In addition, future studies are needed to determine whether grit is a modifiable psychological attribute. Long-term studies are needed to assess the impact of grit on athletic achievement and personal development.

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