ORIGINAL ARTICLE

# Aggression in martial arts coaches and sports performance with the COVID-19 pandemic in the background – a dual processing analysis

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**A** Study Design
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## Abstract

**Background and Study Aims**: Considering the dual processing model, human behaviour is guided by implicit and explicit processing. Implicit or automatic processing is essentially a spontaneous processing that occurs in the absence of conscious control. Coaches' aggression can be, therefore, assessed both explicitly and implicitly. The aims of our research were to identify what is specific for successful martial arts coaches, considering aggression and whether implicit aggression is a better predictor of sports performance than explicit aggression.

**Material and Methods**: Sixty-two martial arts coaches took part in the study. For assessing explicit aggression, Buss-Perry Aggression Questionnaire and the Romanian adaptation of the Makarowski's Aggression Questionnaire were used. Implicit aggression was measured through a test derived from the Implicit Associations Test (IAT) for self-concept measurement, using the 20+40 trials subdivision and the classic 7-block version.

**Results**: Coaches with international and national performances associated aggression (measured IAT) with others at a stronger level (M = 0.46 ±0.010), compared to novice coaches, at the beginning of their career (M = 0.38 ±0.08). The average value for verbal aggression is significantly higher [t(60) = 2.12, p = 0.038] in successful coaches (which obtained a slightly above average score) compared to beginners/ young coaches (below average score). The effect size index (Hedge's g = 0.51) shows a moderate difference between the results (for verbal aggression) of successful coaches and coaches at the beginning of their career. The binomial logistic regressions are statistically significant (p<0.05; "Omnibus test – Model"). The logistic regression models were statistically significant: VA - $\chi2(1) = 4.48$, p<0.05; IAT - $\chi2(1) = 10.29$, p<0.005. In the case of martial arts coaches, implicit aggression test is a better predictor of sports performance than explicit (verbal) aggression.

**Conclusions**: In the case of martial arts coaches, implicit aggression represents a better predictor of sport performances than explicit (verbal) aggression. The study results are also increasing awareness regarding the level of manifestation of different factors of aggression in successful coaches, thus preventing violent and unethical behaviours, with negative impact on well-being of young athletes (mainly). The study offers valuable resources for novice martial arts coaches (and not only), sports psychologists and researchers eager to better understand the role of indirect measures in sports performance.

**Key words**: aggressiveness • explicit aggression • implicit aggression • Implicit Associations Test • Makarowski's Aggression Questionnaire



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## INTRODUCTION

In sports, coaches represent significant figures, their behaviours, advice or aggressive manifestations being able to influence athletes' mental health, especially in the case of the youngest. Analysing the term „aggression", researchers [1], after conducting a review, present several definitions – a behaviour aimed at causing pain and damage, an activity of aggressive stimulus of one person directed towards another one (the aggressive stimuli could be verbal, physical or a gesture). However, in sport, aggressiveness carries a positive connotation, being typically applauded [2]. Specialized literature delimited instrumental aggression and hostile aggression [3]. Generally, aggressiveness and aggression in sport is instrumental, occurs with premeditation, rationally, being directed toward clear objectives. In performance sports athletes must act aggressively in order to defeat their opponents, but this type of aggression (instrumental) is regulated by rules and is accepted socially [4]. Thus, instrumental aggression is intended to procure an advantage within the boundaries of the game. When the primary goal of an athlete is to cause harm to another, we are talking about hostile aggression.

Aggressive behaviours could manifest in various forms: anger, dominance behaviour, verbal aggression, physical violence, or competition. The cognitive-neoassociationistic model of aggression [5] emphasizes the impact of exposure to situational cues associated with aggression. These stimuli activate another set of semantically associated ideas. This network of thoughts, beliefs and feelings functions as priming, increasing the predisposition for hostile behaviour. Individual differences in personality determine the level of shaping of these cognitive networks [6]. Thus, an individual prone to anger will have a wider network at the associative level, and this network will increase the probability that he or she will become aggressive when exposed to environments rich in stimuli associated with aggression. In accordance with The General Aggression Model (GAM) [7] the aggressive behaviour is influenced by the cognitions, arousal, feelings, by one's decisions, the persistent environmental factors (along with the biological ones) changing the knowledge structures and shaping personality. Researchers tested the GAM and trait aggression within the framework of the theory, in martial arts [8].

Martial arts and combat sports are part of the heuristic sport disciplines. In competition, under uncertainty, athletes have to make decisions in fractions of a second, they must be inventive in order to put into practice the most appropriate technical-tactical strategies, showing cold blood under stressful conditions [9]. Considering the main relationship between martial arts and combat sport, Kalina [10] emphasized: "every combat sport is martial arts but not vice versa" (p. 18). Martial arts and combat sports have the potential to convey moral and ethical values, one of the

**Explicit aggression** – *noun* intended at doing harm, causing pain, is deliberate, conscious and controlled (reflects the traditional definition of aggression) and is measured by means of questionnaires [40].

**Implicit aggression** – *noun* a more automatic and impulsive aggressive action, where the cognitive processes underlying the aggression are not totally within a person's conscious awareness [98].

**Implicit measures** – *noun* represent the expression of the associative structures which are suitable for the impulsive system [99].

**Implicit Associations Test (IAT)** – *noun* consists of "clusters of associations between the concept of the self and various psychological attributes (...) and the strength of these associations can be measured with a double-discrimination response latency task" [100].

**Martial arts** – *plural noun* any of various systems of combat and self-defense, e.g. judo or karate, developed especially in Japan and Korea and now usually practiced as a sport [101].

**Sports performance** – *noun* a bio-psycho-social value achieved in an official competition, as a result of a multiple determined capacity and assessed on the basis of rigorously established scales or criteria [102].

key aspect of martial arts training being the moral and social development of the practitioners, fostering higher ethical sensitivity [11]. Therefore, in relation to the codes of conduct in the martial arts, unethical behaviours are discouraged, being encouraged qualities such as: respect, trust, humility, honesty, righteousness, kindness, perseverance and responsibility. In Romania, the New Romanian Civil Code points out to a new form of civil liability - professional liability, in an attempt "to harmonise the Romanian sports legislation with those of the European and Euro-Atlantic structures in which we are integrated" [12]. More attention will be paid to malpractice in sports (in order to create the "particularisation of the professional liability of those involved in sports", including coaches), to professional and legal ethics (with deep moral meanings), the research on this topic being incipient in Romania.

In 2017, after a review of literature considering the link between aggression levels and sports success, researchers highlighted that the results are inconclusive [13]. They also found a higher level of aggression on less experienced and younger athletes. Authors underlined that the results on sports aggression are often contradictory, but these contradictions might stem from the various sports disciplines included in the studies [14]. When talking about martial arts, it was emphasized that long-term training in martial arts is linked to lower aggression [15-19]. We mention, also, that karate is perceived to entail less aggressiveness risks (in comparison to football) and brings more cognitive and emotional benefits [20]. Even without participation in competition, budo practitioners obtained a lower trait-aggression level than individuals from the control group [21]. Regarding gender differences, men display higher levels of aggressive behaviors than women regardless of the level of competition, type of practiced sport, or type of aggressive behavior measured [22]. However, in the case of anger, the differences between women and men (martial arts and combat sports athletes) were not statistically significant, while the level and duration of training did not determine the level of aggression in martial arts respondents [23]. Researchers underline a lack of attention to the aggressive behaviour of martial arts athletes (and coaches), the studies in sporting contexts focusing on ice hockey athletes, football athletes, rugby athletes, baseball or basketball athletes [24].

## Implicit and explicit aggression

According to the dual processing model, there are two ways of processing information [25]. Human behaviour is guided by implicit and explicit processing [26]. Implicit or automatic processing is essentially a spontaneous processing that occurs in the absence of conscious control, as a result of activating from memory a set of associations under certain conditions [27, 28]. Aggression can therefore be assessed both explicitly and implicitly [29]. Moreover, in the case of aggression we must take into account both ways of processing information, both automated and conscious/ deliberate, as both define and contribute differentially to aggressive behaviour [30]. If explicit aggression is measured primarily through questionnaires, implicit aggression is seen as the result of automated processes that can be assessed with indirect measurement tools (e.g., Implicit Association Test).

Implicit aggression is often conceptualized as an automatically activated self-attitude [31, 29], which can be triggered by situational characteristics [32]. In the case of impulsive aggression, implicit cognitive processing is considered a personality disposition/trait [33].

Explicit evaluation, as opposed to implicit/ indirect measure of aggression, generates two problems, namely: 1) the problem of desirable answers – this problem tends to be solved by implicit evaluations, being known that implicit measures allow only a low level of introspection [34] and 2) the problem of accessing from memory some relevant information about aggression. Individuals can remember these episodes in a differentiated way [35], whereas not everyone activates the knowledge structures associated with aggressive behaviour, and this may be due to a lack of introspection [36]. In the case of implicit measures, it starts from the idea that people create associative structures of social knowledge [37]. It seems that explicit assessments better predict controlled behaviour, while implicit measurements better predict impulsive behaviours [38]. Following a meta-analysis, researchers highlighted Implicit Association Test (IAT's) ability to predict various relevant behaviours [39]. The IAT is a „reaction-time-based classification task, measuring the association between the concept of self and the attribute aggressive by contrasting reaction times from two different response tasks" [40]. IATs to assess implicit aggression have been used in previous studies, with children [41, 29].

Specialized literature [42, 43] emphasized that aggressive behaviours generated by a challenge are well predicted by implicit aggression. However, this is also true if aggressive behaviour is not generated by a challenge [41, 29]. We specify also that predictive validity of IAT tends to be affected by a number of individual moderators [44, 45] or contextual ones [39].

To date, there are a limited number of studies which investigated implicit attitudes in sports. For example, implicit measures of beliefs about sport ability in basketball and swimming [46], or implicit attitudes towards sport in the case of elite athletes with low and high burnout symptoms [47] were assessed. Also, researchers used IAT for investigating implicit attitudes toward physical activity and sedentary [48], or in assessing implicit exercise importance [49]. Only one study took into account the ability of IAT (aggressiveness being studied), compared to explicit measures, to predict sports performance – in basketball players [50]. We mention a lack of studies considering implicit aggression level of coaches (and athletes) and its connection with sports performance.

### The current study

The aims of our research were to identify what is specific for martial arts coaches with top performances, considering aggression and whether implicit aggression is a better predictor of sports performance than explicit aggression. The current research analyses explicit traits (measured by questionnaires), which are relatively stable at personality level, manifesting in various circumstances [51, 52], while implicit (indirect) measurements are intended to find subconscious associations between mental representations of aggression (in our case) in memory [53]. Implicit measurements are investigating a combination of traits (stable features of the individual) and states – which are subjected to variation determined by situation-specific circumstances [54].

Starting from the results of studies [55-58], we made the elementary assumption that: investigation of explicit aggression reveals significant differences between successful martial arts coaches (having international or national performances) and novice coaches. Taking into account that due to the limited literature in a research area hypotheses are not formed [59], the following research questions (regarding the implicit aggression in coaches) were put forward:

1. Are there significant differences considering implicit aggression between successful martial arts coaches and novices?

2. If implicit aggression represents a better predictor of sports performance than explicit aggression in martial arts coaches?

## MATERIAL AND METHODS

### Participants

Since the emergence of COVID-19 many studies (in which case face-to-face interaction with the participants was preferable) and many nascent efforts have been put on hold [60]. Research on aggression in sport, at least at the beginning of the pandemic, was made via the Internet and using various remote work software platforms (physical contact being prohibited) [61, 62].

Sixty-two coaches have participated in the research (a face-to-face interaction took place). The distribution of martial arts coaches (C) according to gender, sports performances and sport disciplines (raw scores and percentages), in the total sample:

- $C_{1:}$ International performances at World or European levels 7 men (100%) training karate, fencing, kick-box, pankration and boxing;

- $C_{2:}$ National performances (trains national champions, vice-champions or athletes who are part of national teams) 16 men (72.7%) and 6 women (27.3%); the practiced sport disciplines are the same as $C_{1,}$ but also judo, kempo and taekwondo.

- $C_{3:}$ Novice coaches – have become coaches starting from 2017, this being the inclusion criteria for novice coaches 25 men (75.8%) and 8 women (24.2%), training the same sports disciplines as $C_2$ (but without pankration and kempo), having local/regional performances. We state that a coach could be highly experienced, even at the regional level. Many martial arts instructors tend to focus on other avenues such as: self-defence, cultural expression and the transmission of bodily knowledge. Considering these aspects, the inclusion criteria mentioned above was listed.

From the 62 martial arts coaches, 11.3% obtained international performances, 35.5% registered national performances, while 53.2% have local results.

The age of the 62 coaches was between 35 and 66 years (coaches with international and national results, *M* = 51.6 ±11.3), respectively between 23 and 26 years old (novice coaches, at the beginning of their career, *M* = 24.2 ±1.18). We used the snowball sampling technique due to the specifics of the investigated participants, being part of hard-to-reach populations (martial arts coaches having international, national performances or being novice coaches, having local results). Coaches are working at different sports clubs in Romania. We mention that martial arts and combat sports are popular in Romania, over time, athletes and coaches achieving great performances, starting, for example, with the gold and silver medals obtained at Olympic Games and World level in Greco-Roman wrestling [58] and ending with the silver medal obtained in fencing (épée) at the Tokyo Olympic Games in 2021.

## Measures

### *Explicit aggression measure*

For assessing the explicit aggression, The Aggression Questionnaire developed by A. Buss and M. Perry [63] and The Romanian adaptation of the Makarowski's Aggression Questionnaire for martial arts athletes [61] were used, in order to capture different facets of aggression.

The Aggression Questionnaire developed by Buss and Perry measures physical aggression, verbal aggression, anger (the emotional component of human behaviour), and hostility (the cognitive component of human behaviour). The questionnaire was translated into Romanian – no permission is needed for research purpose [63]. We mention that the internal consistency of the four factors was calculated for the present study (using Cronbach's alpha coefficient). The values were: **α**. = 0.82 for physical aggression, **α**. = 0.70 for verbal aggression, α. = 0.79 for anger, while **α**. = 0.74 in the case of hostility. Cronbach's alpha values were relatively similar to those in the original study (α. = 0.85 – physical aggression; **α**. = 0.72 – verbal aggression; α. = 0.83 – anger, while **α**. = 0.77 – hostility) [63]. The participants responded using a five-point Likert scale: (5) *Very often applies to me*, (4) *Often applies to me*, (3) *Sometimes applies to m*e, (2) *Usually does not apply to me* and (1) *Never or hardly applies to me*.

The Romanian adaptation of the Makarowski's Aggression Questionnaire for martial arts athletes consists of 15 items and measures the following dimensions: Go-ahead, Foul play and Assertiveness [61]. The coaches give their answers on a five-point Likert-type scale where 5 denotes *Definitely yes*, 4 – *Rather yes*, 3 – *Hard to say*, 2 – *Probably not* and 1 – *Definitely not*. There are no reverse-scored items. Regarding "Go-ahead" factor – the participant breaks obstacles, is courageous, attacks. Considering "Foul play" – the respondent has no scruples, is willing to block others (often in an unethical manner) in order to achieve his/her goal. "Assertiveness" is a feature of athletes and coaches who express what they feel or think while respecting peers, referees, opponents etc., their actions being within the boundaries of the game.

Along with the two questionnaires which measure explicit aggression, a social desirability scale was used, from the Zuckerman-Kuhlman Personality Questionnaire, part of the CAS$^{++}$ computerized platform, developed by Cognitrom and calibrated on the Romanian population [64]. No participant was removed from the research (we refer only to explicit aggression) following his/her responses to the social desirability scale.

### *Implicit aggression measure*

For implicit assessment of aggression we used a test derived from the Implicit Associations Test (IAT) for self-concept measurement, using the 20+40 trials subdivision [65] and the classic 7-block version first proposed by Greenwald and his team in 1998 [66].

In an IAT, participants have to classify a series of attributes (displayed in the centre of the monitor) in various categories which can be presented individually or grouped in pairs (displayed in the upper left and upper right of the monitor). An aggressive individual will have faster reactions and will make fewer mistakes when sorting the representative attributes for aggressive behaviours in the *Self* target category, *Aggression* or when grouped – in the *Self and Aggression* target category. The implicit association test used in this study included the following categories: Aggression, Non-aggression, Self and Others. For Self and Others categories, the words used as stimuli in IATs containing these categories were translated [36, 43]. Researchers showed that IAT containing stimuli which emphasize self-representation is more valid compared to the situation when idiographic stimuli are used (e.g., proper name or telephone number) [67]. The following attributes were used for each target category: Aggression – threat, hit, beat, swear, insult; Non-aggression – fair play, respect, fairness,

discipline, encouragement; Self – I, me, my, self, mine; Others – they, them, theirs, other, their (in the research all words were in Romanian language).

To ensure that the stimuli used are representative for the Aggression and Non-Aggression categories, we asked a group made of 32 martial arts athletes and 10 martial arts coaches to write as many words as they consider representative for the two proposed categories (in 20 minutes). Words having an above average frequency ($M$ = 9.4 ±5.23) were selected. At the end of this phase, 16 representative words were selected for the Aggression category, respectively 18 representative words for the Non-aggression category. In a second stage, another 25 participants (16 martial arts athletes and 9 martial arts coaches) were asked to evaluate on a scale of 1 to 5 (1 – to a very small extent, 2 – to a small extent, 3 – moderately, 4 – to a large extent, 5 – to a very large extent) to what extent the words are relevant to the category to which they belong (Aggression, respectively Non-aggression). For each word mean was calculated, the first five words being selected and included in the IAT (in both categories the values of the selected words were higher than 4 – Minimum $value_{Aggression}$ = 4.04, and Minimum $value_{Non\text{-}aggression}$ = 4.07; a value higher than 4 was our condition for including a word in the IAT, meaning that the word is relevant, at least to a large extent). The IAT lasts 16 minutes (the 7-block functioning – seen Table 1).

In the first block, Aggression (upper left) and Non-aggression (upper right) categories were displayed, and in the centre of the monitor, representative attributes for these categories were presented (20 trials). Also, for example, in the third and fourth blocks the categories: Aggression and Self (upper left), respectively Non-aggression and Others (upper right) were presented, and in the centre of the monitor representative attributes of these categories were displayed. In each block the task of the participants was to sort the stimuli into categories by pressing the E or I key on the keyboard. In the case of a correct answer (correct sorting of stimulus) a *smiley face* appeared on the screen, while incorrect sorting was followed by a *sad face* (participants were not able to correct their answer after an incorrect trial). The attributes of each target category (Aggression, Non-aggression, Self and Others) were set to appear randomly, as in Greenwald et al. study [66]. Also, the attributes of each category appeared the same number of times, considering each of the 7 blocks in the IAT. For example, in the first block, during the 20 trials, in the centre of the monitor were displayed the representative attributes (5) for Aggression category and the representative attributes (5) for Non-aggression category, randomly (each attribute was presented twice).

To calculate the score on IAT, we use the improved D-scoring algorithm with error penalty 600 ms – labelled as D4 [68]. A positive D-score refers to stronger association between aggression and self, whereas a negative D-score translates into a stronger association between aggression and others (or association of non-aggression with self). The interpretation thresholds for D-scores, considered as the standard cut-offs, are: 0.15 – weak association/slight; 0.35 – moderate association; 0.65 – strong association [69, 70]. Because we are aware of the somewhat arbitrary character considering the categorizations of D scores [71] we will avoid (throughout the present study) to interpret D scores (at the group level) as strong, moderate or weak association of aggression with self (or with others), instead, we will discuss about a stronger or a weaker association of aggression with self (or with others), in the case of investigated coaches. In order for the confidence

**Table 1.** Sequence of blocks in the IAT.

| Block | No. of trials | Function | Items assigned to left-key response | Items assigned to right-key response |
|---|---|---|---|---|
| 1 | 20 | Practice | Aggression | Non-Aggression |
| 2 | 20 | Practice | Self | Others |
| **3** | **20** | **Test** | **Aggression + Self** | **Non-Aggression + Others** |
| **4** | **40** | **Test** | **Aggression + Self** | **Non-Aggression + Others** |
| 5 | 20 | Practice | Others | Self |
| **6** | **20** | **Test** | **Aggression + Others** | **Non-Aggression + Self** |
| **7** | **40** | **Test** | **Aggression + Others** | **Non-Aggression + Self** |

intervals (in the case of D scores) to span below the 0.65 cut-off, meaning a slight or moderate bias (not a strong bias) [72], participants having |D| >0.65 were removed from research, in our case 9.67% of the total sample. Therefore, considering implicit aggression, the D-scores of the remained coaches (56) were statistically processed. The coaches having |D| >0.65 were from $C_2$ (two coaches, both men) and $C_3$ groups (four coaches, three men and one woman). A satisfactory internal consistency considering IAT (the results of trials within the same test) was registered for coaches (Cronbach alpha = 0.71).

We mention that in the case of our study, coaches obtained negative D-scores – automatically associated aggression with others. Why is aggression automatically associated with others (not with self) in the case of our IAT? Let's take a brief look at the words designated as representative for aggression in sports (designated by martial arts athletes and coaches in early stages of the study). We can easily observe that the words expressing aggression in sport (threat, beat, hit, swear and insult), generally, are closer to hostile aggression, going beyond the rules of the game.

It is very important to emphasize that recent research view IAT as a measure of inequality rather than as a measure of individual differences [73]. This inequality (IAT being seen as a "barometer of inequality") reflects a combination of structural and social factors, transient and stable differences, at individual level. Even if The Implicit Association Test and the individual D scores remain controversial, the noisy individual scores can reveal important patterns at the group level [72], in our case considering aggression, so it is still worth exploring this topic.

## Research design

The study is based on ex post facto research design (the analysis started after the fact has occurred – martial art coaches already obtained different sports performances, without interference from the researchers).

## Procedure

The questionnaires for assessing explicit aggression and IAT (assessing implicit aggression) were applied, in the presence of the experimenter, between November 2019 – March 2020 and then, the application continued starting with April 2021. The research was conducted in Romania. We mention that the gap of one year considering the application of tests was caused by the COVID-19 pandemic, the sports activity (in sports clubs) being stopped or constantly interrupted (in Romania, the vaccination campaign began on December 27, 2020).

During the lockdown period, athletes and coaches worked at home and exclusively online (on different remote learning platforms). When the conditions relaxed, the martial arts athletes and coaches were able to practice outdoors, for example on sports fields or in parks (special spaces have been created even on the buildings in which, normally, training took place), respecting the measures of social distancing. Martial arts competitions were organized in Romania (and televised), but without spectators. Only athletes and coaches had access in the competition hall, and they were previously tested against COVID-19. In October 2020, Bowman and Judkins [60] asserted: "As scholars we are faced with a moment of profound transformation as the pandemic, with its myriad challenging consequences for close-proximity, close-contact, physical interactions of all kinds, may well have intervened decisively into the future of martial arts (…). How many small and often struggling schools will survive the current period?".

Coaches completed the questionnaires and IAT on a computer, in front of the experimenter – similar computers were used by the researchers and the screen resolution was the one recommended by the computer (1920 × 1080 pixels). The application of the Implicit Associations Test was made with the help of the PsyToolkit platform [74, 75]. Coaches faced the screen of the computer at a viewing distance of approximately 50 cm. The experimental room was lit (the time of application varied between 10 a.m. and 4 p.m.).

Through the t-Test for Independent Samples, we verified whether there were significant differences between the specialists with international results (at World or European level), with national performances and beginner coaches. Due to the small number of coaches with international results (7), we grouped coaches with international and national performances in a single sample. The conditions for applying the t-Test were fulfilled.

In the next phase, knowing that verbal aggression and implicit aggression are specific to coaches with international or national performances, we verified to what extent implicit and explicit

aggression predict sports results. To achieve this goal we used binomial logistic regression procedures which estimates the probability for each case to be included in one of the defined DV categories: coaches having World or European results and coaches with local performances (we did not used the multiple binomial regression due to insufficient sample sizes). We further present the most important data of the main logistic regression analysis, predicting likelihood of international or national performances in coaches based on verbal aggression and IAT.

### Statistical analysis

The estimation of the results is based on the following indicators: frequency (N, n); mean (M); standard deviation (SD or ±). We used the following statistical analysis indicators: probability (*p*); Student's *t*-distribution (t); effect size index (g); skewness ($g_1$). We used: Cronbach alpha, the Levene's test, the t-Test, the logistic regression models.

### Ethics

The research was conducted in accordance with the Helsinki Declaration. The present study was approved by the local ethics committee of the National University of Physical Education and Sport, Bucharest, authorization number assigned is 2203. Written informed consent was obtained from all participants, data were treated confidentially and the anonymity of the participants was ensured.

## RESULTS

The Levene's test results were insignificant, p>0.05 (homogeneity of variances) and the dependent variables (DVs) were normally distributed (the skewness values $g_1$ were less than 1).

The coaches with international and national performances associated aggression (measured IAT) with others at a stronger level (*M* = 0.46 ±0.010), compared to novice coaches, at the beginning of their career (*M* = 0.38 ±0.08). The average value for verbal aggression is significantly higher [t(60) = 2.12, p = 0.038] in successful coaches (which obtained a slightly above average score) compared to beginners/ young coaches (below average score). The effect size index (Hedge's g = 0.51) shows a moderate difference between the results (for verbal aggression) of successful coaches and coaches at the beginning of their career (Table 2).

The average values for the other investigated factors of explicit aggression (go-ahead, foul play, assertiveness, physical aggression, anger and hostility) are not significantly different considering the two categories of participants.

When talking about the IAT scores, we emphasized a significant difference [t(54) = 3.34, p = 0.002] between successful martial arts coaches and beginners. The effect size index (g = 1.37) shows a very strong difference between the results (for implicit aggression) of successful coaches and novice coaches.

**Table 2.** Explicit aggression – coaches with international or national results ($C_1$ and $C_2$, *n* = 29) and beginners ($C_3$, *n* = 33).

| Variable | Results | | | | | | |
|---|---|---|---|---|---|---|---|
| | international and national | | local/regional | | Statistical indicators | | |
| | M | SD | M | SD | T | P | g |
| PA | 19.89 | 3.93 | 19.02 | 3.11 | 0.968 | 0.337 | 0.24 |
| VA | **15.51** | 2.35 | **14.21** | 2.67 | 2.12 | **0.038** | 0.51 |
| ANG | 18.13 | 2.95 | 16.98 | 3.37 | 1.52 | 0.134 | 0.36 |
| HOS | 20.52 | 3.11 | 21.27 | 2.49 | −1.06 | 0.293 | 0.27 |
| GO | 18.21 | 1.76 | 17.93 | 2.10 | 0.538 | 0.592 | 0.14 |
| FP | 8.66 | 1.59 | 9.06 | 1.80 | −0.934 | 0.354 | 0.23 |
| AS | 19.13 | 2.28 | 18.73 | 1.96 | 0.763 | 0.448 | 0.19 |

*Note:* **ANG** anger; **AS** assertiveness; **FP** foul play; **GO** Go-ahead; **HOS** hostility; **PA** physical aggression; **VA** verbal aggression

The models are statistically significant (p<0.05; "Omnibus test – Model"). The Hosmer and Lemeshow goodness of fit test is not statistically significant in the case of verbal aggression ($p$ = 0.954) and for IAT $p$ = 0.643 – in this situations, indicating that the models are not a poor fit (Table 3).

The logistic regression models were statistically significant: VA $\chi2(1) = 4.48$, p<0.05; IAT $\chi2(1) = 10.29$, p<0.005. In the case of martial arts coaches, we can assert that implicit aggression test is a better predictor of sports performance than explicit (verbal) aggression. The models explained almost 9% (VA), respectively 22% IAT (Nagelkerke $R^2$) of the variance in international or national results and correctly classified 56.5% (VA), respectively 69.6% (IAT) of cases. Sensitivity was 66.7%, specificity was 44.8% (for verbal aggression), while sensitivity was 69.0% and specificity was 70.4% (implicit aggression).

## DISCUSSION

The contribution of the variables in predicting sports performance is important, representing valuable resources for present and future coaches for their personal and professional development. The effect size index ($R^2$) shows a moderate to strong relation between implicit aggression and sport performance, and a moderate to small relation between explicit aggression and sports performance. We can assert that a slightly above average level of verbal aggression and implicit aggression (successful coaches automatically associated aggression with others at a stronger level, compared to novice coaches) were associated with an increased likelihood of obtaining top performances in martial arts coaches.

Martial arts (and sports, generally) suppose a specific behavioural code which includes ethical and moral values [61]. In light of this code, the acts of uncontrolled violence are discouraged and should rarely occur. But the fierce struggle for winning in competition and the "win-at-all-costs philosophy" which manifests, especially, in the case of young people, can determine violence and aggressive behaviours, in athletes and coaches [76]. Therefore, the management of aggression is an important phenomenon, in a changing world, affected by various issues (most recently by the COVID-19 pandemic).

In a first phase we highlighted the facets of explicit aggression specific to coaches with superior results in competition. We found that the average value for verbal aggression is significantly higher in successful coaches (obtained a slightly above average score), compared to beginners (below average score). We mention that along the time few researchers have investigated verbally aggressive behaviour in coaching [77]. In 2015, Bekiari and Syrmpas [56] emphasized that coaches' verbal aggression negatively predicted athletes' satisfaction, while Mazer et al. [55] argued that coaches' high level of verbally aggression affects coach's credibility. Also, investigating 15 top coaches from different sport disciplines (including martial arts specialists), authors highlighted that coaches with Olympic, World or European performances registered lower scores for neuroticism and significantly higher scores than novice coaches considering agreeableness and conscientiousness, and succeed in controlling their own reactions [58]. In these conditions, and taking into account, also, the results of other studies [55, 57] which suggest that coaches' abusive leadership style affects athletes performance and motivates athletes less, we can argue that

**Table 3.** Results of the binomial logistic regressions analysis.

| Variable | Verbal aggression (VA) | IAT |
|---|---|---|
| Omnibus test – Model | **0.034** | **0.001** |
| Hosmer and Lemeshow test | 0.954 | 0.643 |
| Nagelkerke $R^2$ | 0.093 | 0.224 |
| Wald test | 4.068 | 8.318 |
| *B* | 0.220 | 0.097 |
| *Odds ratio values* | 1.246 | 1.101 |
| Confidence interval for *Exp(B)* | 1.006 to 1.543 | 1.031 to 1.176 |

high levels of explicit aggression are not specific to elite coaches. Therefore, our study results are in line with specialized literature (successful martial arts coaches does not have a high level of verbal aggression). Our findings are increasing awareness regarding the level of verbal aggression in martial arts coaches with superior results in competitions – this level being (generally) slightly above average. The results are important considering that little has been studied in healthy adults practicing martial arts [78].

We mention that in the case of the results obtained by martial arts coaches for: go-ahead, foul play, assertiveness, physical aggression, anger and hostility, there were no significant differences between the two categories of participants. However, is possible to underline some interesting aspects: martial arts coaches having international or national performances obtained slightly higher values for anger, physical aggression, go-ahead, assertiveness and slightly lower scores for hostility and foul play, than martial arts coaches having local/regional results. Considering the norms [63, 61], we can say that martial arts coaches having international or national performances registered (at the group level) below average scores for physical aggression and foul play, a slightly below average score for anger, averages values for hostility and go-ahead and slightly above average scores for assertiveness. We can observe that in the case of the ability to break obstacles and attack, to persistently pursue the goals ("Go-ahead" factor) the successful martial arts coaches obtained an average score. An average value considering go-ahead could be explained if we discuss the results in the framework of the Yerkes-Dodson law [79]. Therefore, the best performance (generally) is obtained when a moderate level of activation, stress and motivation is reached. A high level of motivation and perseverance is recommended to perform a simple task (to maintain concentration and avoid boredom), instead, a moderate level of motivation, stress, is preferable when dealing with difficult and complicated tasks [80] – and sports competitions involves difficult and complicated situations.

Considering the implicit aggression test (IAT scores) coaches with international and national results automatically associated aggression with others at a higher level than novice coaches did. This can be explained through the fact that sport, by its nature and specificity, is a stress-generating environment [81, 82]. We can think at unpleasant remarks coming from supporters, mass-media (even from athletes or other coaches), the psycho-social conditions, fear of failure or even success, issues related to self-esteem (for example, following a weaker result), doubts about one's own abilities, time management etc. We argue that successful coaches, automatically associating aggression with others at a stronger level (than novice coaches), and having a slightly above average level of verbal aggression, better models the competition in training and generates, in the training process, an emotional tension closer to that from competition – being known that sports competitions suppose pressure, are characterized by unique situations, with a high social and financial stake, involving public and mediated actions [83-85].

In the second phase, we were interested in highlighting to what extent implicit and explicit aggression predicts sports performance. To achieve this goal we used binomial logistic regression procedures, predicting likelihood of international or national performances in coaches based on verbal aggression and IAT. We can argue that implicit aggression is a better predictor of sports performance than explicit (verbal) aggression. The predictor variables were statistically significant, representing valuable resources for present and future coaches for their professional and personal development considering the aggressive behaviour. Martial arts coaches, together with sport psychologists, could shape aggression according to the so-called master model of a given sports discipline. We mention a gap in the specialized literature considering implicit aggression level of coaches and its connection with sports performance. For various researchers, the results could represent a starting point to better understand the role of indirect measures in sports performance. We highlighted a moderate to strong relation between implicit aggression and sport performance, and a moderate to small association between explicit (verbal) aggression and martial arts coaches' performances. Increasing verbal aggression to a slightly above average level and also implicit aggression (successful coaches automatically associated aggression with others at a stronger level) was linked with an increased likelihood of obtaining international or national results. We underline that regarding IAT (coaches' aggression) and sports performance, the studies are inexistent. In 2011, Teubel et al. [50] emphasized that IAT (*Aggressiveness* IAT) is a better predictor of

sport performance (translated through coach's judgements on game performance and court playing time) than direct measures, in semi-professional male basketball players (in this case, athletes were investigated and it is perhaps the only study investigating IAT capacity to predict performance outcome in sport).

Our research provides knowledge application for working with future coaches, this aspect being less approached by the current literature [86]. For the personal development of martial arts coaches, in terms of aggressive behaviour (an invaluable process for coaches, generally, in order to optimise their sports performance [87]), various techniques could be used. These may involve: self-monitoring of emotional reactions, awareness of their own motivations, increasing self-confidence [88]; working on Para verbal and nonverbal communication skills; analytical relaxation and autogenic training; inner monologue (positive self-talk), ways of learning conflict mediation and positive resolution of social conflicts, and greater involvement in motor activities which gives them great satisfaction [89]. Not least, knowing that training practices can influence athletes' behaviour and psychological experiences (according to the GAM), the so called *internal* techniques (breathing and self-control, meditation) could be used, having the capacity to reduce state hostility and to ameliorate aggressive impulses in martial arts training [8].

The findings of the present research extend previous studies and, also, addressed gaps in specialized literature. The investigation results presented are subject to some limitations. Maybe the most important limitation of the present study is represented by the controversial aspect of the individual D scores (and IAT), considering the large confidence intervals [72]. For this reason, the participants having |D| >0.65 were removed from the research, this way, maintaining a slight or moderate bias in the case of the results. Even if it is a strength of the study the investigation of coaches with international performances (at World or European level), one could argue that the results must be analysed, separately, for each martial art discipline. New experimental investigations might focus on one specific discipline (e.g., boxing, fencing, taekwondo etc., on other individual, but also team sport). We can observe, also, that the sample of coaches is rather small. Future studies must include larger samples in each martial art discipline and a greater number of coaches having international performances. We mention, also, that the situation regarding the IAT could be different if different words were chosen (in the initial phases of the study), as specific to aggression in sports, e.g., dispossession, warning (not threat), shout (not swear or insult) – we can think of the haka ritual in rugby – "Ka Mate" [90, 91], etc. All these are aspects within the rules of the game, behaviours strategically used to gain an advantage. Also, the results could be different if researchers will use other methods of measuring implicit aggression (Conditional Reasoning Test or Picture Story Exercise).

Advances in the field of sports science and cognitive psychology easily (and largely) enable automatized assessments of individual's cognitive processing in sport [92], the study of implicit/automatic processing in the case of coaches (and athletes) being a goal to be achieved by future research. The research methodology used by us complements the direction of application of the phenomena of diagnosing and reducing aggressiveness with the use of fun forms of martial arts [93, 94], non-apparatus tests and motor simulations [95-97].

## CONTRIBUTION TO THE FIELD

The advancement in technology is an advancement for coaches' (and athletes') development and performance. Specialists (coaches, athletes, scholars, etc) are constantly looking for ways to improve sports performance. The findings provided in the current study advance knowledge considering the role of indirect/automatic aggression in sports performance, to the best of our knowledge, the studies regarding Implicit Associations Test – IAT (implicit assessment of coaches' aggression) and sports performance, being inexistent. Also, the results based on the IAT offer support for making future testable experimental predictions. In addition, the study is increasing awareness regarding the level of manifestation of different factors of explicit aggression in the case of successful martial arts coaches (viewing the coach as a performer within the sports performance field), preventing violent and unethical behaviours, with negative impact on well-being of athletes (and not only). Our research provides knowledge application for working with future martial arts coaches, this aspect being less approached by the current literature. Not least, considering coaches' sports

performances (at international or national level), conclusions relating to the selection process and also relating to the development of novices (and not only) martial arts coaches, can be drawn.

More work is needed to better understand the role of implicit aggression in sports performance (a less approached matter), surprising interesting inequalities and patterns in coaches (and athletes) at the group level.

## CONCLUSIONS

In summary, we emphasize that a slightly above average level of verbal aggression represents a specific feature of successful martial arts coaches. Additionally, we highlight that implicit aggression represents a better predictor of sport performances than explicit (verbal) aggression.

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