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Validación del Índice de Fortaleza Mental (MTI) en jóvenes deportistas españoles

Validation of the Mental Toughness Index (MTI) in young Spanish athletes

Validação do Índice de Resistência Mental (MTI) em jovens atletas espanhóis

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RESUMEN

La fortaleza mental se entiende como el atributo psicológico que permite superar desafíos y adversidades. Esta capacidad es crucial en múltiples ámbitos como el académico, deportivo, afrontamiento de enfermedades, entre otras posibilidades, dado que permite a cualquier persona controlar el estrés y superar los obstáculos que surgen durante la vida. Por ello, y debido a las altas demandas de estrés y exigencia que enfrentan los deportistas españoles, se hace necesario llevar a cabo la validación del índice de fortaleza mental en población española. El estudio tuvo como objetivo examinar las características psicométricas del Índice de Fortaleza Mental (MTI) en deportistas españoles. La muestra fue de 403 deportistas (M*edad* = 15.59; *DE* = 1.57; 208 hombres y 195 mujeres), separados en: muestra 1 (*n* = 201) y muestra 2 (*n* = 202). Se realizó un análisis factorial confirmatorio (AFC) y un modelado exploratorio de ecuaciones estructurales (ESEM), además de un análisis bifactor, en las dos muestras examinadas. Los resultados de los análisis mostraron la existencia de un único factor, así como el ajuste de los 8 ítems del modelo original a la validación en contexto español del MTI. Asimismo, los análisis de correlación mostraron la validez convergente y discriminante del MTI en versión española. En conclusión, los hallazgos respaldaron la validez y fiabilidad de las puntuaciones del MTI en versión española. Por tanto, esta herramienta podría utilizarse para evaluar el nivel de fortaleza mental de los deportistas.

Palabras clave: Determinación, propiedades psicométricas, ajuste psicológico, deportes.

ABSTRACT

Mental toughness is understood as the psychological attribute that allows us to overcome challenges and adversities. This ability is crucial in multiple areas such as academics, sports, and coping with illnesses, among other possibilities, since it allows anyone to control stress and overcome the obstacles that arise during their life. As such, and due to the high stress and demands faced by Spanish athletes, it is necessary to carry out the validation of the mental toughness index in the Spanish population. The study aimed to examine the psychometric characteristic

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of the Mental Toughness Index (MTI) in the Spanish Population. The sample consisted of 403 athletes (M*age* = 15.59; *SD* = 1.57; 208 men and 195 women), divided into sample 1 (*n* = 201) and sample 2 (*n* = 202). A confirmatory factor analysis (CFA) and exploratory structural equation modelling (ESEM) were performed, as well as a bifactor analysis, in the two samples examined. The results of the analyses showed the existence of a single factor, as well as the adjustment of the eight items of the original model to the validation in the Spanish context of the MTI. Likewise, the correlation analyses showed the convergent and discriminant validity of the MTI in the Spanish version. In conclusion, the findings supported the validity and reliability of the MTI scores in the Spanish version. Therefore, this tool could be used to assess the level of mental toughness of athletes.

Keywords: determination, psychometric properties, psychological adjustment, sports.

RESUMO

Entende-se por força mental o atributo psicológico que nos permite superar desafios e adversidades. Esta capacidade é crucial em diversas áreas, como a académica, a desportiva, o enfrentamento de doenças, entre outras, pois permite a qualquer pessoa controlar o stress e ultrapassar os obstáculos que surgem ao longo da vida. Por este motivo, e devido ao elevado stress e às exigências enfrentadas pelos atletas espanhóis, é necessário proceder à validação do índice de força mental na população espanhola. O estudo teve como objetivo examinar as características psicométricas do Índice de força Mental (MTI) em atletas espanhóis. A amostra foi constituída por 403 atletas (M*age* = 15,59; *SD* = 1,57; 208 homens e 195 mulheres), separados em: amostra 1 (*n* = 201) e amostra 2 (*n* = 202). Uma análise fatorial confirmatória (CFA) e modelação exploratória de equações estruturais (ESEM), bem como uma análise bifatorial, foram realizadas nas duas amostras examinadas. Os resultados das análises mostraram a existência de um único fator, bem como o ajuste dos 8 itens do modelo original à validação no contexto espanhol do MTI. Da mesma forma, as análises de correlação mostraram a validade convergente e discriminante do MTI na sua versão espanhola. Em conclusão, os resultados corroboram a validade e fiabilidade dos escores do MTI na versão espanhola. Assim sendo, esta ferramenta poderia ser utilizada para avaliar o nível de força mental dos atletas.

Palavras chave: Determinação, propriedades psicométricas, ajustamento psicológico, desporto.

INTRODUCTION

The study of mental toughness (MT) has been widely addressed in the last two decades (Brace et al., 2020; Crust & Clough, 2005; Gameiro et al., 2023; González et al., 2023; Greiwe et al., 2022; Kuan & Roy, 2007; Liang et al., 2024; Thiessen et al., 2024). Even during the COVID-19 epidemic, the study of mental toughness (MT) did not decline since there are several works where this topic was addressed (Dagnall et al., 2021; Komarudin at el., 2022; Mojtahedi et al., 2021; Tian & Guoxiau, 2023). Moreover, the MT has also been addressed in multiple contexts, such as: sports (Álvarez et al., 2018; Caruzzo et al., 2021; Gu & Xue, 2022; Gucciardi et al., 2022; Lacárcel et al., 2022; Toros et al., 2023; Trujillo et al., 2023), academic field (Hasty et al., 2021; Sağkal, 2019), emotional regulation (Mutz et al., 2017), perceived stress, among others (Gerber et al., 2013; 2015). The study of this variable at the multidisciplinary level lies in the fact that MT is a quality that describes the attributes that help people cope successfully in challenging situations or when facing adversity (Jones et al., 2002).

There are several models to understand MT and most of them are multidimensional and focus on values, attitudes, emotions, and cognitions that are supposed to enable people to behave in such a way that they achieve their goals and overcome obstacles (Clough et al., 2002; Loehrs, 1986; Perry et al., 2021). Hence, Loehr's (1986) model considered that the MT included seven factors: self-confidence, attention control, negative energy motivation, attitude control, positive energy, visual control, and imagery control. On the other hand, Jones's et al. (2002) model understands MT as a construct that includes four dimensions such as self-belief, focus (performance-related and lifestyle-related), confidence, and control (dealing with pressure and anxiety). Likewise, Clough et al. (2002) also

proposed a four-dimensional model of MT: control over their life and emotions, positive approach towards challenging situations, high commitment despite adversity, and confidence in their general abilities and interpersonal skills. Gucciardi et al. (2009a) opted for a quadripartite vision of MT, its dimensions being thriving through challenge, sports awareness, tough attitude, and desire for success. However, Gucciardi et al. (2015) were the first researchers to consider a one-dimensional vision of the MT against a multidimensional vision. In their analyzes, Gucciardi et al. (2015) obtained better factor loadings and a more reliable internal validity score in the one-dimensional model of MT compared to the multidimensional perspective. Multidimensional model scores: (CFI = 0.95, TLI = 0.93, RMSEA = 0.05, SRMR = 0.03; df = 168; p = < 0.00). One-dimensional model scores (CFI = 0.97, TLI = 0.96, RMSEA = 0.05, SRMR = 0.03; df = 20; p = < 0.001) en la muestra 1 ($\chi2$ = 489.03, $\chi2$/df = 28.0); and (CFI = 0.95, TLI = 0.93, RMSEA = 0.08, SRMR = 0.04; df = 28; p =< 0.001) en la muestra 2 ($\chi2$ = 628.64, $\chi2$/df = 28.0). As a result, a one-dimensional model was the most suitable option.

There is a high volume of work that addresses MT, and several models that specify their dimensions (Clough et al., 2002; Gucciardi et al., 2009b; 2015; Jones et al., 2002; Loehr, 1986). Consequently, there are also a multitude of measuring instruments that fit each model. Farnsworth et al. (2021) point out that there are two most widely used questionnaires worldwide to measure MT: the Sports Mental Toughness Questionnaire (SMTQ; Sheard et al., 2009), and the Mental Toughness Index (MTI; Gucciardi et al., 2015). These last two instruments were translated to be used with the Spanish population. Specifically, in Spain, García et al. (2022) used the SMTQ and Álvarez et al. (2018) and Guillén and Santana (2018) used the MTI, resulting in this last instrument in better psychometric properties. However, the SMTQ and the MTI has not been already validated in the Spanish population, although there is previous evidence in Spanish language with Mexican athletes (Jiménez-López & Berengüí, 2022). Also, there is previous evidence of having a related instrument to the concept of MT in Spanish population, which is the Sports Performance Psychological Inventory (Hernández-Mendo et al., 2014), although the rationale in which it is grounded is different than the MT concept. Thus, the existing gap lies in the fact that while there are instruments designed to measure MT according to the worldwide most used theories, these instruments often lack comprehensive validation processes tailored specifically to the cultural and linguistic nuances of the Spanish population. Also, MTI is one of the most widely used questionnaires, because of its brevity (which results in strength from a practical point of view), and because of its adequate psychometric properties (when used with non-Spanish samples). As such, the present study aimed to further explain the psychometric properties in Spanish population of the MTI as a way to strengthen the instruments to measure mental toughness in sports.

Parental educational styles were previously studied in the sports literature (Shah et al., 2024; Vega-Díaz et al., 2023) and are the educational behaviors and motivational climate offered by parents toward their children (Darling & Steinberg, 1993). This was measured through the Spanish version (Del Barrio et al., 2014) of the Parental Acceptance-Rejection Theory (PARTheory; Rohner, 2005). The Spanish version of PARTheory has five dimensions: love/affection, hostility/aggression, indifference/neglect, undifferentiated/rejection and control. Love/affection refers to the interest and warmth of parental-filial. Hostility/aggression is the perception of parents as physical or verbal aggressors. Indifference/neglect examines the degree of attention and care that parents give to their children. Undifferentiated/rejection explores the disaffection expressed by the parents. Control assesses the degree to which parents interfere with their children's behaviors. Another variable selected due to their different conceptualization with MT is sportsmanship. Sportsmanship was previously studied in articles such as Gómez et al. (2015) and Vega-Díaz and González-García (2024). Sportsmanship is an ethical ideal that becomes a reality when players respect the game's rules and their opponents (Iturbide-Luquin & Elosua-Oliden, 2017). There are five dimensions within the construct of sportsmanship (Iturbide-Luquin & Elosua-Oliden, 2017): enjoyment, respect, commitment, fair play, and participation. Enjoyment is the feeling of recreation perceived by participating in sports. Respect is tolerance towards sports and peers. The commitment is the cooperation with colleagues and the pursuit of the scope of excellence. Fair play is compliance with social conventions and rules. Participation is the desire to put in the effort at the expense of knowing what will be lost during competition. Thus, parental educational styles and sportsmanship were selected according to their differentiated meaning to be correlated with MTI scores within sample 1.

Motivational climate was previously studied in articles such as Ruíz-Sánchez et al. (2017). In this study, the focus is on the motivational climate of parents (MC), which refers to the perception of support for engaging in a behavior in an achievement environment (Duda, 2001). The MC is understood as a construct of three elements: the worry-conducive climate, the success-without-effort climate, and the learning/enjoyment climate (Ames, 1992). The worry-conductive climate is fostered when parents make their children feel bad when competitions fail. A success-without-effort climate is encouraged when the parents show pride to their children when they achieve a victory, even if they have not tried to obtain it. A learning/enjoyment climate is offered when parents convey satisfaction at seeing their children learn while having fun in sports. Another variable selected due to their different conceptualization with MT is sports commitment (SC). SC is the psychological disposition representing the desire and decision to continue participating in sports activities (Scanlan et al., 1993). Orlick (2004) specifies that there are different forms of SC: current and future commitment. The current commitment refers to the responsibility that a person perceives when practicing the sport at present. Future commitment reflects the degree of interest in persistence in sports over time. Therefore, MC and SC were selected according to their different meaning with MT scores in sample 2.

As a novelty, this study is intended to further increase the number of measures used to evaluate mental toughness in the Spanish population by examining precisely the distinct psychometric characteristics of the MTI Spanish version. Although there is previous evidence of MTI Validation in the Spanish language, the lack of a Spanish validation with the specific characteristics of the Spanish population is scant. This is surprising as MTI is a powerful tool for briefly evaluating MT. Moreover, the increase in the measures that will evaluate MT will help Spanish practitioners detect functional behaviors in athletes that may protect them in competitive sports contexts. Therefore, the current study aimed to investigate the Mental Toughness Index's (MTI) psychometric characteristics among the Spanish population.

MATERIALS AND METHODS

Design

The research design consists of a work that is categorized as instrumental research (Ato et al., 2013) by analyzing the psychometric properties of a psychological measurement instrument that consists of a new test to evaluate MT.

Participants

A convenience sampling was carried out where participants were selected according to predefined inclusion criteria, such as being young Spanish athletes who were actively competing.

A first sample of 201 young competitive sport athletes (*Mage* = 15.30; *SD* = 1.82; 110 men and 91 women) was used. Regarding the level of competition, one part competed at the local level (*n* = 35), regional (*n* = 24), national (*n* = 13), and international (*n* = 7), while the rest of the participants were athletes who participated in competitive sports, but did not compete at previously aforementioned levels (*n* = 122).

A second sample of 202 young competitive athletes (*Mage* = 15.88; *SD* = 1.22; 98 men and 104 women) was used. Some of the athletes competed at the local level (*n* = 178), regional (*n* = 109), national (*n* = 63) and international (*n* = 24) level. The athletes' level of success was local (*n* = 164), regional (*n* = 89), national (*n* = 31) and international (*n* = 16).

As an inclusion criterion, only Spanish athletes who competed in sports were chosen. Besides, a sample of heterogeneous individuals from different levels of sports competition was selected to ensure the generalizability of the results (Riley et al., 2011).

Materials/Instruments

The Mental Toughness Inventory (MTI; Gucciardi et al., 2015) (see Appendix 1) was administered to measure the MT. The MTI measures the psychological attributes that enable one to overcome challenges in the face of adversity and are important in determining success in sport. The original version of the MTI (Gucciardi et al., 2015) was translated into Spanish using direct translation methods (Carretero-Dios & Pérez, 2005). This process involved translating the scale into Spanish and subsequently having another group of translators assess its equivalence. It consists of 8 items that measure MT, p. e.g., "I believe in my ability to achieve my goals"). The responses correspond to a Likert-type scale ranging from 1 (false, 100% of the time) up to 7 (true, 100% of the time). In this study, adequate internal consistency was obtained (α = 0.90).

To evaluate perceived parenting styles (PS) it was used the Spanish version of the Child-Parental Acceptance-Rejection Questionnaire (Child PARQ/Control; Rohner, 2005). The Spanish version comprises 29 items (Del-Barrio et al., 2014). The answers to the Child PARQ/Control Questions reveal how sons and daughters view their parents' parenting styles. Additionally, even though the questions regarding the maternal and paternal figures are identical, the children answered them separately in order to gather information from the mother and the father. The ChildPARQ/Control scale was used in this research, obtaining the following internal consistency results: love/affection (mother, α = 0.87; father, α = 0.90, eight items, e.g., "My mother/father loves me and needs me"), hostility/aggression (mother, α = 0.90; father, α = 0.92, six items, e.g., "My father/mother gets angry and hurts my feelings"), indifference/neglect (mother, α = 0.82; father, α = 0.85, six items; e.g., "My father/mother ignores me"), undifferentiated/rejection (mother, α = 0.87; father, α = 0.89, four items; e.g., "My father/mother really does not love me"), and control (mother, α = 0.60; father, α = 0.60, five items; e.g., "My father/mother wants to control everything I do"). The responses correspond to a Likert-type scale ranging from 1 (almost never true) to 4 (almost always true).

The Spanish version of the Multidimensional Sportsmanship Questionnaire (MSQ; Iturbide-Luquin & Elosua-Oliden, 2017) was administered to measure athletes' sportsmanship. It consists of 21 items. The MSQ scale was used in this research, obtaining the following internal consistency results in participation (α = 0.72, four items; p.eg., "I don´t mind losing If I´m having fun"), enjoyment (α = 0.91, five items., p.eg., "I play to feel good"), fair play (α = 0.78, four items; p.eg., "I react to provocation"), respect (α = 0.88, four items; p.eg., "I show respect toward opponents"), and commitment (α = 0.88, four items., p.eg., "I respect the rules of the game"). The responses correspond to a Likert-type scale ranging from 1 (never) to 5 (always).

To measure the Motivational Climate (MC) established by parents, the Parent Initiated Motivational Climate Questionnaire-2 (PIMCQ-2; White, 1996) was utilized in the Spanish version (Ortega et al., 2013). The PIMCQ-2 consists of 12 items (which must be answered by the children based on the perceived MC of their mothers and fathers). The items are identical for both parental figures but must be answered separately to gather information on the maternal and paternal figures. The participants must respond to "I feel that my mother/father...". In relation to the perceived motivational climate, in this research the PIMCQ-2 questionnaire is used to measure the worry-conducive climate (mother, α = 0.92; father, α = 0.92, five items; p. e.g., "My mother/father makes me feel bad when I fail"), success-without-effort climate (mother, α = 0.77; father, α = 0.86, three items; p. e.g., "My mother/father tells me that it is important for me to win without much effort") and a learning/enjoyment climate (mother, α = 0.83; father, α = 0.91, four items; p. e.g., "My mother/father is fine that I have fun when I learn new tasks"). The responses correspond to a Likert-type scale ranging from 1 (strongly disagree) to 5 (Totally agree).

To measure sports commitment, the Sports Commitment Degree Scale (CSQ; Orlick, 2004) was taken in its Spanish adaptation (Belando et al., 2012). This scale consists of 11 items used to evaluate the individual commitment of the athlete towards the continued practice and commitment to their sport. The answers must be given considering the degree of personal commitment during sports training. The CSQ scale is used to measure the current sport commitment (α = 0.82, seven items; p. e.g., "I am willing to leave other things like friends, study, leisure time to stand out as a player"), and future sport commitment (α = 0.77, seven items; p. e.g., "I want to

become an excellent competitor in my sport"). The responses correspond to a Likert-type scale ranging from 1 (strongly disagree) to 5 (totally agree).

Procedure

The study was conducted using the ethical principles set out in the World Medical Association Declaration of Helsinki (WMA, 2000), which ensure respect for the dignity, rights, safety, and well-being of all participants. These principles were guaranteed by avoiding any risk for those involved and by obtaining informed consent, which ensured their voluntary participation. At all times, the participants' privacy, dignity and health were preserved (WMA, 2000). Since the participants included in this sample were minors, informed consent was obtained from their parents. Both parents and children have clearly explained the objectives of the study, the procedures, and their rights, including the possibility of withdrawing from the research at any time. Furthermore, this study complied with the Standards of Ethics in Research in Sports and Exercise Sciences (Harriss et al., 2019), ensuring that the research was reviewed and approved by the Ethics Committee of (Universidad Internacional de La Rioja, No. 074/2022). In addition, a thorough analysis of issues such as the ethical use of social networks to recruit participants and obtain data was carried out. In this context, the principles of informed consent, anonymity, privacy, and confidentiality were again respected, avoiding any type of damage, intrusion, protection of property, and data security. In addition, it is guaranteed that the identities of the researchers and participants will be handled ethically and transparently. Finally, the study was carried out in accordance with Organic Law 3/2018, of December 5, on the Protection of Personal Data and Guarantee of Digital Rights (Ley Orgánica 3/2018, de 5 de diciembre, de Protección de Datos Personales y garantía de los derechos digitales). This legal framework also made it possible to ensure the confidentiality of the information collected, based on the informed consent of the participants, respecting the principles of transparency, access to information, and guaranteeing the safe and ethical treatment of personal data. Finally, the study complied with the ethical guidelines established by the American Psychology Association in its seventh edition (APA 7) (American Psychology Association, 2020). The study sample participants were informed online of the purpose of the research through a publication on the federation web page. Interested participants responded to the post and contacted the researchers. As the participants were young athletes, as aforementioned, their parents required online informed consent. Once their parents signed the consent, the children responded to the form through the Google Forms platform. In addition, in case of doubt from the participants, they had the email addresses of the main researchers, whom they could contact at any time. Afterwards, the participants used the link in their email to respond to the surveys completely freely. The data was automatically recorded in the application after a participant finished the questions, and the researcher could see the new information.

Data Analyses

To conduct the different analyses, the software Mplus 7.3 (Muthén & Muthén, 1998-2015) was used. Following Marsh et al. (2009), the confirmatory factor analysis (CFA), bifactor analysis, and exploratory structural equation modeling (ESEM) were performed on the MTI Scale in the two samples (Sample 1 and Sample 2) (see table 1 and table 2).

Regarding the CFA, a correlated CFA model was run in which all cross-loads were constrained to exactly zero and the items were loaded on their expected first-order factor (in Sample 1 and Sample 2). Each item's load on a generic MTI factor and its a priori primary factor in the MTI dimension was provided for each item in the bifactor model. The different item loadings in the ESEM model were randomly assessed for their a priori MTI factor, and all cross-loadings were also randomly calculated (in Sample 1 and Sample 2). To determine whether the questionnaire exhibits a bifactor structure or is made up of multiple specific factors, a bifactor analysis was conducted on both Sample 1 and Sample 2.

The goodness of the model was evaluated using the following metrics: chi-square (2), comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA) with confidence interval, Akaike information criterion (AIC), Bayesian information criterion (BIC), and sample-adjusted BIC (ABIC). Values above

.90 were considered acceptable for CFI and TLI, while values above .95 demonstrated excellent fit, but RMSEA values below (Hu & Bentler, 1999). According to Hu and Bentler (1999), a fit of 0.06 was good and a fit of 0.08 was adequate.

To evaluate the reliability of the MTI values, Cronbach's alpha coefficients, average extracted variance (AVE), and composite reliability values (ρ) were computed. In contrast to variation due to latent components, AVE (i.e., [(sum of standardized loadings)2]/[(sum of standardized loadings)2 + (sum of indicator measurement errors)]) defined the variance captured by measurement errors (Hair et al., 2010). Because the variance of the concept is greater than the variance of the errors, a value of .50 or higher indicates a satisfactory fit (Martinent et al., 2015). The overall dependability of a group of disparate but related items is measured by composite reliability scores, which are expressed as = [(sum of standardized loadings)2 [(sum of standardized loadings)2 + (sum of error variances)]. Martinent et al. (2015) state that a value of .70 or greater denotes acceptable dependability. Finally, a correlation analysis was carried out between the MTI scores and parenting style (Sample 1), sportsmanship (Sample 1), parental motivational climate (Sample 2), and sports commitment (Sample 2) to examine the external validity of the MTI results.

RESULTS

Factorial structure of MTI Scores

Confirmatory Factor Analysis (CFA)

In order to confirm that the instrument factors were suitable with those previously developed in the original version, a CFA was first conducted with the various samples (Samples 1 and 2) (Gucciardi et al., 2015).

In all samples, every index of the correlated single-factor CFA model met the threshold for a suitable data fit (Table 1). Good indexes were found for samples 1 and 2 using the CFI, TLI, and RMSEA (see Table 1). Additionally, all standardized factor loadings (λ) showed significance at $p < .05$ and fit flawlessly in the various CFA analyses (Tables 2 and 3). The CFA findings thus supported the assertion made by Gucciardi et al. (2015) that the structure of the MTI scores followed the same pattern as the initial original version.

Table 1

Results of models CFA, ESEM and Bi-Factor.

Model	χ^2	*p*	df.	CFI	TLI	AIC	BIC	ABIC	RMSEA	90%CI RMSEA	SRMR
CFA Sample1	489.035	< 0.001	28	0.958	0.941	4683.518	4762.797	4686.761	0.070	0.037-0.101	0.047
CFA Sample 2	628.649	< 0.001	28	0.950	0.931	4786.367	4865.766	4789.729	0.086	0.056-0.116	0.040
ESEM Sample 1	489.035	< 0.001	28	0.958	0.941	4683.518	4762.79	4686.761	0.070	0.037-0.010	0.047
ESEM Sample 2	628.64	< 0.001	28	0.950	0.931	4786.367	4865.766	4789.729	0.086	0.056-0.116	0.040
Bi-factor Sample 1	489.035	< 0.001	28	0.958	0.941	4683.518	4762.797	4686.761	0.070	0.037-0.101	0.047
Bi-factor Sample 2	628.649	< 0.001	28	0.950	0.931	4786.367	4865.766	4789.729	0.086	0.056-0.116	0.040

Bifactor Analysis

In order to determine whether the Spanish version of MTI was organized in a first general dimension, a bifactor analysis was conducted with the two separate samples (sample 1 and sample 2). In all samples, sample 1 (CFI = 0.958; TLI = 0.941; RMSEA = 0.070) and sample 2 (CFI = 0.950; TLI = 0.931; RMSEA = 0.086), the fit indices in the bifactor model displayed appropriate scores. However, they were significant at $p < 0.05$ and greater than .35 for each item for the 1-factor model. Therefore, the bifactor model's findings supported the idea that mental toughness is a general factor.

Exploratory Structural Equation Modelling (ESEM)

Third, an ESEM analysis was carried out to ensure no cross-loadings between the elements of the different specific dimensions of MT. According to the fit indices in the ESEM model, sample 1 (CFI = 0.958; TLI = 0.915; RMSEA = 0.061); and sample 2 (CFI = 0.950; TLI = 0.931; RMSEA = 0.086) all had appropriate scores. Additionally, all λ were $p < 0.05$ significant (Tables 2 and 3). Thus, the outcomes of the ESEM offered additional support for the factorial structure of MTI scores.

Reliability of MTI Scores

The Alpha coefficients in samples 1 and 2 of the MTI Spanish version were 0.88 and 0.91, respectively, and both showed promising indicators. Additional evidence for the dependability of MTI scores was provided by AVE and Composite Reliability values, which were 0.919 and 0.928 for samples 1 and 2, respectively. For samples 1 and 2, the Composite Reliability values were 0.719 and 0.70, respectively (Tables 2 and 3).

Table 2

Standardized Factor Loadings for Confirmatory Factor Analysis (CFA) and Exploratory Structural Equation Modeling (ESEM) for the MTI Spanish Validation in the sample 1 (N = 201).

	CFA					
Items	λ	δ	Factor 1 (λ)	δ	AVE	Composite Reliability
MTI						
Item 1	0.618	0.053	0.723	0.076	0.919	0.708
Item 2	0.578	0.058	0.786	0.090		
Item 3	0.678	0.052	0.929	0.091		
Item 4	0.775	0.035	0.925	0.069		
Item 5	0.744	0.040	0.898	0.077		
Item 6	0.765	0.037	1.001	0.075		
Item 7	0.799	0.031	0.982	0.068		
Item 8	0.703	0.046	0.972	0.081		

Notes. MTI= Mental Toughness Inventory.

Table 3

Standardized Factor Loadings for Confirmatory Factor Analysis (CFA) and Exploratory Structural Equation Modeling (ESEM) for the MTI Spanish Validation in the sample 2 (N = 202).

	CFA					
Items	λ	δ	Factor 1 (λ)	δ	AVE	Composite Reliability
MTI						
Item 1	0.755	0.044	0.755	0.044	0.928	0.719
Item 2	0.696	0.065	0.696	0.065		
Item 3	0.770	0.045	0.770	0.045		
Item 4	0.795	0.037	0.795	0.037		
Item 5	0.758	0.040	0.758	0.040		
Item6	0.799	0.038	0.799	0.038		
Item 7	0.788	0.040	0.788	0.040		
Item 8	0.738	0.049	0.738	0.049		

Notes. MTI= Mental Toughness Inventory.

Correlational Analyses

Two correlational analyses were run on the research samples to examine the external validity of the MTI Spanish version (Table 4). The first test examined the connections between MTI, parenting styles, and sportsmanship in sample 1 (*n* = 201). The MT factor correlated positively with maternal and paternal love and affection. However, there was a negative correlation between the MT factor and maternal indifference/rejection, maternal/paternal hostility/aggression, and maternal/paternal neglect. However, there is no relationship between maternal/paternal control, MT, or paternal undifferentiated/rejection. Regarding the relationship between MT and sportsmanship, there is an association between MT and commitment, participation, enjoyment, and respect. However, there is no connection between MT and fair play.

Second, MT was correlated with parental motivational climate, and sport commitment. It was found that MT was positively correlated with maternal/paternal learning/enjoyment climate. However, there is no correlation between MT and maternal/paternal worry-conducive climate, and maternal/paternal success-without-effort climate. Finally, regarding MT and sport commitment, it was found that MT was positively correlated with current and future sport commitment.

Table 4

Correlation among the study variables to test the external validity of MT.

Variables Sample 1	Mental Toughness
Maternal Love/Affection	0.40**
Maternal Hostility/Aggression	-0.20**
Maternal Indifference/Neglect	-0.28**
Maternal undifferentiated/Rejection	-0.19**
Maternal Control	-0.06
Paternal Love/Affection	0.38**
Paternal Hostility/Aggression	-0.16*
Paternal Indifference/Neglect	-0.20**
Paternal undifferentiated/Rejection	-0.05
Paternal Control	-0.08
Participation	0.40**
Enjoyment	0.41**
Fair Play	0.13
Respect	0.50**
Commitment	0.49**
M (*SD*)	2.96 (0.80)
Variables Sample 2	Mental Toughness
Maternal worry-conducive climate	-0.08
Maternal success-without-effort climate	-0.11
Maternal learning/enjoyment climate	0.33**
Paternal worry-conducive climate	-0.06
Paternal success-without-effort climate	-0.05
Paternal learning/enjoyment climate	0.33**
Current sport commitment	0.55**
Future sport commitment	0.52**
M (*SD*)	3.24 (1.04)

Notes. $p<.05^{*}$; $p<.01^{**}$

DISCUSSION

The study aimed to examine the psychometric properties of the Mental Toughness Index (MTI) in the Spanish Population. Results of this research provided evidence of the adequacy criterion for the ESEM and CFA models. Not only do they provide good indexes in the models, but they also provide good factor loadings in the different analyses. The results provided followed the theoretical tenets of Gucciardi et al. (2015), who consider a one-dimensional vision of the MT, against the multidimensional vision supported by other researchers (Clough et al., 2002; Gucciardi et al., 2009a; Jones et al., 2002; Loehr, 1986). Nevertheless, it stands out that the present research was the first article to provide the ESEM results to support the evidence of the MTI Spanish version scores of our translation. Therefore, this work demonstrated that the MTI scores Spanish version might be a useful scale to measure the mental toughness of Spanish people.

In line with that, the results of the structure scores of the MTI Spanish version revealed suitable standardized factors loadings for the bifactor model. In addition, the MTI revealed acceptable fit indices of CFI, TLI, and RMSEA. These results align with the previously established by Gucciardi et al. (2015), who also revealed the

existence of a single dimension of the variable MT. In other words, this work demonstrates the evidence that there is a single general factor of MT.

The validity analysis revealed that the MTI factor (Gucciardi et al., 2015) correlated with parenting styles and sportsmanship variables. Particularly, maternal/paternal love/affection was positively correlated with MT, a connection that had already been previously described by Zhang and Li (2019). The positive relationship between parental love/affection and MT happens because parental acceptance (manifested by love/affection) is consistently related to children's psychological adjustment (Rohner, 2021; Rohner & Landsford, 2017), strengthening MT. On the other hand, maternal/paternal hostility/aggression was negatively correlated with MT. Regarding it, Mahoney et al. (2014) consider that MT is positively related to the satisfaction of basic psychological needs (BPN) (p.eg., competence). Hostility/aggression is a behavior that causes psychological and physical harm (Sharma, 2022), as such it is linked to the perception of needs thwarting (Miller & Dollard, 1941). In other words, parental hostility/aggression does not help to satisfy BPN and is, therefore, negatively related to MT. Likewise, maternal/paternal indifference/neglect was negatively correlated with MT. There is previous evidence that parental indifference/neglect is related to childhood psychological maladjustment and negative perceptions of self-efficacy (Khaleque, 2014). At the same time, the low perception of self-efficacy is negatively related to the perceived control in the different situations that may arise (Bandura, 2006), and consequently, the MT is low. Finally, maternal undifferentiated/rejection was negatively correlated with MT. Wood et al. (2003) found that parental undifferentiated/rejection increased children's anxiety levels, which can inhibit perceptions of control in situations (Šrol et al., 2021). One of the characteristics of mentally strong people is their perception of control over the situations surrounding them (Gucciardi et al., 2015). Therefore, the low perception of control is negatively related to MT.

In line with the aforementioned, this research's results have shown a correlation between sportsmanship and MT. More specifically, a positive correlation exists between MT and participation, enjoyment, respect, and commitment. Connaughton et al. (2008) and Gucciardi et al. (2009a) suggest that the development of MT depends on athletes having opportunities to explore and voluntarily participate in their desired actions. Therefore, athletes who participate voluntarily in sports must relate positively to MT. On the other hand, Mahoney et al. (2014) describe a negative relationship between MT and anxiety (that can be perceived by not being mentally strong). The fact of not feeling anxiety (for having high MT) helps athletes not to perceive insecurity or threatening feelings. At the same time, it is recognized that low perceived anxiety facilitates enjoyment (Farris et al., 2019). Respect implies listening to colleagues, not fighting, respecting the opponent, and helping and complying with the rules (Omeñaca et al., 2015). Some athletes do not trust their abilities (low self-efficacy), and because of this, they try to win by all means and do not respect their opponents. Since MT involves a high perception of self-efficacy (Thom et al., 2020), finding a positive relationship between MT and respect is not unusual. On the other hand, Mahoney et al. (2014) describe that MT helps to try to reach new achievements in sports. Therefore, the relationship between MT and commitment is apparently logical since the athlete must try and maintain a certain resistance to achieve these achievements.

Regarding the correlations between the study variables, this project found that parental motivational climate correlated with MT and sports commitment. In the first case, it was found that maternal/paternal learning/enjoyment climate was positively correlated with MT. In previous works, a reference is made to a type of parents who give children time to carry out their tasks, reward their effort, accept their mistakes as part of their learning, and understand their successes as a sign of their personal development, fostering the learning/enjoyment climate (Ames, 1992). The learning/enjoyment climate encourages the athlete to grow professionally, so the person's perception of competence will grow, and de MT will be strengthened (Corrion et al., 2018). This same positive relationship between learning/enjoyment climate and MT has already been described by Taştan (2021). Secondly, it was found that current and future sports commitment was positively correlated with MT. One of the characteristics of mentally strong people is their commitment to goals (Clough et al., 2002). Therefore, the relationship between MT and sports commitment is not strange (In-Soo, 2016), as athletes commit to the sport to achieve their goals.

Thus, these findings offered ample evidence that the Spanish version of the MTI scores followed the same pattern as the prior English version (Gucciardi et al., 2015). However, certain limitations of this study need to be stated. Competitive sports practitioners were among the features of the samples used to validate the questionnaire. Therefore, the scale must be applied to various populations to view their scores in several settings. Additionally, correlation analysis between PS, sportsmanship, parental motivation climate, and sport commitment were used for the study's validation analysis. Thus, it would be advisable to assess its external validity with other variables to ensure the external validity.

CONCLUSIONS

The Spanish validation of the MTI may be a relevant and trustworthy tool for assessing mental toughness in Spain. Gucciardi et al. (2015) stated that the findings of CFA, Bifactor, and ESEM supported the existence of a single factor in MT. Additionally, the consistency of this measure was demonstrated by the similar outcomes seen in the various analyses in the subpopulations. The need to quantify MT in the population is further increased by the current scenario, in which the paradigm of psychological adjustment is becoming increasingly necessary in society. MT required a Spanish measurement as a result. Overall, the MTI Spanish version meets the criteria as a Spanish instrument and has sufficient reliability and validity to be applied in subsequent studies.

PRACTICAL APPLICATIONS

In practical terms, the MTI Spanish version has proven to be a valid tool for assessing mental toughness in the Spanish-speaking population. Particularly, the psychometric indexes of the scale demonstrated sufficient values for the measure to be considered appropriate. Additionally, the MTI Spanish version could be used to test MT in various settings, including health, the classroom, sports, emotional control, and others. A more accurate picture of the significance of self-assurance, self-control, and other qualities that come naturally to mentally strong people, as well as the range of accomplishments and improved performance in several domains at a multidisciplinary level, might be given by one measure of MT.

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Appendix 1. The Mental toughness Inventory Spanish version

Indique que tan cierta es cada una de las siguientes afirmaciones con respecto a su forma de pensar como deportista:

Desde 1-Falso el 100% del tiempo al 7-Verdadero el 100% del tiempo

Creo en mi capacidad para lograr mis objetivos	1	2	3	4	5	6	7
Soy capaz de controlar mi atención cuando realizo tareas	1	2	3	4	5	6	7
Soy capaz de usar mis emociones para manejarme de la manera que quiero	1	2	3	4	5	6	7
Me esfuerzo por alcanzar el éxito continuo.	1	2	3	4	5	6	7
Uso mis conocimientos cuando es necesario para lograr mis objetivos	1	2	3	4	5	6	7
Supero constantemente la adversidad	1	2	3	4	5	6	7
Soy capaz de ejecutar de manera apropiada mis habilidades y conocimientos ante un desafío	1	2	3	4	5	6	7
Puedo encontrar algo positivo en la mayoría de las situaciones	1	2	3	4	5	6	7