



# French Validation of the Competitive Aggressiveness and Anger Scale (FVCAAS)

Youssef Albouza, Pierre Chazaud

## ► To cite this version:

Youssef Albouza, Pierre Chazaud. French Validation of the Competitive Aggressiveness and Anger Scale (FVCAAS). Psychologie Française, 2019, 10.1016/j.psfr.2018.11.003 . hal-02332075

**HAL Id: hal-02332075**

**<https://hal.science/hal-02332075>**

Submitted on 21 Dec 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

## **Validation Française de l'Échelle d'Agressivité et de Colère Compétitive (VFEACC)**

### **French Validation of the Competitive Aggressiveness and Anger Scale (FVCAAS)**

Youssef Albouza<sup>1,2</sup> and Pierre Chazaud<sup>3</sup>

<sup>1</sup>Université Côte d'Azur, LAMHESS, EA 6312, Nice, France.

<sup>2</sup>Université de Toulon, LAMHESS, EA 6312, Toulon, France.

<sup>3</sup>Université de Claude Bernard-Lyon 1, L-Vis, EA 7428, France.

Address for correspondence:

Youssef Albouza, PhD.  
Faculty of Sport Sciences  
Laboratory of Human Motricity, Education, Sport, and Health (LAMHESS, EA 6312)  
Nice Sophia Antipolis University  
261, route de Grenoble BP 3259  
06205 Nice cedex 03, France  
Tel.: +33 (0) 6 14 67 29 90  
Fax: +33 (0) 4 92 29 65 49  
Email: [youssefpr1@hotmail.com](mailto:youssefpr1@hotmail.com)

#### **Acknowledgement:**

We are thankful to our colleagues for their comments on an earlier versions of the manuscript. We are also immensely grateful to coaches and their athletes participating voluntarily in this research.

**Validation Française de l'Échelle d'Aggressivité et de Colère Compétitive (VFEACC)**

**French Validation of the Competitive Aggressiveness and Anger Scale (FVCAAS)**

## ABSTRACT

The aim of this study was to propose a French Validation of the Competitive Aggressiveness and Anger Scale (FVCAAS). The instrument was developed from the original version, which is composed of two subscales (six items by subscales) assessing aggressiveness and anger in competitive athletes (CAAS, Maxwell & Moores, 2007). Four studies have been conducted with 1,428 competitors. In the first study, the exploratory factor analysis extracted the two-factor structure from the original version, both with good internal consistency. The second study confirmed that the two-factor structure of the instrument was consistent with the original version and showed its partial invariance across genders. The third study demonstrated the temporal stability of the FVCAAS. In the fourth study, both concurrent and discriminant validities were confirmed, supporting the validity and reliability of the FVCAAS. The contributions of this study and limitations are discussed, together with perspectives for future studies of aggressiveness in competitive sports.

*Keywords:* Aggressiveness, Validation, Competitive Aggressiveness and Anger Scale, Structural equation modeling, Gender invariance.

## RÉSUMÉ

L'objet de cette étude est de valider une version française de l'échelle d'agressivité et de colère compétitive (VFEACC) parce qu'elle met l'accent sur les antécédents les plus importants de l'agression chez l'athlète. L'outil a été développé à partir de la version originale qui est composée de deux sous-échelles de six items mesurant l'agressivité et la colère des compétiteurs (CAAS, Maxwell & Moores, 2007). Quatre études ont été réalisées auprès de 1428 compétiteurs. Dans la première étude, l'analyse factorielle exploratoire reproduit le même model à deux factors de la version originale, avec de bonnes consistances internes [Colère:  $\alpha = .87$ ; Agressivité:  $\alpha = .84$ ; Échelle totale:  $\alpha = .81$ ]. La deuxième étude a confirmé la même structure à deux facteurs de la version originale avec de bonnes indices d'ajustement [ $X^2(53) = 100,77$ ; CFI et TLI  $\geq .95$ ; RMSEA et SRMR  $\leq .06$ ]. Aussi, elle soutient l'invariance partielle au niveau le plus contraint (i.e., strict) de la structure factorielle de la VFEACC à travers le genre et montre que cet instrument est valide pour les garçons et les filles. La troisième étude a montré la stabilité temporelle de la VFEACC. Les tests  $t$  se sont avérés non significatifs, ainsi les scores de corrélation, de consistance et de fiabilité étaient significatifs [ $r \geq .60$  ;  $\alpha \geq .69$  ; ICC  $\geq .60$ ,  $p < .05$ ]. Enfin, la quatrième étude a montré la validité concourante de l'instrument au travers de ses relations avec d'autres construits mesurant l'agressivité et la colère (Masse, 2001) et le désengagement moral en sport (Corrion *et al.*, 2010), aussi la validité discriminante a été vérifiée par les scores de comparaison selon le sexe d'athlète (garçons *vs* filles) et le type du sport (contact *vs* sans-contact). Ces résultats supportent la validité, la fiabilité et l'utilité de l'VFEACC pour mesurer l'agressivité et la colère compétitive chez les athlètes français. L'apport de cette étude, certaines limitations et des perspectives pour de futures recherches sur l'agressivité et la colère ont été discutées.

*Mots clés* : Agressivité, Validation, Échelle d'Aggressivité et de Colère Compétitive, Équation structurelle, Invariance selon le sexe.

The current research in applied sport and exercise psychology evidences that the Competitive Aggressiveness and Anger Scale (CAAS; Maxwell & Moores, 2007) has been one of the most efficient self-report inventories for measuring athletes' aggressiveness and anger over the past ten years in studying Chinese and American (Maxell, Moores, & Chowc, 2007; Visek, Maxwell, Watson, & Hurst, 2010), Greek (Bebetsos, Christoforidis, & Mantis, 2008; Bebetsos, 2018), and Portuguese athletes (Sofia & Cruz, 2012, 2017).

The construct validity of the CAAS has been demonstrated among Greek team handball athletes (Bebetsos *et al.*, 2008). The CAAS has also been useful in predicting aggressive behaviors or other outcomes in athletes through the relationship between its two subscales and both past unsanctioned aggression and professionalization in Hong Kong Rugby players (Maxwell & Vasik, 2009), and athletic experience among Greek male and female water-polo athletes (Bebetsos, 2018). Likewise, Sofia and Cruz (2017) confirmed the relationship between two subscales of the CAAS and anti-social behavior, provocation, aggressive behavior toward opponents and teammates, anger rumination, and state/trait anger expression in a sample of Portuguese athletes involved in sports with various contact levels (i.e., roller hockey, rugby, volleyball, basketball, kickboxing, and Greco-Roman wrestling).

Little is known, however, about the propensity for aggressiveness and anger among French athletes compared with the other athletes. This dearth of research is partly due to the lack of standard measurement tools that are linguistically, metrically, and conceptually equivalent for this sample of athletes. Thus, the research presented here describes the development of a French version of the CAAS (Maxwell & Moores, 2007).

A number of sports psychologists have noted that competitive, organized sport is conducive to unethical and aggressive behavior, particularly if such behavior is positively reinforced (Conroy, Silva, Newcomer, Walker, & Johnson, 2001) or a win-at-all-costs philosophy prevails (Keeler, 2007; Nucci & Kim, 2005). Researchers have shown that

athletes' aggression is related to a variety of contextual and personal factors, including the type of sport (Maxwell, Visek, & Moores, 2009; Mutz, 2012), training methods (Nosanchuk & MacNeil, 1989), level of competition (Maxwell *et al.*, 2009), sex (Coulomb-Cabagno & Rascale, 2005), moral disengagement (Boardley & Kavussanu, 2007; d'Arripe-Longueville, Corrion, Scoffier, Roussel, & Chalabaev, 2010; Stanger, Kavussanu, Boardley, & Ring, 2013), performance in contact sports (McCarty & Kelly, 1978; Sheldon & Aimar, 2001), and goal orientation (Rasclé, Coulomb, & Pfister, 1998; Dunn & Dunn, 1999).

Over the past 15 years, theories of aggression have emerged from a wide range of social and psychological perspectives (see Bredemeier, 1985; Kimble, Russo, Bergman, & Galindo, 2010; Maxwell, 2004; Russell, 2008). A number of quantitative studies have used self-report measures to examine aggression, particularly to predict aggression in on-field athletes (Kimble *et al.*, 2010). Several instruments are widely used by sport psychologists to study aggression: (a) the Buss-Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957); (b) Buss-Perry Aggression Questionnaire (BPAQ, an updated version of the Buss-Durkee Hostility Inventory; Buss & Perry, 1992); (c) the Bredemeier Athlete Aggression Inventory (BAAGI; Bredemeier, 1975); (d) the Continuum of Injurious Acts (CIA) and its variants (Bredemeier, 1985); and (e) the Sports Behavior Inventory (Conroy *et al.*, 2001).

Despite their popularity and the fact they have been widely used in the study of aggression, a number of studies have revealed some psychometric problems that may call into question the reliability and the validity of these instruments (Teubel, Asendorpf, & Banse, 2011; Maxwell, 2007; Bryant & Smith, 2001; Hennessy & Wiesensthal, 2001; Stephens, 1998; Wall & Gruber, 1986). At first, some studies reported that the structural models based on Buss and Perry's (1992) original four-factor (29-item) scale failed to replicate in three independent American (Bryant & Smith, 2001) and the Chinese samples (Maxwell, 2007), and achieved only mediocre goodness-of-fit (i.e., GFI = .76 - .81). Some of

the scale's items did not reflect the direct endorsement of aggressive traits, had low or multiple loadings, and reverse-scored (Bryant & Smith, 2001). Additionally, in the sport context, the German version of Buss and Perry's (1992) four-factor (27-item) scale failed to predict both aggressive behavior in players (i.e., fouls in ten minutes), and other outcomes such as scoring in ten minutes, and coach's judgment on game performance in semi-professional basketball (Teubel *et al.*, 2011). The authors indicated that the poor validity of this measure was one of the reasons for their results and confirmed the previous critiques. They noted that, "At the first, standard aggressiveness measures could be criticized for their poor validity in sport context (Maxwell & Moores, 2007)" (Teubel *et al.*, 2011, p. 397). In addition, the BAAGI (Bredemeier, 1975) is criticized for two main reasons: (1) analysis of the internal consistency revealed somewhat poor values for the instrumental subscale (Wall & Gruber, 1986), and (2) its items failed to account for differences across sports aggression (Stephens, 1998; Hennessy & Wiesensthal, 2001).

In fact, Maxwell and Moores (2007) made three important criticisms of these questionnaires, arguing that they (a) lacked validity, (b) were not sensitive to sport-specific confrontations, and (c) captured moods rather than traits. They indicated that "application of the Buss–Durkee and Buss–Perry scales is problematic in sport because some of the items refer to acts that are integral to performance in some sports and other items are not applicable" (Maxwell & Moores, 2007, p. 181). They also noted that aggression in athletes has been linked to anger arising, which is linked to increased arousal during the competition and acceptance of aggression; yet none of the existing questionnaires directly measured these factors of arousal arising and acceptance of aggression in sport. To overcome these problems, Maxwell and Moores (2007) suggested focusing on the most important antecedents of the aggression: anger and aggressiveness. Aggressiveness is defined as the "acceptance of and willingness to use abuse, both physical and verbal, to gain a competitive advantage"



(Maxwell & Moores, 2007, p. 185), and “anger can be triggered by a multitude of events that may occur externally (e.g., threatening language from an opponent or poor officiating) or internally (e.g., negative self-talk related to poor performance and memories of past defeat)” (Maxwell *et al.*, 2009, p. 289).

As a result, Maxwell and Moores (2007) developed the Competitive Anger and Aggression Scale (CAAS) on this basis to measure different antecedents of aggression in sport (i.e., the disposition to become aggressive, acceptance of and willingness to use aggression, incidents of irritation associated with losing, and negative emotions directed at opponents). In their study, the CAAS was developed through several phases. It began with constructing a pool of potential items rated on five-point Likert scales ranging from “not at all severe” (1) to “extremely severe” (5). Next, an Exploratory Factor Analysis (EFA) was used to evaluate the underlying structure of the items and two factors were extracted: anger and aggressiveness. Six items loaded saliently on each factor, which had a good internal consistency (Anger:  $\alpha = .87$ ; Aggressiveness:  $\alpha = .84$ ; Total:  $\alpha = .87$ ). Subsequently, a Confirmatory Factor Analysis (CFA) revealed that all the parameters had a good fit. The two subscales and the total scale also showed good test-retest reliability. Finally, the concurrent and discriminate validity were also supported, the CAAS score was positively associated with aggression as a personality trait as measured by the BPAQ, and varied across genders and sports. They showed that males scored higher than females on both anger and aggressiveness measures; the intensity of anger was relatively low, compared with aggressiveness, but endorsement by British athletes was higher. These analyses confirmed that the CAAS was a suitable instrument for measuring anger and aggressiveness in competitive sports. Hence, the CAAS, by its psychometrical quality, was tested and encouraged in cross-cultural studies, which showed that the two-factor structure of the 12-item CAAS was largely replicable

across cultures (Maxell *et al.*, 2007; Visek *et al.*, 2010; Bebetos *et al.*, 2008; Bebetos, 2018; Sofia & Cruz, 2012, 2017).

In conclusion, the evidence to date suggests that the CAAS was developed to measure antecedents of aggression in sport (i.e., the disposition to become aggressive, acceptance of and willingness to use aggression, incidents of irritation associated with losing, and negative emotions directed at opponents), is a valid measure of anger and aggressiveness in many sports, and that these concepts reliably differentiate players who admit unsanctioned aggression from those who do not (e.g., Maxell *et al.*, 2007; Visek *et al.*, 2010; Bebetos *et al.*, 2008; Bebetos, 2018; Sofia & Cruz, 2012, 2017). Therefore, the CAAS will be more appropriate in a variety of sports in measuring the traits of aggressiveness and anger than other standard aggressiveness measures that have been criticized for their poor validity in sports (e.g., Maxwell & Moores, 2007; Teubel *et al.*, 2011; Wall & Gruber, 1986; Hennessy & Wiesensthal, 2001).

However, according to Maxwell and Moores' critics, it appears that a valid questionnaire for measuring anger and aggressiveness does not actually exist among French competitive athletes. The aim of this study, therefore, was to test a French Validation of the Competitive Aggressiveness and Anger Scale (FVCAAS) based on the original CAAS, using a large sample of French competitive athletes.

In accordance with Vallerand's (1989) recommendations, the FVCAAS was developed through four studies: (a) development of a preliminary version of the FVCAAS (Study 1); (b) confirmation of the factor structure of the FVCAAS and testing its gender invariance (Study 2); (c) evaluation of the temporal stability of the instrument (Study 3); and (d) assessment of its concurrent and discriminant validity (Study 4).

## 1. Study 1

The aims of the first study were (a) developing items for a preliminary FVCAAS, (b) verifying the clarity of items using a sample of French athletes, and (c) assessing its structure using EFA.

## *1.1. Method*

### *1.1.1. Participants and procedure*

Sample 1a consisted of 30 athletes (15 men; 15 women;  $M_{age} = 15.66$  years;  $SD = 1.47$ ; range: 14-18) who were randomly selected from various individual and team sports; the sample was used to assess the clarity of the items of the FVCAAS. Sample 1b consisted of 201 volunteer athletes (109 males; 92 females;  $M_{age} = 19.61$ ;  $SD = 4.95$ ; range: 14-25) in a range of sports (e.g., handball, football, basketball, and judo). These athletes provided data for the EFA. They completed the initial FVCAAS at their clubs. Athletes under 18 were enrolled if they agreed to participate and their parents provided written consent for their participation, in line with ethical standards. Participation was voluntary and anonymous and participants were assured that their data would remain strictly confidential.

## *1.2. Results and Discussion*

### *1.2.1. Formulation of items*

First, in accordance with Vallerand's (1989) and Brislin's (1986) back-translation procedures, the CAAS was translated into French. Two independent translations into French, led by two English-language experts, were undertaken to establish the best expression of each item, and a French version was created thereafter. The French version was then translated back into English by a perfectly bilingual speaker. The French version was established based on this process of translating and adapting the instruments. The original CAAS and the French version FVCAAS were equivalent (Table 1). Responses to the FVCAAS items were

made on a five-point Likert scale (1 = almost never; 2 = occasionally; 3 = sometimes; 4 = quite often; 5 = almost always).

### *1.2.2. Assessment of item clarity*

In the second phase, the clarity of the 12-item FVCAAS was measured using a six-point Likert scale ranging from 1 (“not at all clear”) to 6 (“completely clear”). Sample 1a was asked to respond as honestly as possible to the questions and assured that their responses would be anonymous. The results showed that the items had satisfactory clarity ( $M = 4.88$ ,  $SD = 1.12$ ) and in one-to-one interviews all the participants declared that the items were easy to understand and represented their behaviors.

### *1.2.3. Exploratory factor analysis*

In the third phase, responses to the FVCAAS were analyzed using SPSS12.0 software. Principal component analysis followed by Oblimin rotation with Kaiser normalization revealed two six-item factors that together accounted for 45.90% of the variance in scores. The two factors were named “Anger” and “Aggressiveness,” and their initial Eigen values were 4.14 and 1.36, respectively; they accounted for 34.45 % and 11.38% of variance in scores, respectively. Also, factor loadings generally were good to high (Table 1).

Table 1 also shows that in descriptive terms the mean Anger score ( $M = 2.64$ ,  $SD = 1.23$ ) was higher than the mean Aggressiveness score ( $M = 1.94$ ,  $SD = 1.23$ ). Our results are in accord with Maxwell *et al.*’s (2009) study on Hong Kong Chinese athletes, which showed that the intensity of anger was relatively high, compared with the aggressiveness in different contact sports (i.e., basketball, rugby union, association football/soccer, and squash). Our results, however, did not support the early findings in British athletes (Maxwell & Moores, 2007). Our findings suggest that the expression of Anger may be more frequent than Aggressiveness among French athletes. Our results also support the idea that intense anger and irritation, which are generated by losing frequently or a referee’s mistakes, may be

reflected as an ineffective reaction directed at opponents or officials in French contact sports, such as soccer (Maxwell *et al.*, 2009; Reynes, Canovas, Ferrand, & Pantaleon, 2008).

All items had acceptably low skewness and kurtosis ( $< \pm 1.98$ ), and the distribution of data did not deviate significantly from normality. Both subscales and the scale as a whole showed good internal consistency, as measured by Cronbach's alpha (Anger:  $\alpha = .71$ ; Aggressiveness:  $\alpha = .76$ ; Total:  $\alpha = .82$ ).

**“(Insert Table I here)”**

## **2. Study 2**

The second study aimed to assess (a) the factor structure of the FVCAAS using CFA and (b) the gender invariance of the instrument according to previously described procedures (Chen, 2007; Cheung & Rensvold, 2002; Keith, 2015).

### *2.1. Method*

#### *2.1.1. Participants and procedure*

Two new samples of volunteer athletes who were competing regularly were recruited from various clubs. Sample 2a consisted of 252 athletes (141 male; 111 females;  $M_{age} = 18.84$ ;  $SD = 3.99$ ) and provided data for the first CFA. Sample 2b consisted of 619 athletes (310 males; 309 females;  $M_{age} = 16.97$ ;  $SD = 2.96$ ) and provided data for the second CFA and the invariance test. The athletes completed the FVCAAS using a five-point scale, ranging from 1 (“almost never”) to 5 (“almost always”).

#### *2.1.2. Data analysis*

CFAs were conducted using IBM SPSS AMOS 24 software (Arbuckle, 2016) to confirm the factor structure of our scale in a new sample (Sample 2a). The appropriateness of the model must assess with global goodness-of-fit indices to the data. The fit of the model was assessed using five indices, with the criteria for acceptable fit (Hu & Bentler, 1999)

given in the following parentheticals: chi-squared ( $\chi^2$ ); root mean square error of approximation (RMSEA;  $\leq .08$  at 90% CI); comparative fit index (CFI;  $\geq .90$ ); the Tucker-Lewis index (TLI;  $\geq .90$ ); and standardized root mean square residual (SRMR;  $\leq .08$ ).

The gender invariance of the FVCAAS was computed using procedures described previously (Chen, 2007; Cheung & Rensvold, 2002; Keith, 2015). Two perspectives were used: (a) the traditional perspective based on change on chi-squared ( $\Delta\chi^2$ ), and (b) the practical perspective based on differences in the comparative fit index ( $\Delta$ CFI). The  $\Delta\chi^2$  test allows one to compare nested models (e.g., configural vs. metric; metric vs. strong; and strong vs. strict), but due to its sensitivity to model complexity and large samples, it is nearly always large and statistically significant (Chen, 2007). Cheung and Rensvold (2002) recommended  $\Delta$ CFI over  $\Delta\chi^2$  based on its relative insensitivity to model complexity, sample size, and overall fit. They stated, “A value of  $\Delta$ CFI smaller than or equal to -.01 indicates that the null hypothesis of invariance should not be rejected” (Cheung & Rensvold, 2002, p. 251). In this study, in deciding whether the fit of more restrictive models was gender invariant we used Chen’s (2007) criteria for invariance between nested models given a sample of  $>300$ :  $\Delta$ CFI  $\leq .01$ ;  $\Delta$ RMSEA  $\leq .015$  and  $\Delta$ SRMR  $\leq .03$  for metric invariance; and  $\Delta$ CFI  $\leq .01$ ,  $\Delta$ RMSEA  $\leq .015$  and  $\Delta$ SRMR  $\leq .01$  for the more complex models.

## 2.2. Results and Discussion

### 2.2.1. Confirmatory factor analysis

To verify the two-factor structure suggested by EFA, we carried out CFA with a new sample. Figure 1 shows that the factor loadings were fair to high (.58-.78 for Sample 2a) and the CFA results provided good fit indices [CFI and TLI  $\geq .93$ , RMSEA  $\leq .08$ , and SRMR  $\leq .05$ ] and confirmed that the 12-item FVCAAS has a two-factor structure (Table 2). These results confirmed that the FVCAAS was similar to the original CAAS scale (Maxwell & Moores, 2007).

“(Insert Figure 1 here)”

### 2.2.2. Gender invariance

Table 2 reveals that the model fits each data group well, suggesting that the following invariance verification was meaningful. Also, it reveals that the configural invariance model was accepted, based on the global fit indices. There was a significant  $\chi^2$  value and good fit indices [CFI and TLI  $\geq .92$ , RMSEA = .05, and SRMR = .06], which makes it possible to envisage the metric invariance. Next, the metric invariance model was practically supported by the data. The addition of test loading factors reduced the fit according to  $\Delta\chi^2$  [i.e.,  $\Delta\chi^2 = 37.58$ ,  $\Delta p < .01$ ], due to its sensitivity to complex models and large samples, but not according to  $\Delta$ CFI,  $\Delta$ RMSEA, and  $\Delta$ SRMR. The change value for these measures was  $\leq .01$ , which is equal to or well below the recommended criteria (Chen, 2007; Cheung & Rensvold, 2002), which revealed that the FVCAAS two-factor structure between men and women should be similar. However, we rejected full, strong invariance. The differences in the  $\chi^2$  and CFI between the strong and the metric invariance models were very large and beyond the recommended criteria [i.e.,  $\Delta\chi^2 = 79.97$ ,  $\Delta p < .01$ ,  $\Delta$ CFI = .03]. Next, we tested for partial strong invariance. The modification indices put forward by the AMOS program suggested unconstraining the error of measurement for item agg1 (Violent behavior directed towards an opponent is acceptable) and item agg2 (It is acceptable to use illegal physical force to gain an advantage) in both groups, which the analysis showed satisfactory partial strong invariance according to changes in CFI and other fit indices [ $\Delta$ CFI = .01,  $\Delta$ RMSEA, and  $\Delta$ SRMR = 0]. Finally, partial strict invariance was also supported by data [ $\Delta$ CFI = .01,  $\Delta$ RMSEA = 0, and  $\Delta$ SRMR = -.01], implying that the test intercepts and test residuals were the same in both male and female groups (Chen, 2007; Cheung & Rensvold, 2002), with the exception of two items (agg1 and agg2). Therefore, an adaptation to improve the invariance in these items according to gender should be considered in future studies. In sum, this series of sample

analyses indicated partial invariance at the most complex (i.e., strict) levels of the FVCAAS factorial structure across genders.

“(Insert Table II here)”

### 3. Study 3

The aim of this study was to check the temporal stability and internal consistency of the FVCAAS.

#### 3.1. Method

##### 3.1.1. Participants and procedure

The new sample (Sample 3) consisted of 61 volunteer athletes (42 males, 19 females;  $M_{age} = 18.47$ ;  $SD = 4.91$ ) who undertook regular physical activity. They completed the FVCAAS twice (T1 and T2) in a four-week period as interval between two tests.

#### 3.2. Results and Discussion

The intraclass correlation coefficient (ICC) and 95% CI for the ICC, together with a series of paired-sample *t*-tests, were used to assess the temporal stability of the questionnaire’s structure. The ICCs and the ICC 95% CIs for both subscales are provided in Table 3. The ICCs were statistically significant in all cases. The ICCs for Anger, Aggressiveness, and the FVCAAS as a whole were .71, .71, and .79, respectively at T1. The corresponding values at T2 were .72, .60, and .66. These results indicate that both subscales and the FVCAAS had acceptable temporal stability. The results of *t*-tests comparing subscale scores at T1 and T2 were non-significant, indicating that FVCAAS responses remained similar over a four-week period. In addition, significant positive correlations were found between the first and second collections of data for each subscale (Anger:  $r = .63$ ; Aggressiveness:  $r = .60$ ; Total:  $r = .62$ ; all  $ps < .05$ ). These findings show that the FVCAAS and its subscales had good temporal stability over four weeks. Finally, the internal



consistency of the subscales was assessed at T1 and T2; once again the Cronbach's  $\alpha$  were acceptable (T1:  $\alpha = .72-.79$ ; T2:  $\alpha = .69-.71$ ).

**“(Insert Table III here)”**

#### **4. Study 4**

Study 4 had two aims. First, to assess the concurrent validity of the FVCAAS by calculating correlations between FVCAAS scores and scores on two other instruments measuring constructs that are theoretically related to those measured by the CAAS (Maxwell & Moores, 2007). The second aim was to check its discriminant validity.

In accordance with Maxwell and Moores's (2007) research, the concurrent validity was assessed by comparing subscale and total scores on the FVCAAS with (a) subscale and total scores on the French version of BPAQ (Masse, 2001), which measures four components of trait aggression (physical aggression, verbal aggression, anger, and hostility) and (b) an index of moral disengagement, which has been defined as “the self-regulatory process by which individuals cognitively restructure their inhumane conduct, the negative effects of their actions, their role in causing harm, or the targets of their transgressive acts” (d'Arripe-Longueville *et al.*, 2010, p.598). Researchers (e.g., Boardley & Kavussanu, 2007; d'Arripe-Longueville *et al.*, 2010; Stanger *et al.*, 2013) have demonstrated: (a) strong positive associations between sport-related moral disengagement and both negative affect (e.g., irritability) and antisocial or transgressive behavior (i.e., behavior intended to harm or disadvantage other athletes; the intention to cheat) and (b) moderate negative correlations between sport-related moral disengagement and prosocial behavior (i.e., behavior intended to help or benefit other athletes).

Next, to check the discriminant validity of the FVCAAS, we used a multivariate analysis of variance (MANOVA) to examine how FVCAAS subscale scores varied across genders and sports. Maxwell and Moores (2007) suggested that scores on the Competitive

Aggressiveness and Anger subscales of the CAAS varied across genders and sports. They reported that male athletes tended to be more aggressive in sports than female athletes, and that aggressive athletes were drawn to contact sports over non-contact sports.

#### *4.1. Method*

##### *4.1.1. Participants and procedure*

A new sample (Sample 4) of 175 volunteer athletes (106 males; 69 females;  $M_{age} = 19.59$ ;  $SD = 5.34$ ; range: 12-35) who were involved in high-contact (rugby:  $n = 83$ ) or low-contact (basketball:  $n = 92$ ) sports (see Table 5). This sample was recruited to verify the concurrent and discriminant validity of FVCAAS. The athletes completed four questionnaires to enable us to assess the correlations between the FVCAAS and (a) a French version of the BPAQ and (b) an index of moral disengagement. All participants were treated with APA ethical guidelines.

##### *4.1.2. Instruments*

###### *4.1.2.1. French Validation of the Competitive Anger and Aggressiveness Scale*

The 12-item FVCAAS developed for this research was used. In Sample 4 the 12-item model was a good fit for the data,  $\chi^2(53) = 118.48$ ;  $p < .01$ ; CFI = .90; TLI = .90; RMSEA = .07; 95% CI RMSEA: .06-.10; SRMR = .06. Values of Cronbach's alpha were good (Anger:  $\alpha = .78$ ; Aggressiveness:  $\alpha = .81$ ; Total:  $\alpha = .86$ ).

###### *4.1.2.2. Buss–Perry's Aggression Questionnaire*

The validated French version of the BPAQ (Masse, 2001) has been used to assess the various aspects of aggression in athletes. It consists of 20 items distributed unequally across four subscales; namely, physical aggression, verbal aggression, anger, and hostility. The physical aggression subscale measures one's tendency to be physically aggressive toward other people or objects (sample item: "If I have to resort to violence to protect my rights, I will"). The verbal aggression subscale measures verbal expression of aggression (sample

item: “When people annoy me I tell them what I think of them”). The anger subscale measures the respondent’s feelings of anger (sample item: “I sometimes feel like gunpowder ready to explode”). The hostility subscale assesses hatred of others and of life (sample item: “When people are especially nice to me, I wonder what they want”). Responses are given using a five-point Likert scale ranging from “Extremely uncharacteristic of me” (1) to “Extremely characteristic of me” (5). In this study the subscales had good internal consistency ( $\alpha$ : .75-.90; see Table 4).

#### 4.1.2.3. French Short Moral Disengagement Scale

Moral disengagement was assessed with the French Short Moral Disengagement Scale (Corrion, Scoffier, Gernigon, Cury, & d’Arripe-Longueville, 2010). The scale consists of three items measuring minimization of transgressions and their consequences (e.g., “It’s not serious if I behave badly [cheating or aggression] if it’s in order to win”) and three items measuring projection of fault onto others (e.g., “It’s not my fault if I behave badly [cheating or aggression] if my opponent started it”). Responses are given on a six-point Likert scale ranging from 1 (“Do not agree at all”) to 6 (“Completely agree”). The reliability of the scale as a whole is  $\alpha = .88$ .

### 4. 2. Results and Discussion

#### 4. 2.1. Concurrent validity of the FVCAAS

Correlations were used to evaluate the relationships between subscale and total scores on the FVCAAS and (a) subscale (physical aggression, verbal aggression, anger, and hostility) and total scores on the French BPAQ, and (b) moral disengagement. Pearson correlations indicated FVCAAS-aggressiveness, FVCAAS-anger and FVCAAS-total were systematically correlated with BPAQ-physical aggression, BPAQ-verbal aggression, BPAQ-anger, BPAQ-hostility, and BPAQ-total ( $r$ : .39-.57, all  $ps < .05$ ; see Table 4). These findings are consistent with the literature (e.g., Maxwell & Moores, 2007).

The concurrent validity of the FVCAAS was also demonstrated by the existence of the expected correlations between FVCAAS-aggressiveness, FVCAAS-anger, and FVCAAS-total and moral disengagement ( $r: .42-.55$ , all  $ps < .05$ ; see Table 4). These findings are in line with the other research demonstrating strong positive associations between moral disengagement and both antisocial and aggressive behaviors in sport (e.g., Boardley & Kavussanu, 2007; d'Arripe-Longueville *et al.*, 2010). As the FVCAAS was shown to be related to both the established constructs with which it was compared, we concluded that the instrument had concurrent validity.

**“(Insert Table IV here)”**

#### 4. 2.2. Discriminant validity of the FVCAAS

To determine how FVCAAS scores varied across genders and sports, we carried out a 2x2 between-subject MANOVA, with gender and types of sport as the independent variables and FVCAAS-aggressiveness, FVCAAS-anger, and FVCAAS-total as the dependent variables. Gender affected the results [Wilks's  $\lambda = .88$ ,  $F(2, 170) = 11.22$ ,  $p < .001$ ,  $\eta^2 = .12$ ] as did the type of sport [Wilks's  $\lambda = .85$ ,  $F(2, 170) = 5.33$ ,  $p < .01$ ,  $\eta^2 = .06$ ], but there was no interaction between gender and type of sport [Wilks's  $\lambda = .96$ ,  $F(2, 170) = 0.73$ ,  $p = .69$ ,  $\eta^2 = .004$ ]. Separate univariate ANOVAs were conducted to analyze group differences in each dependent variable. There were gender differences in FVCAAS-aggressiveness [ $F(1, 171) = 22.56$ ,  $p < .001$ ,  $\eta^2 = .16$ ], FVCAAS-anger [ $F(1, 171) = 6.82$ ,  $p < .01$ ,  $\eta^2 = .04$ ] and FVCAAS-total [ $F(1, 171) = 16.75$ ,  $p < .001$ ,  $\eta^2 = .11$ ]. The type of sport affected FVCAAS-aggressiveness [ $F(1, 171) = 6.71$ ,  $p < .05$ ,  $\eta^2 = .09$ ] but not FVCAAS-total [ $F(1, 171) = 1.65$ ,  $p = .2519$ ,  $\eta^2 = .01$ ] and FVCAAS-anger [ $F(1, 171) = 0.03$ ,  $p = .86$ ,  $\eta^2 = .01$ ]. No multivariate outliers were identified and the means are provided in Table 5.

As a result, discriminant validity was established based on the athletes' differences. A number of authors have reported that there is a gender difference in the tendency to value

aggressiveness and anger in sport (e.g., Maxwell & Moores, 2007; Christoforidis, Kalivas, Matsouka, Bebetos, & Kambas, 2010; Bebetos, 2018). This general observation was completely supported by our data. Male athletes had higher FVCAAS-total, FVCAAS-anger, and FVCAAS-aggressiveness scores than female athletes (Maxwell & Moores, 2007). In the present study, male athletes appear to take advantage of their anger more than female athletes. These findings may suggest that male athletes express their anger, though they experience persistent anger and therefore had a greater tendency toward expressing both their anger and aggressiveness compared with female athletes. However, our results are not consistent with the results of previous research showing no statistically significant differences between female and male athletes regarding trait anger and anger expression styles in taekwondo (Lapa, Aksoy, Certel, Çalışkan, Özçelik, & Çelik, 2013) and volleyball (Esfahani, Gheze, & Soflu, 2010). The results of this previous research were somewhat unsurprising given the nature of the psychosocial factors underlying anger, such as frequently losing or a referee's mistakes (Reynes *et al.*, 2008). This also makes sense when taking into account the importance of anger expression for the athlete's performance (e.g., Lapa *et al.*, 2013; Maxwell, 2004; Robazza & Bortoli, 2007), which may play a role in explaining these findings. But these are factors beyond the scope of the current study. Further investigation on possible associations between these factors may be warranted.

As expected, there were also differences in FVCAAS-aggressiveness based on type of sport. Athletes involved in high-contact sports had higher FVCAAS-aggressiveness scores than those involved in low-contact sports. This finding is consistent with previous results (Maxwell & Moores, 2007; Maxwell *et al.*, 2009). It may be that contact sports give players more opportunity for legitimate expression of aggression than non-contact sports.

“(Insert Table V here)”

## 5. General Discussion

The aim of this research was to develop and test a French Validation of the CAAS. First, the 12 items of the CAAS were translated by two English-language experts into French to create a preliminary list of items for the FVCAAS. The EFA indicated that these 12 items were organized equally into two factors, Anger and Aggressiveness, with satisfactory internal consistency (Study 1). Study 2 provided evidence of the factorial validity of the FVCAAS, its similarity to the original version, and demonstrated its partial invariance across gender at the most complex level (i.e., strict), also *an adaptation to improve the invariance according to genre was suggested for two items (agg1 and agg2) in future study*. The temporal stability of the instrument was also confirmed (Study 3). The concurrent validity of the FVCAAS was demonstrated by relationships between its scales and two instruments measuring constructs that are theoretically related to athletes' aggression. Additionally, the discriminant validity of the FVCAAS was demonstrated by the differences in scores associated with genders and sports (Study 4). Together, these analyses provide comprehensive evidence of the validity of the FVCAAS and its ecological validity because the item content was provided by junior and adult competitive athletes.

This series of studies carried out with French athletes resulted in the creation of six-item scales measuring competitive anger (sample item: "I become irritable if I am disadvantaged during a match") and competitive aggressiveness (sample item: "Opponents accept a certain degree of abuse"), which are structurally and theoretically valid, reliable, stable over time, and well-suited for testing assumptions about gender differences in anger and aggressiveness. The links between the FVCAAS and different facets of trait aggression and moral disengagement are in line with the existing sport psychology literature, which indicates that competitive anger and aggressiveness are associated with physical and verbal aggression, anger, and hostility (Maxwell & Moores, 2007). It also demonstrates that moral disengagement reduces negative emotional reactions to transgressive behavior and increases

one's self-reported likelihood of behaving antisocially in sport (e.g., d'Arripe-Longueville *et al.*, 2010; Stanger *et al.*, 2013).

Although the FVCAAS demonstrated good psychometric properties in this research, several limitations must be acknowledged. First, all research relying on self-report measures, particularly research concerning moral variables, may be subject to social desirability bias.

A second limitation is that the assessment of the scale's construct validity was limited to analysis of its convergent validity and ability to reproduce the gender and type-of-sport-related differences that exist in theoretically related constructs. There is, therefore, a need for further research into the scale's discriminant validity based on comparisons with scales measuring other constructs. The discriminant validity of the instrument would be strengthened by evidence that FVCAAS-anger and FVCAAS-aggressiveness are negatively correlated with theoretically related constructs, such as self-regulatory efficacy in sport (Boardley & Kavussanu, 2007; d'Arripe-Longueville *et al.*, 2010).

A third limitation is the specific focus of the FVCAAS. Despite the validity of the FVCAAS for measuring aggressiveness and anger in a variety of sports, some items (e.g., agg1, agg2, and ang6) that described the acceptability or normativity of aggression and anger expression against the opponent and the referee to gain a competitive advantage are more common and suitable in contact sports (e.g., football/soccer, basketball, rugby, and boxing) than non-contact sports (i.e., climbing, swimming, and gymnastics), which should be acknowledged (e.g., Conroy *et al.*, 2001; Maxwell & Moores, 2007). Therefore, it would be of interest in future studies to undertake more careful scientific investigations to improve the appropriateness of the aggressiveness subscale according to non-contact sport types, or change the format of the original five-point scale from (almost never = 1; occasionally = 2; sometimes = 3; quite often = 4; almost always = 5) to a six-point scale ranging from 1 ("extremely uncharacteristic of me") to 6 ("extremely characteristic of me") to eliminate the

scale's midpoint and force respondents to decide whether each statement was characteristic of them (Bryant & Smith, 2001).

A fourth limitation is that, to date, no predictive validity data are available for this study. The current results of different psychometric tests and their interpretations provide evidence that the FVCAAS is a valid measure of anger and aggressiveness in many sports, and thus there is no coherent argument against its future use with the French athletic population until such data are available to evaluate the test's predictive validity. Therefore, we proposed to continue testing the predictive validity of FVCAAS according to Maxwell and Moores', (2007) and Teubel *et al.*'s (2011) recommendations in future studies, as a second step of validating this scale. The recommendations of Maxwell & Moores (2007) and Teubel *et al.* (2011) indicates the importance of combining both implicit and explicit aggressiveness' questionnaires, interviews, and observations to gain better insight into aggression in sport, rather than relying solely on the subjective interpretation of the athletes. Accordingly, and consistent with prior studies providing the predictive validity of the original CAAS scale (e.g., Bebetos *et al.*, 2008; Maxwell & Vasik, 2009; Sofia & Cruz, 2017; Bebetos, 2018), we hypothesized the existence of a significant positive correlation between FVCAAS scores and frequency of observed aggressive behavior for players in the premier basketball league in France. It will be important to deepen this analysis in future studies.

It would also be of interest to compare the levels of anger and aggressiveness between French and British athletes, and to explore whether the cultural differences between France and Great Britain (Hébert & Dugas, 2010) influence their experiences and expressions of anger, as well as the use of aggressive tactics in their behaviors to achieve athletic success. Indeed, many empirical studies have reported that culture was a potential source of difference in aggressiveness between athletes. For example, Hong Kong Chinese athletes reported lower aggressive responses than both British (Maxwell *et al.*, 2007) and American athletes (Vissek



*et al.*, 2010), although the difference was not observed in anger (Maxwell *et al.*, 2009; Maxwell *et al.*, 2007). The anger reflected frustration provoked by losing points or games and an official's mistakes (Reynes *et al.*, 2008).

From a practical standpoint, the FVCAAS could help identify athletes with low or high anger or aggressiveness and determine how these constructs are related to performance among French athletes. Some studies have demonstrated that high aggressiveness and an intermediate level of anger enhance athletic performance, particularly in contact sports (e.g., McCarty & Kelly, 1978; Robazza, & Bortoli, 2007; Sheldon & Aimar, 2001). Anger may have a positive or negative effect on performance through its effect on arousal; moderate arousal enhances performance but high arousal has a detrimental effect. These findings suggest that aggressiveness and anger are significant aspects of an athlete's profile and should be taken into account to enhance training methods.

In conclusion, despite the aforementioned limitations, this series of studies fills a gap in the existing literature and demonstrates that the FVCAAS is a sound, sport-specific instrument for assessing competitive anger and aggressiveness in French athletes.

#### **Conflict of interest 'none'**

The authors declare that they have no links of interest.

## References

- Arbuckle, J. L. (2016). *IBM SPSS Amos 24.0. User's guide*. New York: IBM.
- Bebetsos, E., Christoforidis, C., & Mantis, K. (2008). Examination of athletes' aggressiveness and anger among Greek team handball athletes. *Exercise & Society*, 47, 80–86.
- Bebetsos, E. (2018). How important is the role of national division and experience on water-polo players' levels of anxiety and aggression? *Polish Psychological Bulletin*, 49(3), 360–364.
- Boardley, I., & Kavussanu, M. (2007). Development and validation of the Moral Disengagement in Sport Scale. *Journal of Sport & Exercise Psychology*, 29(5), 608–628.
- Bredemeier, B. (1975). The assessment of reactive and instrumental aggression. Dans In Landers, I. D. M. (Ed.), *Psychology of sport and motor behaviour II* (pp. 71–84). State College, PA: Penn State HPER Series.
- Bredemeier, B. (1985). Moral reasoning and the perceived legitimacy of potentially injurious acts. *Journal of Sport & Exercise Psychology*, 7(2), 110–124.
- Brislin, R. W. (1986). The wording and translation of research instruments. Dans In Lonner, W., & Berry, J. (Eds.), *Fields methods in cross-cultural research* (pp. 137–162). Beverly Hills, CA: Sage.
- Bryant, F.B., & Smith, B.D. (2001). Refining the architecture of aggression: A measurement model for the Buss-Perry Aggression Questionnaire. *Journal of Research in Personality*, 35(2), 138-167.
- Buss, A. H., & Durkee, A. (1957). An inventory for assessing different kinds of hostility. *Journal of Consulting Psychology*, 24, 349–354.
- Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, 63, 452–459.

553 Chen, F. F. (2007). Sensitivity of goodness of fit indices to lack of measurement invariance.  
 554 *Structural Equation Modeling*, 14, 464-504.

555 Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing  
 556 measurement invariance. *Structural Equation Modeling*, 9, 233–255.

557 Christoforidis, C., Kalivas, V., Matsouka, O., Bebetos, E., & Kambas, A. (2010). Does  
 558 Gender Affect Anger and Aggression in Handball Players? *The Cyprus Journal of*  
 559 *Sciences*, 8, 3–11.

560 Conroy, D. E., Silva, J. M., Newcomer, R. R., Walker, B. W., & Johnson, M. S. (2001).  
 561 Personal and participatory socializers of the perceived legitimacy of aggressive  
 562 behavior in sport. *Aggressive Behavior*, 27, 405–418.

563 Corrion, K., Scoffier, S., Gernigon, C., Cury, F., & d'Arripe-Longueville, F. (2010).  
 564 Development and factorial validity of a moral disengagement in Sport Short Scale.  
 565 *L'Encéphale*, 36(6), 495–503.

566 Coulomb-Cabagno, G., & Rascle, O. (2005). Team sports players' observed aggression as  
 567 a function of gender, competitive level, and sport type. *Journal of Applied Social*  
 568 *Psychology*. 36(8), 1980–2000.

569 d'Arripe-Longueville, F., Corrion, K., Scoffier, S., Roussel, P., & Chalabaev, A. (2010).  
 570 Socio-cognitive self- regulatory mechanisms governing judgments of the acceptability  
 571 and likelihood of sport cheating. *Journal of Sport and Exercise Psychology*, 32, 595-  
 572 618.

573 Dunn, J. G. H., & Dunn, J. C. (1999). Goal orientations, perceptions of aggression, and  
 574 sportpersonship in elite male youth ice hockey players. *Sport Psychologist*, 73, 183–  
 575 200.

576 Esfahani, N., & Gheze Soflu, H. (2010). The Comparison of Pre-Competition Anxiety and  
577 State Anger between Female and Male Volleyball Players. *World Journal of Sport*  
578 *Sciences*, 3(4), 237–242.

579 Hébert, T., & Dugas, E. (2010). France and Great Britain: the perception of aggressiveness in  
580 football seen from different angles. *International Review on Sport and Violence*, 94–  
581 103.

582 Hennessy, D. A., & Wiesensthal, D. L. (2001). Gender, driver aggression and driver violence:  
583 An applied evaluation. *Sex Roles*, 44, 661–676.

584 Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure  
585 analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling:*  
586 *A Multidisciplinary Journal*, 6, 1–55.

587 Keeler, L. A. (2007). The differences in sport aggression, life aggression, and life assertion  
588 among adult male and female collision, contact, and non-contact sport athletes.  
589 *Journal of Sport Behavior*, 30(1), 57–76.

590 Keith, T. Z. (2015). *Multiple regression and beyond: An introduction to multiple regression*  
591 *and structure equation modeling* (2nd edn.). NY: New York: Routledge.

592 Kimble, N. B., Russo, S. T., Bergman, B. G., & Galindo, V. H. (2010). Revealing an  
593 empirical understanding of aggression and violent behavior in athletics. *Aggression*  
594 *and Violent Behavior*, 15, 446– 462.

595 Lamarre, B.W., & Nosanchuck, T. A. (1999). Judo-The gentle way: A replication of studies  
596 on martial arts and aggression. *Perceptual and Motor Skills*, 88(3), 992-996.

597 Lapa, T.Y., Aksoy, D., Certel, Z., Çalışkan, E., Özçelik, M.A., & Çelik, G. (2013). Evaluation  
598 of trait anger and anger expression in taekwondo athletes in relation to gender and  
599 success. *Procedia - Social and Behavioral Sciences*, 93,1976–1979.

600 McCarty, J. F., & Kelly, B. R. (1978). Aggressive behaviour and its effect on performance  
 601 over time in ice hockey athletes: An archival study. *International Journal of Sport*  
 602 *Psychology*, 9, 90– 96.

603 Masse, C. (2001). *The aggression questionnaire. Adaptation, validation and implementation*  
 604 *of the French version Aggression Questionnaire de Buss et Perry*. Thèse de doctorat  
 605 dissertation. Université Joseph Fourier (Grenoble I).

606 Maxwell, J. P. (2004). Anger rumination: an antecedent of athlete aggression? *Psychology of*  
 607 *Sport and Exercise*, 5, 279–289.

608 Maxwell, J. P., & Moores, E. (2007). The development of a short scale measuring  
 609 aggressiveness and anger in competitive athletes. *Psychology of Sport and Exercise*, 8,  
 610 179 –193.

611 Maxwell, J. P., Moores, E., & Chow, C. C. F. (2007). Anger rumination and aggression  
 612 amongst British and Chinese athletes: a cross cultural comparison. *International*  
 613 *Journal of Sport and Exercise Psychology*, 5, 9–27.

614 Maxwell, J.P. (2007). Development and preliminary validation of a Chinese version of the  
 615 Buss-Perry Aggression Questionnaire in a population of Hong Kong Chinese. *Journal*  
 616 *of personality assessment*, 88(3), 284–294.

617 Maxwell, J., & Visek, J. (2009). Unsanctioned aggression in rugby union: Relationships  
 618 among aggressiveness, anger, athletic identity, and professionalization. *Aggressive*  
 619 *Behavior*, 35(3), 237–243.

620 Maxwell, J. P., Visek, A. J., & Moores, E. (2009). Anger and perceived legitimacy of  
 621 aggression in male Hong Kong Chinese athletes: Effects of type of sport and level of  
 622 competition. *Psychology of Sport and Exercise*. 10, 289 –296.

623 Miller, B. W., Roberts, G. C., & Ommundsen, Y. (2004). Effect of motivational climate on  
624 sportpersonship among competitive youth male and female football players.  
625 *Scandinavian Journal of Medicine and Science in Sports*, 14(3), 193–202.

626 Mutz, M. (2012). Athletic participation and the approval and use of violence: A comparison of  
627 adolescent males in different sports disciplines. *European Journal for Sport and*  
628 *Society*, 9(3), 177–201.

629 Nosanchuk, T. A., & MacNeil, M. L. C. (1989). Examination of the effects of traditional and  
630 modern martial arts training on aggressiveness. *Aggressive Behavior*, 15, 153-159.

631 Nucci, C., & Kim, Y. (2005). Improving socialization through sport: an analytic review of  
632 literature on aggression and sportsmanship. *Physical Educator*, 62(3), 123–129.

633 Rascale, O., Coulomb, G., & Pfister, R. (1998). Aggression and goal orientations in  
634 handball: Influence of institutional sport context. *Perceptual and Motor Skills*, 86,  
635 1347–1360.

636 Reynes, E., Canovas S, Ferrand, C., & Pantaléon N. (2008). Conséquences émotionnelles des  
637 erreurs d’arbitrage chez les footballeurs : étude exploratoire. *Psicologia & Sociedade*,  
638 20(1), 5-15.

639 Robazza, C., & Bortoli, L. (2007). Perceived impact of anger and anxiety on sporting  
640 performance in rugby players. *Psychology of Sport and Exercise*, 8, 875–896.

641 Russell, G. W. (2008). *Aggression in the sports world: A social psychological perspective*.  
642 New York: Oxford University Press.

643 Sheldon, J. P., & Aimar, C. M. (2001). The role aggression plays in successful and  
644 unsuccessful ice hockey behaviors. *Research Quarterly for Exercise and Sport*, 72,  
645 304–309.

646 Sofia, R.M., & Cruz, J. F. (2012). Adaptação e características psicométricas da "Escala de  
647 Agressividade e Raiva Competitiva": Estudo preliminar com futebolistas portugueses

- [Adaptation and psychometric characteristics of the “Competitive Aggressiveness and Anger Scale”: Preliminary study with Portuguese soccer athletes]. *Gymnasium - Revista de Educação Física, Desporto e Saúde*, 1, 210–237.
- Sofia, R.M., & Cruz, J. F. (2017). Unveiling anger and aggression in sports: The effects of type of sport, competitive category and success level. *Journal of Sport Psychology*, 26, 21–28.
- Stanger, N., Kavussanu, M., Boardley, I. D., & Ring, C. (2013). The influence of moral disengagement and negative emotion on antisocial sport behavior. *Sport, Exercise & Performance Psychology*, 2, 117–129.
- Stephens, D. E. (1998). Aggression. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp.277–292). Morgantown, WV: Fitness Information Technology, Ltd.
- Teubel, T., Asendorpf, J.B., & Banse, R. (2011). Implicite but not explicite aggressiveness predicts performance outcome in basketball players. *International Journal of Sport Psychology*, 42, 390-400.
- Vallerand, R. J. (1989). Toward a methodology for transcultural validation of psychological questionnaires: Implications for research in the French language. *Canadian Psychology*. 4, 662–680.
- Vissek, A. J., Maxwell, J. P., Watson, J. C., & Hurst, J. R. (2010). A cross-cultural evaluation of the factorial invariance of the competitive aggressiveness and anger scale. *Journal of Sport Behavior*, 33(2), 218-237.
- Wall, B. R., & Gruber, J. J. (1986). Relevancy of athletic aggression inventory for use in women’s intercollegiate basketball: A pilot investigation. *International Journal of Sport Psychology*, 17, 23–33.

**Table I: Les items de la VFEACC et l'échelle originale (CASS, Maxwell & Moores, 2007)**

**Table I: The items of the FVCAAS and original scale (CASS, Maxwell & Moores, 2007)**

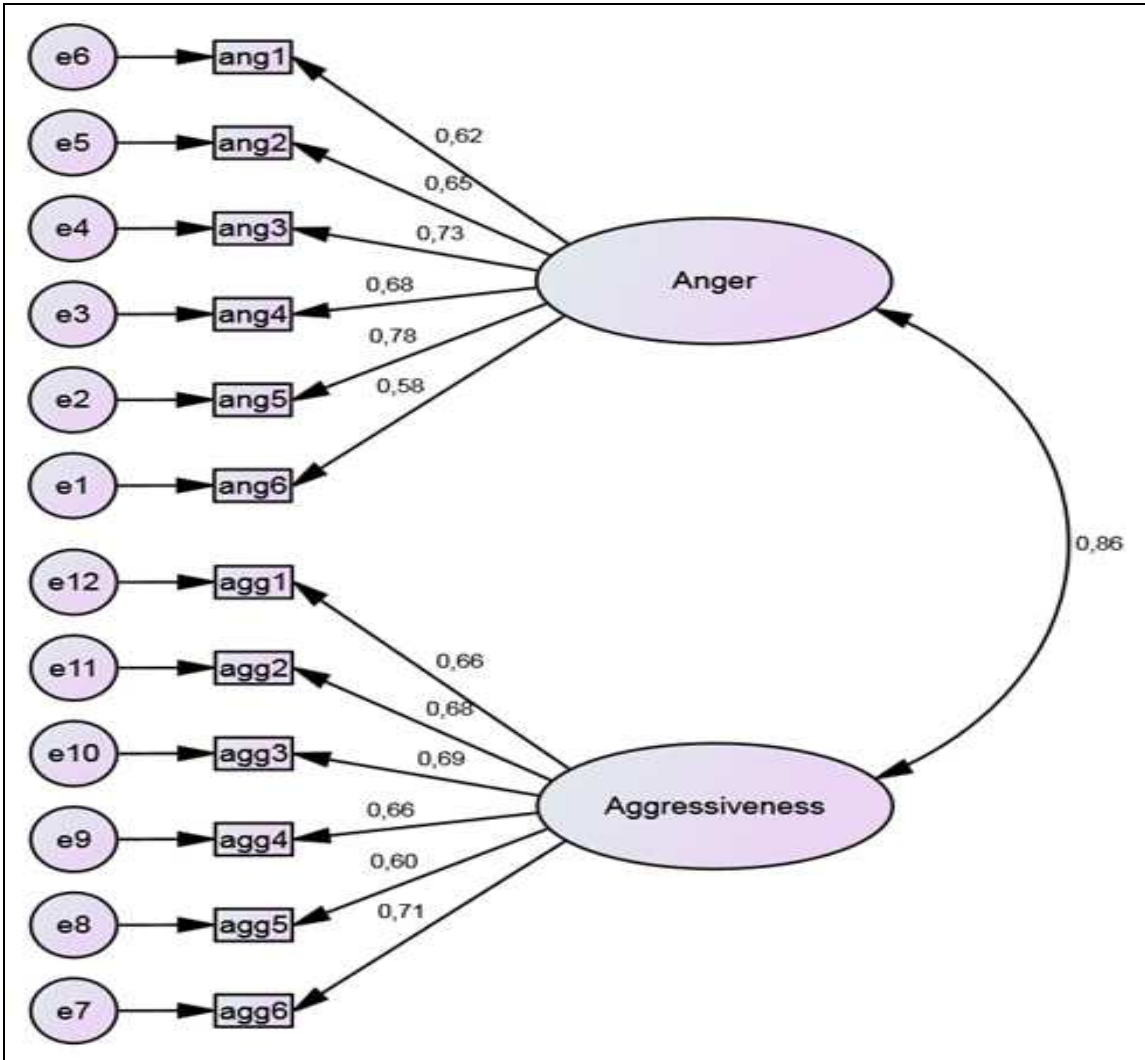
Items assigned to each factor	M	SD	skewness	kurtosis	$\alpha$	EFA
<b>Anger (F1)</b>	2.64	1.23	-0.70	-0.73	.71	
<b>Ang1.</b> I become irritable if I am disadvantaged during a match. <i>Je deviens irritable si je me sens dépassé(e) lors de ma prestation.</i>	2.83	1.22	-0.42	-0.97		.58
<b>Ang2.</b> I feel bitter towards my opponent if I lose. <i>J'en veux à mes adversaires quand je perds.</i>	2.37	1.25	0.64	-0.52		.64
<b>Ang3.</b> I get mad when I lose points. <i>Je deviens fou/folle quand je perds des points.</i>	2.27	1.26	0.74	-0.53		.69
<b>Ang4.</b> I show my irritation when frustrated during a game. <i>Je montre mon agacement quand je suis frustré(e) pendant ma prestation.</i>	2.36	1.26	0.59	-0.77		.55
<b>Ang5.</b> I find it difficult to control my temper during a match. <i>Je trouve difficile de contrôler ma colère pendant ma prestation.</i>	2.26	1.29	0.73	-0.51		.65
<b>Ang6.</b> Officials' mistakes make me angry. <i>Les erreurs des arbitres me font enrager.</i>	3.08	1.07	-0.13	-1.09		.66
<b>Aggressiveness (F2)</b>	1.94	1.23	0.81	0.72	.76	
<b>Agg1.</b> Violent behavior, directed towards an opponent, is acceptable. <i>Un comportement violent, dirigé contre un adversaire, est acceptable.</i>	1.69	1.07	0.17	0.17		.79
<b>Agg2.</b> It is acceptable to use illegal physical force to gain an advantage. <i>Il est acceptable d'utiliser une force physique non autorisée pour obtenir un avantage.</i>	1.96	1.23	1.28	0.38		.78
<b>Agg3.</b> I taunt my opponents to make them lose concentration. <i>Je provoque mes adversaires pour leur faire perdre leur concentration.</i>	1.89	1.29	1.29	0.16		.63
<b>Agg4.</b> I use excessive force to gain an advantage. <i>J'utilise une force physique excessive pour obtenir un avantage.</i>	2.61	1.33	0.26	-1.19		.60
<b>Agg5.</b> I verbally insult opponents to distract them. <i>J'insulte verbalement mes adversaires pour les distraire.</i>	1.35	0.87	1.74	1.86		.71
<b>Agg6.</b> Opponents accept a certain degree of abuse <i>Les adversaires tolèrent un certain degré de violence.</i>	2.16	1.13	0.17	-0.57		.55

Notes.  $\alpha$ : Cronbach's alpha; EFA: loading in the exploratory factor analysis. Ang: Anger; Agg: Aggressiveness. The items French translations are in italics. For each item the participant had to answer on a five-point Likert-type scale from "almost never" (1) to "almost always" (5),  $n = 201$ .



Figure 1: Coefficients standardisés d'estimation de la structure de la VFEACC

Figure 1: Standardized coefficients of estimation of the structure of the FVCAAS



Notes. The standardized coefficients of estimation are all significant at  $p < .001$ ,  $n = 252$ .

681 **Table II: Indices d'ajustement des modélisations structurales de la VFEACC.**

682 **Table II: Fit indices for the structural modelings of the FVCAAS.**

Models	$\chi^2$	df	p	CFI	TLI	RMSEA	90% CI	SRMR	ECVI	AIC	Comparison	$\Delta\chi^2$	$\Delta df$	$\Delta p$	$\Delta CFI$	$\Delta RMSEA$	$\Delta SRMR$
<b>Structure (n = 252)</b>																	
All (12 items)	100.77	53	< .01	.96	.95	.06	.04–.07	.05	.69	174.76	–	–	–	–	–	–	–
Anger (6 items)	17.26	9	.05	.98	.97	.06	.00–.10	.03	.21	53.25	–	–	–	–	–	–	–
Aggressiveness (6 items)	28.01	9	< .01	.96	.93	.08	.05–.13	.04	.25	64.01	–	–	–	–	–	–	–
<b>Gender invariance(n = 619)</b>																	
Man (n = 310)	190.08	53	< .01	.93	.91	.07	.07–.08	.05	.68	211.73	–	–	–	–	–	–	–
Woman (n = 309)	137.73	53	< .01	.95	.93	.06	.04–.07	.04	.62	192.68	–	–	–	–	–	–	–
Configural (non invariance)	256.42	106	< .01	.94	.92	.05	.04–.06	.05	.65	404.42	–	–	–	–	–	–	–
Metric ( $\lambda$ equal)	294.00	118	< .01	.93	.92	.05	.04–.06	.06	.67	418.00	1	37.58	12	< .01	.01	0	–.01
Strong ( $\tau$ equal)	373.97	130	< .01	.90	.90	.05	.04–.06	.06	.79	473.97	2	79.97	12	< .01	.03	0	0
Partial strong (tagg1, agg2)	323.44	126	< .01	.92	.92	.05	.04–.06	.05	.69	431.44	2	29.44	8	< .01	.01	0	0
Partial strict (δagg1, agg2)	360.26	134	< .01	.92	.91	.05	.04–.06	.06	.73	452.26	3	36.82	8	< .01	.01	0	–.01

683 *Notes.*  $\tau$ : Intercepts;  $\chi^2$ : Maximum Likelihood chi-square; df: degrees of freedom; TLI: Tucker-Lewis index; CFI: Comparative Fit Index; RMSEA: Root Mean Square Error of  
684 Approximation; 90% CI: Confidence Interval 90% for RMSEA; SRMR: Standardized Root Mean Square Residual; ECVI: Expected Cross-Validation Index; AIC: Akaike's  
685 Information Criterion;  $\Delta\chi^2$ : Difference in  $\chi^2$ ;  $\Delta\chi^2$  (ML): Difference in  $\chi^2$  (ML);  $\Delta df$ : Difference in degrees of freedom;  $\Delta CFI$ : Difference in comparative fit index;  $\Delta RMSEA$ :  
686 Difference in mean square error of approximation;  $\Delta SRMR$ : Difference in standardized root mean square residual..

687 **Table III: Les corrélations du test-retest (4 semaines) pour les échelles de la VFEACC.**

688 **Table III: Four-week test–retest correlations for the FVCAAS subscales.**

Scales	Temporal stability	<i>M</i>	<i>SD</i>	<i>α</i>	ICC	ICC 95% CI	<i>p</i>
Anger	T1	2.60	0.83	.74	.71	.60–.82	< .01
	T2	2.40	0.80	.71	.68	.54–.79	< .01
Aggressiveness	T1	2.04	0.75	.72	.70	.56–.80	< .01
	T2	1.97	0.60	.69	.60	.55–.62	< .01
Total	T1	2.33	0.66	.79	.76	.56–.84	< .01
	T2	2.18	0.57	.70	.66	.51–.77	< .01

689 *Notes.* *α*: Cronbach’s alpha; ICC: Intraclass Correlation Coefficient; ICC 95% CI: 95% Confidence Interval for  
690 the ICC, *n*= 61.

691 **Table IV: Liens de la VFEACC avec l'agression et le désengagement moral.**

692 **Table IV: Relationships between the FVCAAS and aggression and moral disengagement.**

Scales	Anger ( $\alpha = .78$ )	Aggressiveness ( $\alpha = .81$ )	Total ( $\alpha = .86$ )
FR-BPAQ Physical ( $\alpha = .75$ )	.39*	.51*	.52*
FR-BPAQ Verbal ( $\alpha = .80$ )	.45*	.47*	.51*
FR-BPAQ Anger ( $\alpha = .75$ )	.57*	.29*	.50*
FR-BPAQ Hostility ( $\alpha = .82$ )	.42*	.38*	.45*
FR-BPAQ Total ( $\alpha = .90$ )	.52*	.46*	.57*
Moral disengagement ( $\alpha = .88$ )	.42*	.55*	.53*

693 *Notes.* \* $p < .05$ . FR-BPAQ: French version of Buss and Perry's Aggression Questionnaire,  $n = 175$

**Table V: Moyennes et écart-types des échelles de la FVCAAS en fonction du group.**

**Table V: Means and standard deviations for the FVCAAS scales organized by group.**

Grouping factor	Group	Anger			Aggressiveness		Total	
		<i>N</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
All		175	2.45	0.81	1.95	0.80	2.20	0.71
	Males	106	2.58*	0.82	2.21*	0.81	2.93*	0.72
Gender	Females	69	2.25	0.75	1.55	0.59	1.90	0.59
	High-Contact	83	2.51	0.84	2.20*	0.89	2.35	0.77
Sport	Low-contact	92	2.40	0.78	1.71	0.63	2.06	0.63
	Males x High-Contact	63	2.61	0.76	2.36	0.85	2.48	0.27
Gender x Sport	Females x High-Contact	20	2.15	0.98	1.73	0.84	1.94	0.79
	Males x Low-contact	44	2.52	0.90	1.99	0.71	2.25	0.71
Gender x Sport	Females x Low-contact	49	2.29	0.64	1.47	0.44	1.88	0.49

*Note.* \* $p < .05$ ,  $n = 175$ .

697

### **Figure captions**

698 Table1: Theoretical structure of the FVCAAS was similar to the original scale (CAAS)

699 Figure 1: Validity of the theoretical structure of the FVCAAS

700 Table 2: Factorial validity of the FVCAAS structure and its partial invariance across gender

701 Table 3: Temporal stability of the FVCAAS

702 Table 4: Theoretical validity of the FVCAAS

703 Table 5: Usefulness of the FVCAAS to measur the differences amongst athletes' groups