

Measurement Invariance and Latent Mean Differences of the Thai version of Athletic Coping Skill Inventory

Tanida Julvanichpong¹, Naruepon Vongjaturapat¹, Junggil Park²,
and Chatkamon Singnoy¹

¹Faculty of Sport Science, Burapha University, Thailand

² Research Analytics Lab of Korea

Abstract

Background: The Athletic Coping Skills Inventory-28 (ACSI-28) has been proposed as a valid and reliable instrument (Smith et al., 1995) to assess psychological skills in a number of athletic populations. Its extensive application history covers a wide variety of competitive, mainly team-based sports, but there has been no published verification of the ACSI-28's psychometric properties when applied to Thai national athletics team. **Purpose:** The current study examined (1) the factorial validity of a Thai version of ACSI-28; (2) the measurement (configural, metric, scalar, and variance) invariance of a shortened version of ACSI-23 across gender, age, types, and classification of sports; (3) the latent factor mean difference between gender, age, and sport groups. **Method:** A total of 408 athletes (217 males, 191 females) in Thai national athletics team participated in Hangzhou 2022 Asian Games were surveyed using the Thai version of The Athletic Coping Skills Inventory-28 (ACSI-28). The mean athlete age was 22.52(SD = 5.93) years, with a range of 14 to 55. Data were conducted using a confirmatory factor analysis (CFA) and multi-group CFAs. **Results:** Confirmatory factor analysis (CFA) test supported the multidimensionality of the shortened version of in the ACSI-23. The ACSI-23 is invariant across gender, age, type and classification of sports at both configural, full metric, full scalar, and full variance levels. Findings from latent mean comparisons showed that males reported higher coping with adversity/concentration (CONC), confidence and achievement motivation (CONF), goal setting and mental preparation (GOAL), and freedom from worry(FREE). Athletes 21 years of age or over had a higher score than athletes 20 years under on confidence and achievement motivation (CONF) and goal setting and mental preparation (GOAL). Individual sports athletes had more coping with adversity/concentration (CONC) than team sports athletes. Outdoor sortsathletes had significantly lower confidence and achievement motivation (CONF), goal setting and mental preparation (GOAL), and freedom from worry (FREE) than indoor sports athletes. **Conclusion:** Findings suggest the Thai version of ACSI-23 is a valid scale for measuring Thai athletes' coping skills.

Keywords: Thai athletes, coping skills, factor analysis, measurement invariance, latent mean comparison

Introduction

Coping is defined as a process based on motor, behavioral, and cognitive effort to deal with the psychophysical demands that exceed an individual's capacity. When athletes compete in sport they may appraise an array of potential stressors, including pain, fear, lack of confidence, psychological demands, coach stress, and the demands of playing sport (Nicholls & Polman, 2007). Nicholls and Polman (2007) postulate that much of the studies concerning confrontation in sport adopt the perspective of a dynamic process, which varies according to the situation, age and gender of the athlete. Therefore, the evaluation of cognitive and behavioral approaches provides consistency to the stress management interventions in the sporting context. Moreover, Singnoy et al. (2022) found that Thailand's sailors demonstrate a-5 characteristics including (1) willpower, (2) mindfulness, (3) confidence, (4) commitment, and (5) fighting spirit and utilize diverse coping strategies to thrive in their high-pressure environment. They exhibit strong self-belief, unwavering motivation, and impressive resilience, allowing them to bounce back from setbacks and maintain composure under pressure. These sailors effectively manage emotions through techniques like deep breathing and positive self-talk, while simultaneously employing problem-focused coping to analyze performance and adjust strategies. They also leverage strong social support networks, utilize goal-setting to maintain focus and direction, and embrace acceptance and mindfulness to navigate the unpredictable nature of their sport. However, performing superstitious rituals in which closed to Thailand believe in guardian spirit to make mental energy and mindfulness and meditation that relate to the Buddhist way that was used to reset the mind and increase focus, awareness, and concentration on the breath. This potent combination of mental fortitude and adaptive coping mechanisms enables Thai sailors to consistently perform at their peak in the demanding world of international competition.

The Athletic Coping Skills Inventory-28 (ACSI-28) is a widely used instrument in sports psychology (Smith, et al., 1995; Kenny et al., 2018), The ACSI-28 is composed of seven sub variables, including coping with adversity, peaking under pressure, goal setting/mental preparation, concentration, freedom of worry, confidence and achievement motivation, and coachability, and consists of a total of 28 questions with four items for each subscale. The participants were asked to respond to the questions using 4-point Likert scale (1 point, not at all; 4 points, always). There was popularity has led to its translation into numerous languages to

facilitate research and practice across diverse cultures such as Chinese (Cheung, & Kwak, 2009); Croatian (Baric, R., & Horga, S. (2007); Czech (Hojka, Hřebíčková, & Slepíčka, 2006); Dutch (Goudas, Hatzigeorgiadis, & Theodorakis, 2006); Farsi (Persian) (Besharat, 2007); French (Gaudreau & Blondin, 2002); Greek (Goudas, Theodorakis & Hatzigeorgiadis, 1999); Italian (Comani, Bortoli & Robazza, 2003); Korean (Han & Park, 2002); Spanish (Graupera, Ruiz-Pérez, & García-Coll, 2006); Portuguese (Fonseca & Paula Brito, 2001); Thai (Khemmarat, Thianthong & Vongjaturapat, 2014). However, it's crucial to acknowledge that the rigor of the validation process may vary between translations, and researchers and practitioners must prioritize using versions that have demonstrated adequate psychometric properties, specifically validity and reliability, within their target populations.

Summarizing the findings of every study that has (a) higher ACSI-28 subscale scores correlate with better performance outcomes, such as higher competitive levels, greater success, and lower performance anxiety. Furthermore, (b) coping skills, as measured by the ACSI-28, are linked to other key psychological factors like motivation, self-confidence, mental toughness, and burnout. The instrument has also proven valuable (c) in identifying athletes who could benefit from psychological skills training, with lower scores on specific subscales indicating a need for targeted interventions. Finally, (d) the ACSI-28 effectively differentiates between athletes of varying skill levels, as more experienced and successful athletes generally exhibit higher scores on the ACSI-28 subscales.

Therefore, specific findings were research utilizing the Athletic Coping Skills Inventory-28 (ACSI-28) across its various language versions reveals diverse findings and focus areas reflective of cultural and sporting contexts. In its original English form, studies have predominantly focused on establishing the ACSI-28's relationship with performance outcomes, competitive anxiety, motivation, and mental toughness across various sports. The Chinese version's research explores coping skills within the framework of cultural factors, examining their role in managing stress and pressure among elite athletes and differences between individual and team sports. Croatian studies have utilized their validated version to investigate the connection between coping skills and competitive anxiety, including variations across different sports and the predictive power of coping skills on performance. With the Czech version, a major area of inquiry has been using the ACSI-28 to differentiate psychological skills among athletes from various sports and competitive levels and exploring its correlation with other psychological constructs. Dutch research has delved into the interplay between coping skills, burnout, injury rehabilitation, and performance anxiety in young athletes. In Farsi, studies have concentrated on coping mechanisms related to psychological well-being and stress management in competitive settings among Iranian athletes. The

French version's investigations have broadly covered emotional regulation, prediction of performance across sports, and coping with competitive stress. Greek research has extensively examined the developmental aspects of coping skills, particularly in young athletes, and the influence of coaches and parents. Italian studies have focused on confirming the reliability of their adapted version and its sensitivity to differences in competition levels. Korean research has targeted coping skills in elite athletes, exploring their association with mental toughness and performance in sports like archery and taekwondo. The Spanish version's research has investigated coping's relationship with competitive anxiety and performance prediction, including differences between individual and team sports. Studies with the Portuguese version have confirmed its validity for use among Portuguese athletes, opening avenues for research on coping skills within this population. The Thai version has a specific focus on the role of coping skills for national athletes, including gender differences and the development of mental toughness. Each language version provides unique insights into how athletes in different cultures utilize coping skills to navigate the pressures of their sport and achieve peak performance.

Pereira, et al. (2020) suggest that future research should address some of the methodological and measurement limitations of the sport psychology coping literature. One of the instruments used most often for evaluating coping skills is the Athletic Coping Skills Inventory-28 (ACSI-28). The ACSI-28 has been proposed as a valid and reliable instrument (Smith et al., 1995) to assess psychological skills in a number of athletic populations including football (Spieler et al., 2007), baseball (Kimbrough et al., 2007), rugby (Yeomans et al., 2019), field (Polenske et al., 2022), equestrian (Salma & Meyers, 2019) and a group of diverse Olympic champion athletes (Gould et al., 2002).

The need to evaluate repertoires of coping in the sport environment is an important element to promote and enhance the full operation and performance of the athlete (Arnold, Fletcher, & Daniels, 2016). Knowing the instruments that can provide good psychometric properties helps professionals working with athletes to examine the effectiveness of their strategies, assists in the preparation of interventions for specific populations of athletes, in addition to contributing to the development and improvement of these athletes' coping resources (Nicholls, Taylor, Carroll, & Perry, 2016).

For this reason, the primary purpose of this study was to assess the psychometric properties of the Thai version of the Athletic Coping Skills Inventory-28 (ACSI-28; Kanoktipporn, Komaitt, & Boonchu, 2009). If model fit recommendations for the instruments were not met, we would re-examine the factor structure of the ACSI-28 using confirmatory factor analysis (CFA). A secondary

purpose of the study was to test the measurement (configural, metric, scalar, and variance) invariance of a shortened version of ACSI-23 across gender, age, types, and classification of sports. A third purpose of this study was examine the latent factor mean difference between gender, age, types, and classification of sports.

Method

1. Participants

The demographic characteristics can be found in Table 1. We obtained permission to conduct the study prior to the investigation from the Institutional Review Board of Burapha University, the Athletics Association of Thailand, and the participants. Data collectors helped check missing questions and reminded the participants to complete all questions if necessary. The missing data were small and excluded from the data. The final data include a total of 408 athletes (217 males, 191 females) in Thai national athletics team who participated in Hangzhou 2022 Asian Games. Their average age was 22.52 (SD = 5.93). Type of sports was individual sport (219 athletes) and team sport (189 athletes); however, classification of sports was indoor sport (212 athletes) outdoor sport (196 athletes).

2. Measurement

The Thai version of ACSI-28 (Khemmarat, Thianthong & Vongjaturapat, (2014) is a 28-item instrument designed to measure seven factors, each containing four items. Subscales include peaking under pressure (PEAK), freedom from worry (FREE), coping with adversity (COPE), concentration (CONC), goal setting and mental preparation (GOAL), confidence and achievement motivation (CONF), and coach ability (COACH). Participants respond on a four-point Likert scale from 0 = “Almost never” to 3 = “Almost always”. A higher score indicates an athlete perceived higher coping skills. And reliability was 0.899. This instrument has adequate reliability as measured by McDonald’s Omega (i.e., $v = 0.92$ for males, $v = 0.94$ for females; $v = 0.92$ for individual sport, $v = 0.92$ for team sport groups; $v = 0.90$ for ≤ 20 years; $v = 0.89$ for ≥ 20 years). The characteristics of all scale items had indicating univariate normality test of the data was assumed that the data found the skewness and kurtosis were between -2 and +2 (Kline, 2016).

3. Data analysis

First, SPSS Version 22.0 (IBM Corp., Armonk, NY, USA) was used to conduct descriptive statistics together with the univariate normality check, including the assessment of skewness and kurtosis values. Second, we used AMOS Version 22.0 (IBM Corp.) to work confirmatory factor analysis (CFA) with maximum likelihood estimation to test the multidimensionality of the Thai version of ACSI-28. Because the model fit did not meet the recommended guidelines as

outlined in the literature (Kline, 2015) forte scale. Model fit indices were evaluated based on a priori values to evaluate the proposed initially factor structures.

Second, we followed the customary forward-step approach to measurement invariance (Sass, 2011), by (1) estimating our model in each group separately and subsequently testing (2) a configural invariance model (i.e., factor structure held equal), (3) a metric invariance model (i.e., factor structure and factor loadings held equal), (4) a scalar invariance model (i.e., factor structure, factor loadings, and intercepts held equal), and (5) a variance model (i.e., factor structure, factor loadings, intercepts, and residual held equal). But residual invariance is not necessary for meaningful comparisons of group means, and itself is of limited practical value (Gregorich, 2006).

Third, we compared latent mean differences between gender, age (i.e., ≤ 20 years vs ≥ 21 years), type (i.e., individual sport vs team sport), and classification of sports (i.e., indoor sport vs outdoor sport). Specifically, a full scalar invariance model was used as the baseline. To compare latent mean between groups, we constrained the reference group (i.e., males, 20 years, individual sport, and indoor sport) latent mean to 0 and the latent means of the comparing group (i.e., females, 20 years, team sport, and outdoor sport) was free to estimate.

To evaluate the fit of the models, we used the χ^2 goodness-of-fit statistics, Tucker-Lewis index (TLI), Comparative Fit index (CFI), root mean square error of approximation (RMSEA), and Aitken's Information Criteria (AIC). We used the criteria from Byrne (2010) for close (RMSEA ≤ 0.04 ; SRMR ≤ 0.08 ; TLI ≥ 0.99 ; CFI ≥ 0.99) and acceptable fit (RMSEA ≤ 0.08 ; SRMR ≤ 0.05 ; TLI ≥ 0.90 ; CFI ≥ 0.90). With respect to the invariance tests, the non-significant result of the chi-square difference test and the change value of CFI smaller than 0.01 indicate that the invariance tests claimed are supported (Byrne, 2010).

Results

1. Confirmatory Factor Analysis The CFA was conducted using the total sample (N=408) to test the fit of the ACSI factor structure. As can be seen from Table 1, the fit indices for the four models were not so good. But fit indices for 23-item models (i.e., total sample, different genders, different age, and different sports groups) were excellent. According to Chiu et al.'s (2013) tests of reliability and validation, in this study, the shortened Thai version of ACSI was identified as a coping skill model with five dimensions. As shown in Figure 1, all items' standardised factor loadings were above 0.50, supporting the multidimensionality characteristics of this scale.

Table 1. Model fit of a shortened T-ACSI-23 model across groups

Model	χ^2	df	p	CFI	TLI	RMSEA (90%CI)	AIC
Model A (28-item, 7-factor)	733.47	329	.001	.887	.871	.055 (.050-.061)	887.47
Model B (26-item, 7-factor)	636.50	278	.001	.896	.879	.056 (.051-.062)	782.50
Model C (25-item, 7-factor)	556.12	254	.001	.910	.894	.054 (.048-.060)	698.12
Model D (24-item, 6-factor)*	459.01	215	.001	.922	.909	.053 (.046-.059)	581.01
Model E (23-item, 5-factor)*	466.47	220	.001	.922	.910	.052 (.046-.059)	578.47
Male	461.42	220	.001	.860	.840	.071 (.062-.080)	573.42
Female*	283.28	220	.003	.952	.945	.039 (.058-.078)	395.28
≤20 years*	347.23	220	.001	.908	.894	.058 (.047-.070)	459.23
≥20 years	415.96	220	.001	.891	.874	.061 (.052-.070)	527.96
Individual sport	436.82	220	.001	.877	.858	.067 (.047-.069)	548.82
Team sport*	359.67	220	.001	.908	.894	.058 (.062-.081)	471.67
Indoor sport	439.65	220	.001	.860	.839	.072 (.042-.063)	551.65
Outdoor sport*	350.08	220	.001	.922	.911	.053 (.042-.063)	462.08

The asterisk (*) indicates groups with acceptable model fit.

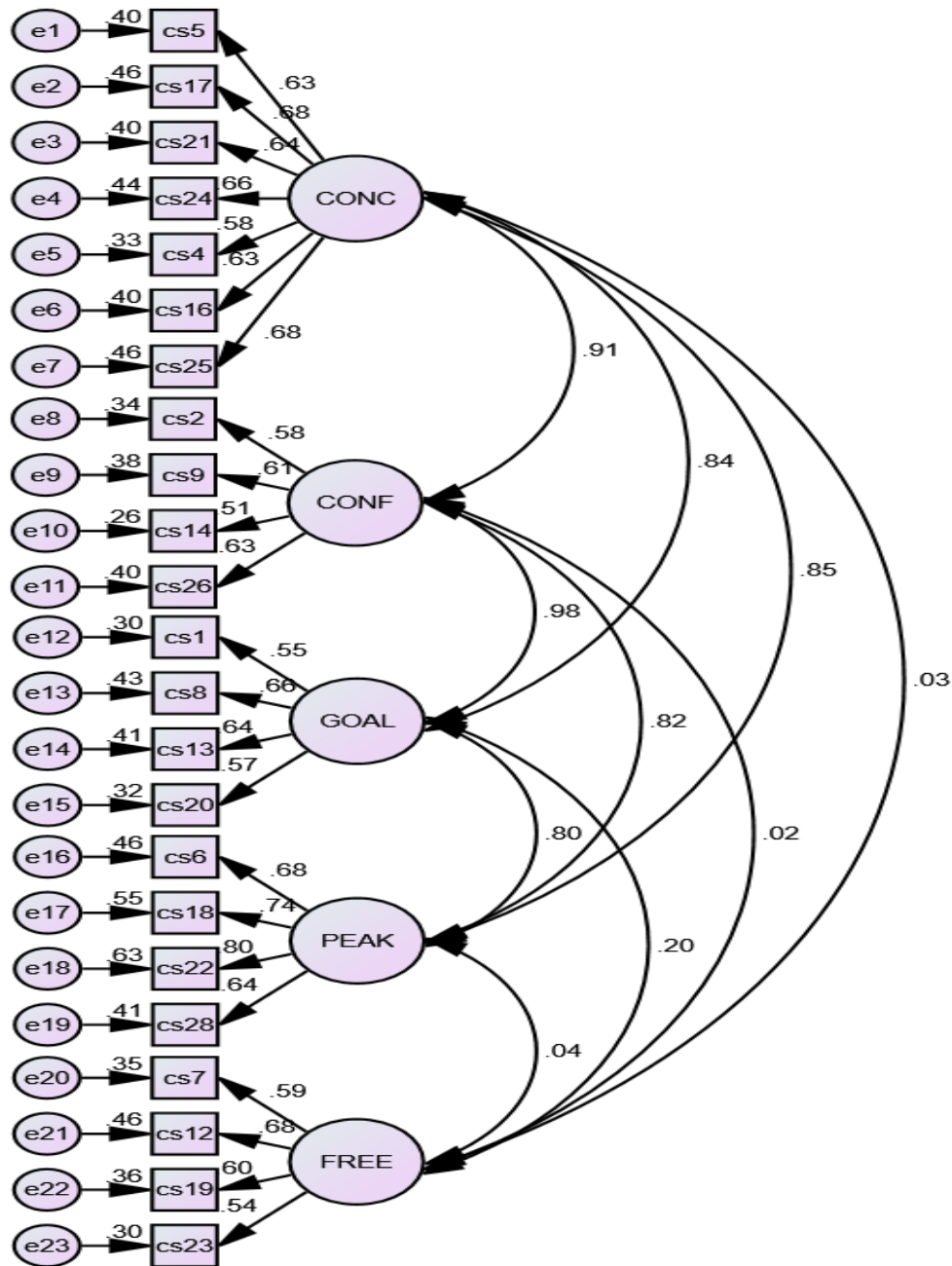


Figure 1. Confirmatory factor model of a 23-shortened Thai version of ACSI-23 (Cronbach's α : CONC=.76, CONF=.78, GOAL=.76, PEAK=.77, FREE=.87)

2. Measurement Invariance

Before conducting latent mean analysis, several invariance tests were performed. Measurement invariance is tested by evaluating how well the specified model (e.g., the model set up by the researcher) fits the observed data (Kline, 2015).

First, the progressive gender invariance test showed that configural invariance model across gender demonstrated acceptable model fit ($\chi^2 = 744.66$, $df = 440$, $CFI = 0.900$, $RMSEA = 0.041$). The metric invariance test constrained factor loading to be equal across genders. Findings of this test showed that the model fits the data well. Additionally, the change of CFI between configural and metric invariance tests is within the threshold of 0.01, supporting the metric invariance across gender. The scalar invariance test also demonstrated that the indicators' intercepts were variant across genders, as the CFI change between the scalar and metric invariance tests was not greater than 0.01.

Second, the age invariance test showed that configural invariance model across ages demonstrated acceptable model fit ($\chi^2 = 763.24$, $df = 440$, $CFI = 0.898$, $RMSEA = 0.043$). The metric invariance test constrained factor loading to be equal across ages. The findings of this test showed that the model fits the data well. Additionally, the change of CFI between configural and metric invariance tests is within the threshold of 0.01, supporting the metric invariance across ages. The scalar invariance test also demonstrated that the indicators' intercepts varied across ages, as the CFI change between the scalar and metric invariance tests was not greater than 0.01.

Third, the sport type invariance test showed that configural invariance model across ages demonstrated acceptable model fit ($\chi^2 = 796.49$, $df = 440$, $CFI = 0.891$, $RMSEA = 0.045$). The metric invariance test constrained factor loading to be equal across sport types. The findings of this test showed that the model fits the data well. Additionally, the change of CFI between configural and metric invariance tests is within the threshold of 0.01, supporting the metric invariance across types of sport. The scalar invariance test also demonstrated that the indicators' intercepts were variant across types of sport, as the CFI change between the scalar and metric invariance tests was not greater than 0.01.

Finally, the sport classification invariance test showed that configural invariance model across ages demonstrated acceptable model fit ($\chi^2 = 789.75$, $df = 440$, $CFI = 0.892$, $RMSEA = 0.044$). The metric invariance test constrained factor loading to be equal across classification of sports. Findings of this test showed that the model fits the data well. Additionally, the change of CFI between configural and metric invariance tests is within the threshold of 0.01, supporting the metric invariance across classifications of sport. The scalar invariance test also demonstrated that the indicators' intercepts were variant across sport classifications, as the CFI change between the scalar and metric invariance tests was not greater than 0.01.

Although the chi-square difference between the metric model and the scalar model is significant ($p < .05$), the change value of CFI is smaller than 0.01, suggesting that the metric and scalar invariance hypotheses are supported. Since the three invariance tests were all satisfied, the latent mean analysis could be conducted in the next stage.

Table 2. Measurement invariance tests of a 23-shortened Thai version of ACSI across groups

Model	χ^2	df	CFI	RMSEA (90% CI)	ΔCFI	$\Delta \chi^2$	Δdf
Gender							
Configural	744.66	440	.900	.041 (.036-.046)	-	-	-
Invariance							
Metric Invariance	754.97	458	.903	.042 (.037-.047)	.003	10.31	18
Scalar Invariance	800.54	476	.894	.041 (.036-.046)	-.009	45.57***	18
Variance	837.97	486	.885	.042 (.037-.047)	-.009	37.43***	10
Age							
Configural	763.24	440	.898	.043 (.037-.048)	-	-	-
Invariance							
Metric Invariance	778.60	458	.899	.042 (.036-.046)	.001	15.36	18
Scalar Invariance	826.29	476	.891	.042 (.037-.047)	-.008	47.69***	18
Variance	835.92	486	.890	.042 (.037-.047)	-.001	9.63	10
Type of Sport							
Configural	796.49	440	.891	.045 (.040-.050)	-	-	-
Invariance							
Metric Invariance	829.34	458	.886	.045 (.040-.050)	-.005	32.85*	18
Scalar Invariance	862.09	476	.883	.044 (.039-.049)	-.003	32.75*	18
Variance	865.48	486	.884	.044 (.039-.049)	.001	3.39	10
Classification of Sport							
Configural	789.75	440	.892	.044 (.039-.049)	-	-	-
Invariance							
Metric Invariance	825.45	458	.887	.044 (.040-.049)	-.005	35.70**	18
Scalar Invariance	857.77	476	.882	.044 (.040-.049)	-.005	32.32*	18
Variance	870.36	486	.881	.044 (.039-.049)	-.001	12.59	10

3. Latent Mean Analysis

After the invariance tests, the latent mean analysis approach was conducted to estimate the differences regarding the coping skills of the different groups. Latent mean analysis was performed by constraining the latent means of the reference group (i.e., males, 20 years, individual sport, indoor sport) to be zero. The latent mean estimates were displayed in Table 4, indicating that there exist significant differences with respect to CONC(coping with adversity/concentration), CONF(confidence and achievement motivation), GOAL(goal setting and mental preparation), PEAK(peaking under pressure), FREE(freedom from worry) of athletic coping skills.

Findings from latent mean comparisons showed that males reported higher coping with adversity/concentration (CONC), confidence and achievement motivation (CONF), goal setting and mental preparation (GOAL), and freedom from worry(FREE). Athletes 21 years of age or over had a higher score than athletes 20 years under on confidence and achievement motivation (CONF) and goal setting and mental preparation (GOAL). Individual sports athletes had more coping with adversity/ concentration (CONC) than team sports athletes. Outdoor sortsathletes had significantly lower confidence and achievement motivation (CONF), goal setting and mental preparation (GOAL), and freedom from worry (FREE) than indoor sports athletes. To compute the effect size in a standardized way, it has been suggested that Cohen's d indices could be calculated (Kember & Leung, 2011). The Cohen's d indices presented in Table 4 indicate that the values of effect size for four factors are medium.

Table 3. Tests of latent mean differences for gender, types, and classification of sport

Model	MD	CR(t)	<i>P</i>	Cohen's <i>d</i>
Gender				
CONC	-.225	-4.150	.001	.428
CONF	-.222	-3.684	.001	.394
GOAL	-.333	-5.527	.001	.610
PEAK	.017	.312	.755	.025
FREE	-.195	-3.422	.001	.313
Age				
CONC	.105	1.898	.058	.195
CONF	.126	2.091	.037	.220
GOAL	.156	2.591	.010	.283
PEAK	-.213	-3.717	.001	.309
FREE	.090	1.605	.108	.146
Type of Sport				
CONC	-.122	-2.218	.027	.228
CONF	-.059	-.973	.331	.102
GOAL	-.044	-.760	.447	.079
PEAK	-.111	-1.963	.050	.162
FREE	-.019	-.349	.727	.030
Classification of Sport				
CONC	.086	1.600	.110	.160
CONF	.124	2.049	.040	.216
GOAL	.144	2.499	.012	.262
PEAK	.049	.872	.383	.075
FREE	.110	1.977	.048	.176

* $p < .05$, ** $p < .01$; MD: mean difference; CONC: coping with adversity/concentration; CONF: confidence and achievement motivation; GOAL: goal setting and mental preparation; PEAK: peaking under pressure; FREE: freedom from worry.

DISCUSSION & CONCLUSION

Discussion

In this version, study there on are the two athletic main coping concerns: Skills Factor Inventory invariance (ACSI-23) and in latent its mean Thai differences. The notion of factor invariance, which is very important in order to make sure that a measurement tool is interpreted the same way by different groups of people, was

assessed across gender, age and type of sports at different levels (configural, metric, scalar, and variance), which established that ACSI-23 is a valid tool for measuring coping skills of Thai athletes of different age, gender, and athletic achievement (Gregorich, 2006; Byrne, 2010). This invariance is crucial in order to make comparisons across groups meaningful. Meanwhile, when testing latent mean differences as proposed by Kline (2016) and Sass (2011), it was found that there were statistically significant differences in coping skills according to the participants' demographic characteristics. Male, older athletes and those who engaged in individual sports had different coping skills as seen in previous research works (Arnold et al., 2016; Bourgeois et al., 2003). The same studies also agree with Bhadauriya & Tripathi (2018) and Nicholls & Polman (2007) where the need for demographic data in the psychological management and support of athletes is highlighted.

The aim of this study was to develop a shorter and more relevant instrument to measure psychological skills in athletes. This was done by shortening the existing 28 item Athletic Coping Skills Inventory (ACSI-28) through confirmatory factor analysis (CFA), a statistical method for assessing the structural validity of a scale (Brown, 2015). This led to the development of the ACSI-23 which has 23 items and five subscales that aim to measure concentration, confidence and achievement motivation, goal setting and mental preparation, peaking in pressure situations, and freedom from worry.

The ACSI-23 showed a high degree of construct validity and internal consistency and predict validity which is consistent with the studies that have used ACSI-28 (Smith et al., 1995). This therefore strengthens its reliability and its usefulness as a tool in assessing such skills among the Thai athletes of different age, gender and sporting discipline. The study also tested the factorial invariance by gender, age and type of sports, and this showed that ACSI-23 is insensitive to differences in groups, which is an important aspect of the measurement quality (Cheung and Rensvold, 2002). This is especially useful when interpreting the scores as the athletes belong to different categories. Also, the study also found out that gender, age and type of sport that one is practicing could play a role in the coping mechanisms of an athlete, which is in consistent with the works of other researchers (Arnold, Fletcher, & Daniels, 2016; Bourgeois et al., 2003). This underlines the need for the tailored approach to the psychological assistance to athletes taking into consideration their unique needs and experiences. Culture also affects how athletes are expected to behave, including the importance of respecting elders and authority figures such as coaches. This may explain why a Thai athlete might not vocalize a concern such as being unhappy or feeling offended by criticism from a coach (Item 3: when a coach or manager tells me how to correct a mistake I've made, I tend to take it personally and feel upset; Item

10: When a coach or a manager criticizes me I become upset rather than feel helped; Item 15: If a coach criticizes or yells at me, I correct the mistake without getting upset about it; and Item 27: I improved my skills by listening carefully to advice and construction from coaches and managers) as it may be seen as rude to challenge or disagree with a coach. Rather, they may have a tendency to suffer in silence, toady for their coach and focus on the task at hand and the possibility of improving themselves, which is in accordance with the cultural standard of hard work and skill development in which one has to learn to suffer through the feedback given by superiors. Such cultural standard on respect and coherence may also affect how athletes receive and act to feedback from coaches. This paper has identified that the Thai culture is a culture that values respect and harmony especially in the family and in the workplace including sports (Komin, 1991). It would be disrespectful and may be viewed as rebellion if a coach is challenged or argued with and thus a Thai athlete may not overtly express concern about getting upset or being offended by criticism. Rather, they may act passive and listen to the feedback and work on improving themselves as is the custom when one is in a subservient position to a superior (Matsumoto et al., 2008). Such cultural practice may also influence how athletes perceive and react to feedback from coaches. A Thai athlete may not express his or her feelings of being upset or being annoyed by criticism as it is deemed to be rude or may disturb the team spirit. Furthermore, Thai culture is collectivistic; people tend to adhere to group concerns and avoid actions that may be considered as self-serving or divisive (Triandis, 1995). Therefore, an athlete may reduce his or her verbal reporting of how he or she feels about the feedback received from coaching in order to avoid arguments or to draw attention to self. All these findings can help to explain why a Thai athlete would report less concern on these items than athletes from other cultural background who are more likely to voice their feelings and challenge the authority. However, it is important to note that these are just some of the cultural characteristics and every person responding to the questions will be different in his or her response. Although cultural values help in explaining possible behaviors, individual differences, prior history, and specific coach–athlete interactions also matter. Hence, it is imperative to take into consideration cultural influences as well as the individual factors when interpreting an athlete's reaction to the feedback received from the coach and designing his/her psychological intervention. Finally, the study also points out the need to make adjustments to the instruments used in sports psychology as pointed out by Borsa, Damasio & Bandeira (2012) and Cid et al. (2022). Translating the questions into another language can cause misleading results because the concepts of psychological skills may have different meanings in other cultures. The following tools should be adapted when translating into other languages by paying attention to the language, cultural, and sporting aspects to ensure that they are appropriate for different athletes. This makes sure that the tools are used as they should be and are helpful to both the athletes as well as the practitioners regardless of the cultural background.

The questionnaire was developed in an effort while to at decrease the the same length time of preserving the instrument level of its reliability and validity. In a similar manner, Chang, Yi and Song (2020) discovered that a novel 13-item short Chinese version of the Sport Orientation Questionnaire (SOQ-CA), which was developed based on the framework of Gill's original SOQ with 40 items, was found to be a reliable and valid instrument to measure sport orientation among Chinese adolescents. Dagnall et al. (2019) concluded that the 18-item Mental Toughness Questionnaire (MTQ-18) is a brief, widely used measure of mental toughness. The MTQ-18 is an abbreviation of the longer MTQ-48 which consists of four factors namely challenge, commitment, control and confidence. Despite deriving the items of MTQ-18 from across the different dimensions of MTQ-48, as intended, MTQ-18 does measure a single, overall factor. Arnold, Fletcher and Daniels (2016) as well as Bourgeois et al. (2003) have also pointed out that demographic factors such as gender, age or type of sport influence the psychological coping skills of athletes. The findings of this study are also consistent with the need for demographic characteristics in the psychological training and support of athletes as identified in other research works including Bhadauriya & Tripathi (2018) and Nicholls & Polman (2007).

This research aimed at creating a shorter and more appropriate instrument to assess the psychological skills in athletes. This was done by shortening the existing 28-item Athletic Coping Skills Inventory (ACSI-28) through confirmatory factor analysis (CFA), which is a statistical technique that is used to test the structure of a measurement tool (Brown, 2015). This led to the formation of the ACSI-23 with 23 items and five subscales which include concentration, confidence and achievement motivation, goal setting and mental preparation, peaking in pressure situations, and freedom from worry. ACSI-23 showed that the model had a good level of construct validity, internal consistency and predictive validity, which is consistent with the previous research on ACSI-28 (Smith et al., 1995). This therefore strengthens its reliability and its usefulness as a tool in assessing these skills in Thai athletes across different age groups, gender and types of sports. The study also established factor invariance across gender, age and types of sports and this showed that ACSI-23 is insensitive to differences in groups, which is an important aspect of measurement quality (Cheung and Rensvold, 2002). This is especially useful when comparing scores because the athletes can be of different categories.

Also, the current study found that gender, age, and type of sport that one is practicing may be factors that could affect an athlete's coping skills in line with what other researchers have found (Arnold, Fletcher & Daniels, 2016; Bourgeois et al., 2003). This underlines the need for the individual approach to the psychological

help to athletes, taking into account their characteristics and backgrounds. Culture also plays a role in the expected conduct of athletes including seniority and authority figures such as coaches. This may help to explain why a Thai athlete may not express concern such as being unhappy or feeling offended by critic from a coach (items 3 and 10): it may be seen as rude to argue with a coach. In contrast, they may suffer in silence, toady for their coach, and work and improve themselves, which is in accordance with the cultural standard of hard work and skill development in which one has to learn to suffer through the feedback given by the superiors. Such cultural standard on respect and coherence may also influence the athletes' perception and responses to coaching feedback. This paper has identified that the Thai culture is a culture that values respect and harmony in the family and at the workplace including sports (Komin, 1991). It would be viewed as rude and may be deemed as rebellion if a coach is challenged or an argument started with the coach and, thus a Thai athlete may not express his or her worry of getting angry or feeling offended by feedback. Instead they may act passive and listen to the feedback and work on improving themselves as is the culture when one is in a subordinating position to the superior. The dominant-subordinate relationship which is evident in the Thai culture may also affect how athletes perceive and react to feedback. A Thai athlete may not express concerns such as getting upset or getting offended by criticism as this will be deemed to be rude or will tend to cause a disturbance within the team. Furthermore, Thai culture is collectivistic; people tend to adhere to group concerns and avoid actions that can be considered as self-serving or will cause division (Triandis, 1995). Therefore, an athlete may reduce his or her verbal reporting of how he or she feels about the feedback received from coaching in order to avoid arguments or to draw attention to themselves. This cultural context assists in understanding why a Thai athlete would report less concern with these items than athletes from other cultural groups who are more likely to report feelings and challenge authority. Nevertheless, it is necessary to note that these are certain general characteristics of culture, and people from any culture may be different in their individual responses. Cultural values help in explaining possible behaviors, but individual differences, prior history, and specific coach-athlete relationships are also important. Hence, it is crucial to take into consideration cultural influences as well as the individual factors when analysing an athlete's reaction to the feedback received from the coach and prescribing some intervention. Finally, the study also shows the need to make some changes to the instruments used in sports psychology as pointed out by Borsa, Damasio and Bandeira (2012) and Cid et al. (2022). A direct translation of a questionnaire may not always produce right results this is because some psych skills may have different meanings in other cultures. The following tools should be adapted when

translating into other languages by paying attention to the language, cultural, and sporting aspects to ensure that they are accurate and relevant for use with different athletes. This makes sure that the tools effectively measure what they are trying to, which is useful for both the athletes and the practitioners in different cultures.

The questionnaire was developed with an aim of shortening the participants' time in responding to the items and at the same time ensuring that the reliability and validity of and the Song measurement (2020) are discovered not that compromised. Similarly, novel Chang, 13-item Yi short Chinese version of the Sport Orientation Questionnaire (SOQ-CA), which was constructed based on the framework of Gill's original SOQ with 40 items, was found to be a reliable and valid instrument to measure sport orientation in Chinese adolescents. Dagnall et al. (2019) concluded that the 18-item Mental Toughness Questionnaire (MTQ-18) is a brief, widely used measure of mental toughness. The MTQ-18 is an abbreviation of the longer MTQ-48 which has been broken down into four factors which include challenge, commitment, control, and confidence. Although the items of MTQ-18 were drawn from across the four factors of MTQ-48, as intended, MTQ-18 provides a single, overall score. Arnold, Fletcher and Daniels (2016) and Bourgeois and colleagues (2003) also found that gender, age or the type of sport that one is involved in affects psychological coping skills of athletes. The findings of this study are also consistent with the need for demographic characteristics in the psychological training and support of athletes as identified in other research works including Bhadauriya & Tripathi (2018) and Nicholls & Polman (2007).

Conclusion

The current study supports the multidimensionality of the shortened Thai version of Athletic Coping Skill Inventory-23 (ACSI-23). In addition, the ACSI-23 for Thai athletes is invariant across different groups (i.e., gender, age, type, and classification of sport) at the configural, full metric, full scalar, as well as full variance levels. Researchers can compare the concept of coping skills meaningfully across gender, age, and characteristics of sports for Thai national athlete's teams. Additionally, results from latent mean comparison indicated that the levels of coping skills were different across groups.

REFERENCES

- Arnold, R., Fletcher, D., & Daniels, K. (2016). Demographic differences in sport performers' experiences of organizational stressors. *Scandinavian Journal of Medicine & Science in Sports*, 26(3), 348-358.
- Bhadauriya, B., & Tripathi, R. (2018). Stress management technique for athletes during sports: A critical review. *Journal of Drug Delivery and Therapeutics*, 8(5-s), 67-72.
- Baric, R., & Horga, S. (2007). Adaptation and validation of the Croatian version

- of the Athletic Coping Skills Inventory (ACSI-28). *Kinesiology*, 39(1), 25-34.
- Besharat, M. A. (2007). Reliability and factorial validity of a Farsi version of the Athletic Coping Skills Inventory-28 (ACSI-28) with Iranian athletes. *Psychology of Sport and Exercise*, 8(4), 509-522.
- Borsa, C.J., Damásio., B.R., and Bandeira, D.R. (2012). Cross-Cultural Adaptation and Validation of Psychological Instruments: Some Considerations. *Paidéia (Ribeirão Preto)* 22(53):10.
- Bourgeois, A. E., Loss, R., Meyers, M. C., & LeUnes, A. D. (2003). The athletic coping skills inventory: Relationship with impression management and self-deception aspects of socially desirable responding. *Psychology of Sport and Exercise*, 4(2), 71-79.
- Byrne, B. M. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2nd ed.). New York, NY: Routledge.
- Chang, J., Yi, Y., and Song, N. (2020). Development and Validation of a Short Version Sport Orientation Questionnaire for Chinese Adolescents (SOQ-CA). *Front Psychol.* 17;11:1039. doi: 10.3389/fpsyg.2020.01039. PMID: 32625128; PMCID: PMC7311786.
- Cheung, S., & Kwak, Y. S. (2009). Validity and reliability of the Chinese version of the athletic coping skills inventory-28. *International Journal of Sport and Exercise Psychology*, 7(2), 189-200.
- Cid, L., Monteiro, D., Teixeira, D.S., Evmenenko, A., Andrade, A., Bento, T., Vitorino, A., Couto, F. N., and Rodrigues, F. (2022). Assessment in Sport and Exercise Psychology: Considerations and Recommendations for Translation and Validation of Questionnaires. *Front. Psychol., Sec. Movement Science*, Volume 13.
- Comani, S., Bortoli, L., & Robazza, C. (2003). Adattamento italiano dell'Athletic Coping Skills Inventory-28 (ACSI-28): Proprietà psicometriche e validità predittiva. *Giornale Italiano di Psicologia dello Sport*, 5, 5-17.
- Daroglou, G. (2011). Coping skills and self-efficacy as predictors of gymnastic performance. *The Sport Journal*, 14(1), 1-6.
- Dagnall N., Denovan, A., Papageorgiou, K.A., Clough, P.J., Parker, A., Drinkwater, K.G., (2019). Psychometric Assessment of Shortened Mental Toughness Questionnaires (MTQ): Factor Structure of the MTQ-18 and the MTQ-10. *Front. Psychol., Sec. Quantitative Psychology and Measurement*. Volume 10 - 2019 | <https://doi.org/10.3389/fpsyg.2019.01933>
- Fonseca, A. M., & Paula Brito, A. (2001). A adaptação do Athletic Coping Skills Inventory-28 à população desportiva portuguesa [The adaptation of the Athletic Coping Skills Inventory-28 to the Portuguese sports population]. *Revista Portuguesa de Ciências do Desporto*, 1(2), 41-51.
- Goudas, M., Hatzigeorgiadis, A., & Theodorakis, Y. (2006). Dutch version of the Athletic Coping Skills Inventory-28 (ACSI-28). *International Journal of Sport and Exercise Psychology*, 4(1), 45-54.
- Gaudreau, P., & Blondin, J. P. (2002). French translation and validation of the Athletic Coping Skills Inventory-28 (ACSI-28). *International Journal of Sport Psychology*, 33(4), 339-355.

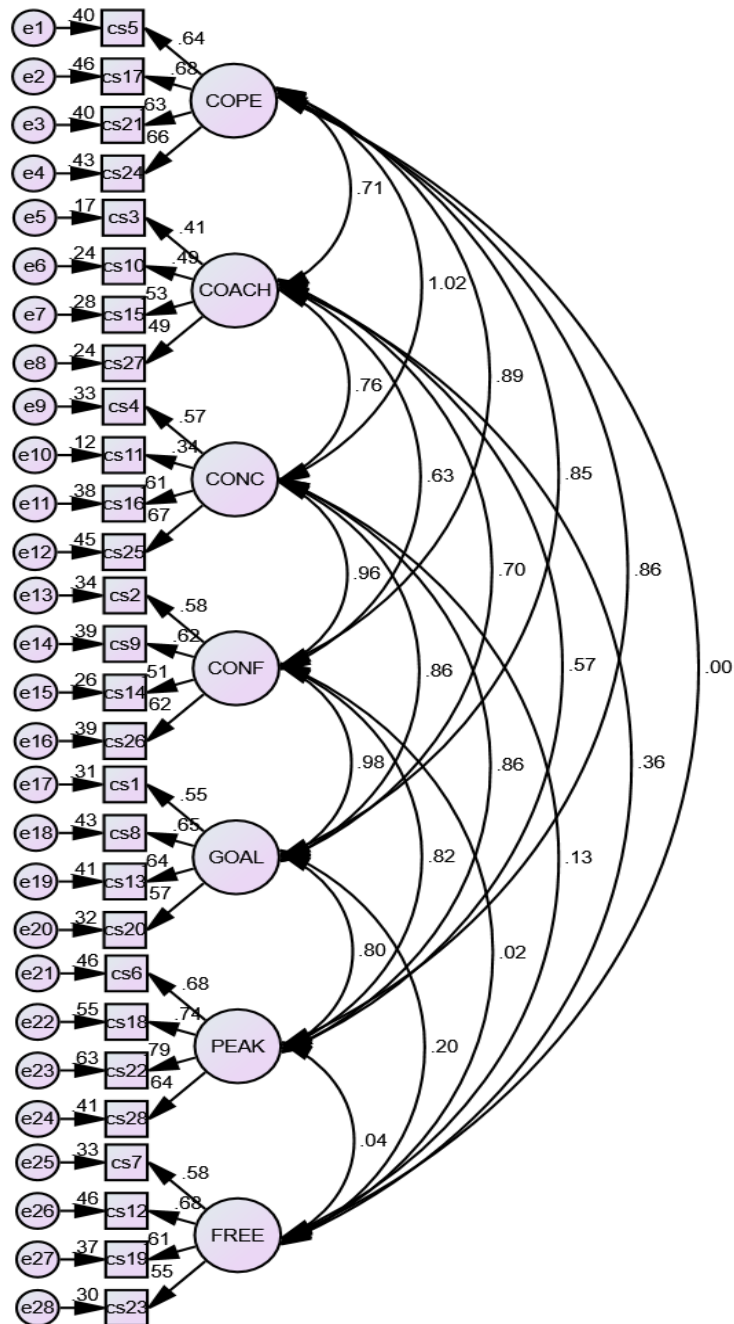
- Goudas, M., Theodorakis, Y., & Hatzigeorgiadis, A. (1999). Development and initial validation of the Greek version of the Athletic Coping Skills Inventory-28. *European Yearbook of Sport Psychology*, 3, 115-135.
- Graupera, J. L., Ruiz-Pérez, L. M., & García-Coll, V. (2006). Adaptación española del Athletic Coping Skills Inventory-28 (ACSI-28). *Revista de Psicología del Deporte*, 15(1), 33-52.
- Goudas, M., Theodorakis, Y., & Karamousalidis, G. (1998). Psychological skills in basketball: Preliminary study for development of a Greek form of the Athletic Coping Skills Inventory-28. *Perceptual and Motor skills*, 86(1), 59-65.
- Gould, D., Dieffenbach, K., & Moffett, A. (2002). Psychological characteristics and their development in Olympic champions. *Journal of Applied Sport Psychology*, 14(3), 172-204.
- Gregorich, S. E. (2006). Do self-report instruments allow meaningful comparisons across diverse population groups? Testing measurement invariance using the confirmatory factor analysis framework. *Medical Care*, 44(11), S78-S94.
- Han, M. W., & Park, J. K. (2002). Cross-cultural study of psychological skills development in sports: An application of the ACSI-28. *Korean Journal of Sport Psychology*, 13(2), 27-47.
- Hojka, V., Hřebíčková, S., & Slepíčka, P. (2006). Psychometrické vlastnosti české verze Dotazníku sportovních dovedností (ACSI-28). *Československá psychologie*, 50(6), 517-528.
- Hayes, A. F., & Coutts, J. J. (2020). Use omega rather than Cronbach's alpha for estimating reliability. But... *Communication Methods and Measures*, 14, 1-24.
- Kenny, S.J.; Palacios-Derflinger, L.; Owoeye, O.B.A.; Whittaker, J.L.; Emery, C.A. (2018). Between-day reliability of pre-participationscreening components in pre-professional ballet and contemporary dancers. *J. Danc. Med. Sci* 2018, 22, 54-62
- Kember, D., & Leung, D. Y. (2011). Disciplinary differences in student ratings of teaching quality. *Research in Higher Education*, 52, 278-299.
- Khemmarat, S., Thianthong, A., and Vongjaturapat, N. (2014). Development and Validation of a Thai Version of the Athletics Coping Skills Inventory. *Journal of Exercise and Sports Science*, 11(2). 7-20.
- Kimbrough, S., DeBolt, L., & Balkin, R. S. (2007). Use of the athletic coping skills inventory for prediction of performance in collegiate baseball. *The Sport Journal*, 10(1), 1-3.
- Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th Ed.). New York: The Guilford Press.
- Komin, S. (1991). *Psychology of the Thai people: Values and behavioral patterns*. Bangkok: National Institute of Development Administration.
- Matsumoto, D., Yoo, S. H., & Fontaine, J. (2008). Mapping expressive differences around the world: The relationship between emotional display rules and individualism versus collectivism. *Journal of Cross-Cultural Psychology*, 39(1), 55-74.

- McErlean, L. P. (2013). *An examination of the psychometric properties of the athletic coping skills inventory-28 for adult recreational runners*. Doctoral dissertation, Memorial University of Newfoundland.
- Milavić, B., Grgantov, Z., & Milić, M. (2013). Relations between coping skills and situational efficacy in young female volleyball players. *Facta Universitatis: Series Physical Education & Sport*, 11(2), 165-175.
- Miranda, R., Coimbra, D. R., Bara Filho, M. G., Miranda Júnior, M. V., & Andrade, A. (2018). Brazilian version (ACSI-28BR) of athletic coping skills inventory-28. *Revista Brasileira de Medicina do Esporte*, 24, 130-134.
- Nicholls, A. R., & Polman, R. C. J. (2007). Coping in sport: A systematic review. *Journal of Sports Sciences*, 25(1), 11-31.
- Nicholls, A. R., Taylor, N. J., Carroll, S., & Perry, J. L. (2016). The development of a new sport-specific classification of coping and a meta-analysis of the relationship between different coping strategies and moderators on sporting outcomes. *Frontiers in Psychology*, 7, e1674-e1674.
- Ozcan, V., & Gunay, M. (2017). The Turkish adaptation of athletic coping skills inventory-28 (ACSI-28): The validity and reliability study. *Turkish Journal of Sport and Exercise*, 19(1), 130-136.
- Pereira, F. S. A., Passos, M. A., Pesca, A. D., & Cruz, R. M. (2020). Coping measurement in the sports context: A systematic review. *Revista de psicología del deporte*, 29(2), 35-46.
- Polenske, A. D., Meyers, M. C., Wright, H. M., Robinson, S. K., & Shuman, K. M. (2022). Coping Skills of NCAA Division I Field Athletes. *Journal of Sport Behavior*, 45(3), 61-74.
- Salma C. L. & Meyers, M. C. (2019). Athletic and pain coping skills of competitive female equestrian athletes. *Journal of Sport Behavior*, 42(1), 91-108.
- Sanz, J. L. G., Pérez, L. M. R., Coll, V. G., & Smith, R. E. (2011). Development and validation of a Spanish version of the Athletic Coping Skills Inventory, ACSI-28. *Psicothema*, 495-502.
- Sass, D. A. (2011). Testing measurement invariance and comparing latent factor means within a confirmatory factor analysis framework. *Journal of Psychoeducational Assessment*, 29(4), 347-363.
- Silva, A. A. D., Freire, G. L. M., Fortes, L. D. S., Moraes, J. F. V. N. D., Carvalho, R. G. D. S., & Nascimento Junior, J. R. A. D. (2023). Coping in soccer athletes: A systematic review. *Journal of Physical Education*, 34, e3412.
- Singnoy, C., Chardenwattana, S., Chailert, P., Tanida Julvanichpong, T. (2022). The Mental Toughness and Coping Strategies of Thailand's Competitive Sailors. *Inter International Journal of Sports Science*, 12(2): 34-42. doi:10.5923/j.sports.20221202.02
- Smith, R. E., Schutz, R. W., Smoll, F. L., & Ptacek, J. T. (1995). Development and validation of a multidimensional measure of sport-specific psychological skills: The Athletic Coping Skills Inventory-28. *Journal of Sport & Exercise Psychology*, 17(4), 379-398.

- Smith, B. L. (2006). *Utilizing the athletic coping skills inventory-28 to predict competitive success in elite-level triathletes*. Doctoral dissertation, United States Sports Academy.
- Spieler, M., Czech, D. R., Joyner, A. B., Munkasy, B., Gentner, N., & Long, J. (2007). Predicting athletic success: Factors contributing to the success of NCAA Division I AA collegiate football players. *Athletic Insight*, 9(2), 22-33.
- Tamminen, K. A., Holt, N. L., & Crocker, P. R. (2012). Adolescent athletes: psychosocial challenges and clinical concerns. *Current Opinion in Psychiatry*, 25(4), 293-300.
- Triandis, H. C. (1995). Individualism & collectivism. Boulder, CO: Westview Press.
- Vičar, M., Koukal, V., Šašinka, V., & Vaculíková, P. (2021). Development and validation of the Czech version of the Athletic Coping Skills Inventory (ACSI-28) for soccer referees. *Acta Gymnica*, 50(4), 147-156.
- Yeomans, C., Comyns, T. M., Cahalan, R., Hayes, K., Costello, V., Warrington, G. D., & Kenny, I. C. (2019). The relationship between physical and wellness measures and injury in amateur rugby union players. *Physical Therapy in Sport*, 40, 59-65.

Appendix:

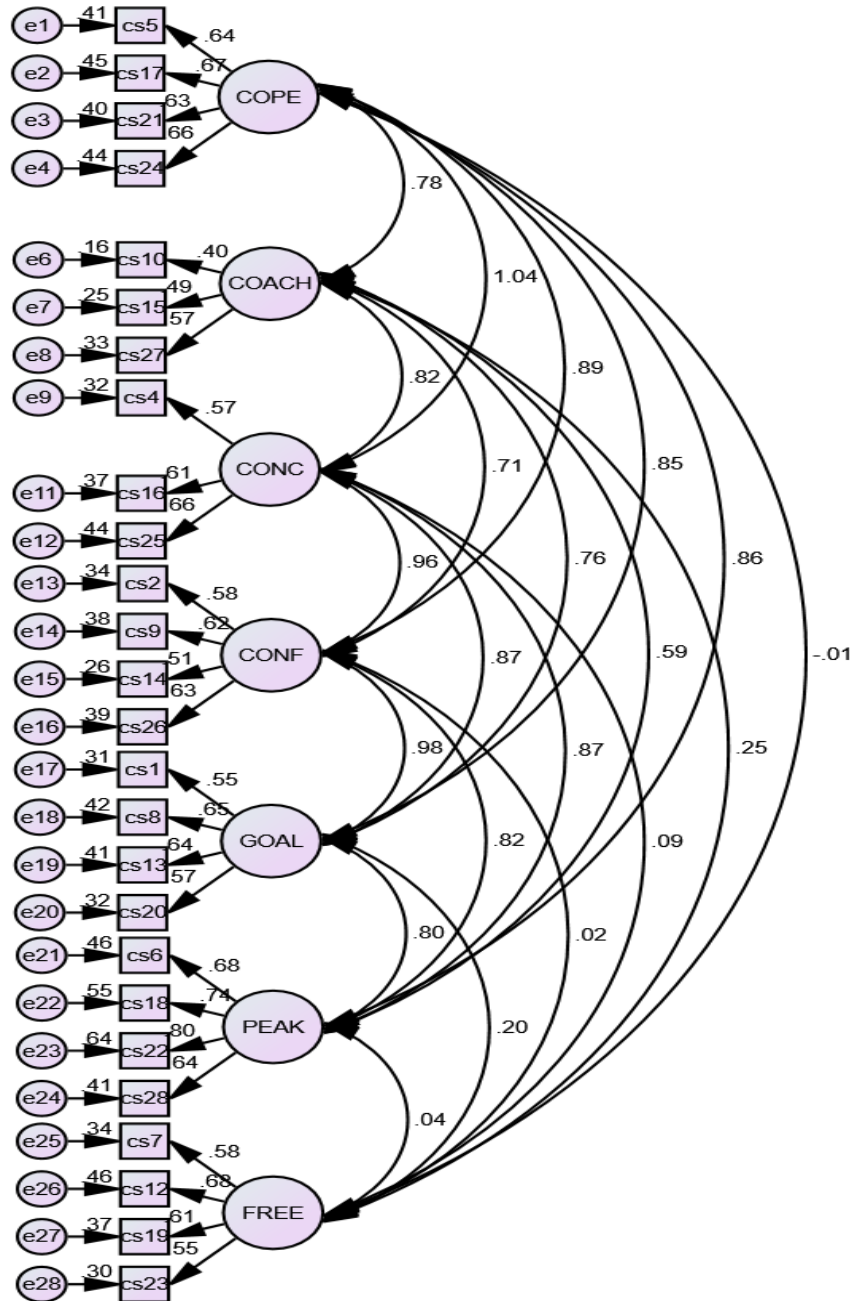
Model A. 28-item and 7-factor model



Note: factor loadings of cs3 and cs11 ≤ 0.50 ; Correlation coefficients between COPE and CONC ($r=1.02$)

Model B. 26-item and 7-factor model

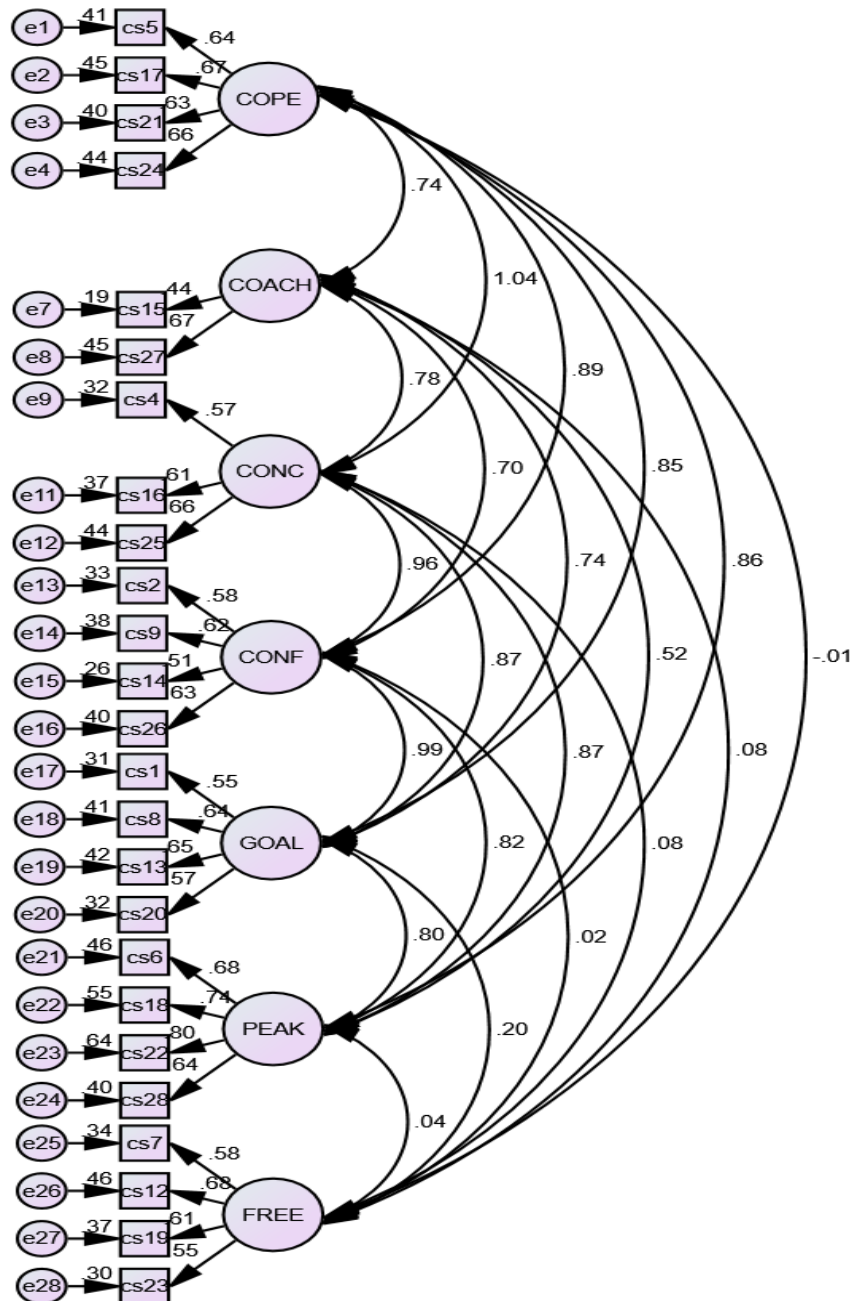
$\chi^2 = 636.50$, $df = 278$, $p = .001$, $CMIN/DF = 2.29$, $CFI = .896$, $TLI = .879$,
 $RMR = .040$, $RMSEA = .056$ (90% CI: .051, .062), $AIC = 782.50$



Note: factor loading of cs10 ≤ 0.50 ; Correlation coefficients between COPE and CONC ($r=1.04$)

Model C. 25-item and 7-factor model

$\chi^2 = 556.12$, $df = 254$, $p = .001$, $CMIN/DF = 2.18$, $CFI = .910$, $TLI = .894$,
 $RMR = .039$, $RMSEA = .054$ (90% CI: .048, .060), $AIC = 698.12$



Note: factor loading of cs15 ≤ 0.50 ; Correlation coefficients between COPE and CONC ($r=1.04$)

Model D. 24-item and 6-factor model

$\chi^2 = 459.01$, $df = 215$, $p = .001$, $CMIN/DF = 2.13$, $CFI = .922$, $TLI = .909$,
 $RMR = .039$, $RMSEA = .053$ (90% CI: .046, .059), $AIC = 581.01$

