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Aggression and sport: A cross-sectional study on behavioral tendencies of athletes

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ABSTRACT

This cross-sectional study aimed to measure aggression in a more heterogeneous population of athletes, with the purpose of determining whether some specific conditions are related to aggressive behaviour. Athletes of 18–64 years old were enrolled in the study. The Italian version of Buss Perry Aggression Questionnaire (BPAQ) was self-administered. A total of 390 questionnaires were collected. Males showed higher levels of physical aggression (19.58 ± 6.32) than females (15.69 ± 6.65), $p < 0.001$ and a significant reduction in all domains of the questionnaire with advancing age, except for physical aggression. Furthermore, subjects who practiced full contact sports showed higher levels of physical aggression (20.23 ± 6.68) than those who practiced partial contact (17.89 ± 5.86) or non-contact sports (17.19 ± 6.64) $p < 0.006$. Finally, those who have played competitively in the past showed lower levels of anger (14.95 ± 5.22) than those who have played amateurishly (16.05 ± 5.54), $p < 0.05$. Age and gender appeared to be significant in aggression scores. Martial artists and combat sports players showed significantly higher levels of physical aggression than those who practice partial contact or non-contact sports. The type of sport (individual or team players), the practice time (beginners or experts) and the current level of sport (amateurs or competitive players) did not affect the aggression scores. Instead, the past level of sport participation is correlated with current anger.

1. Introduction

Aggression is "any form of behaviour directed toward the goal of harming or injuring another living being who is motivated to avoid such treatment" (Baron and Richardson, 1994). This definition highlights the psychological and social implications of aggression, which are necessarily also reflected in the world of sport. Sport is a social phenomenon that involves not only athletes, but also coaches, parents, and spectators (Burton, 2005). Many studies have investigated the relationship between individual aggression and sports practice d, with a particular focus on martial arts and combat sports (MA/CS) (Vertonghen and Theeboom, 2010; Mickelsson, 2020; Moore et al., 2020; Kostorz and Sas-Nowosielski, 2021; Stankovic et al., 2022; Lafuente et al., 2021). The unique aspect of martial arts and combat sports is the intrinsic need to express physical aggression when engaging in these disciplines. Consequently, scientific literature (Vertonghen and Theeboom, 2010; Mickelsson, 2020; Moore et al., 2020; Kostorz and Sas-Nowosielski, 2021; Stankovic et al., 2022; Lafuente et al., 2021) has attempted to investigate the potential psychosocial effects of martial arts and combat sports on practitioners. These studies examined whether these disciplines serve as a cathartic tool (Bushman, 2002; Freud, 1920/1959; Lorenz, 2002) and are useful in educational programs or if they reinforce violent conduct consistently with the social learning theory (Bandura et al., 1963, 1983). However, the results obtained are contradictory, making it difficult to determine the socio-psychological outcomes of these disciplines (Vertonghen and Theeboom, 2010). This inconsistency in results can be attributed to mediating factors in the relationship between martial arts and aggression (Vertonghen et al., 2014; Chen et al., 2019). These factors include the practitioner's behaviours and personality traits (e.g., self-control, self-esteem, self-efficacy, knowledge, attitudes), their social determinants (e.g., parent educational levels, socio-economic status), the type of martial art (e.g., traditional, modern) and its philosophical foundation (Zivin et al., 2001), as well as

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Abbreviation

STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
MA/CS	Martial arts and combat sports
BPAQ	Buss Perry Aggression Questionnaire
SPSS	Statistical Package for Social Science
SD	Standard deviation
CI	Confidence interval
CFA	Confirmatory factor analysis
TLI	Tucker-Lewis Index
CFI	Comparative Fit Index
RMSEA	Root Mean Square Error of Approximation

differences related to the coach's teaching style (Vertonghen et al., 2014). These mediating factors can positively or negatively affect aggressive behaviour and influence the choice of a specific discipline over others. Social background and related values can also influence the choice of a specific discipline. Vertonghen et al. (2014) found that kick/Thai boxers have more physical aggression and conduct problems than judo, aikido, and karate participants. However, no interaction effect was found between the type of martial art and level of experience, suggesting that the duration of martial art involvement may not be related to aggression. This finding is consistent with Eddehbia's and van der Putte's (Eddehbia and van der Putte, 2009) research, which suggested that kick/Thai boxing may attract young people predisposed to such behaviour rather than increasing aggression in practitioners. Additionally, Vertonghen et al. found that youngsters practising kick/-Thai boxing came from less privileged social backgrounds than the judoka, aikidoka, and karateka involved (Vertonghen et al., 2014). This is consistent with Bourdieu's habitus theory (Bourdieu, 1984), which suggests that a person's social class might be related to specific sports choices. Regarding other personality aspects, Chen et al. (2019) studied the relationship between aggression, self-control, and self-efficacy in boxers. The study found that self-efficacy and self-control increase with age, years of training, and competitive level. Furthermore, self-efficacy and self-control were positively correlated with each other and negatively correlated with aggression. Additionally, some studies have attempted to investigate the differences in aggression among participants in contact or non-contact sports, but the results remain inconclusive. Some studies concluded that contact sport players exhibit higher levels of aggression than non-contact players (Trivedi and Pinto, 2015; Boostani and Boostani, 2012; Xia et al., 2018). At the same time, Keeler found no differences in aggression levels among collision, contact, and non-contact sports (Keeler, 2000). Lemieux et al. (2002) also found no differences in aggression levels between contact, non-contact, and non-athletes but did find that participants with higher body weight and taller stature scored higher in aggression than those with lower height and body weight. However, it is worth noting that in the last two studies cited (Keeler, 2000; Lemieux et al., 2002), martial arts and combat sports were not included.

Few studies examined the relationship between aggression and the level of sport participation. Basiaga-Pasternak et al. (2020) found that competitive players are generally less aggressive than amateurs, but the difference was not statistically significant. On the other hand, Sofia and Cruz (2017) found that athletes from lower competitive categories tended to be more aggressive in the sports context than those from higher competitive levels. These results confirm that more advanced and skilled athletes are better at controlling their anger and aggression (Coulomb-Cabagno and Rascle, 2006). Regarding sporting experience, research has focused on aggression perceived as legitimate in sports, but findings are contradictory. Differences in aggression levels may depend on the type of sport (Ryan et al., 1990; Visek and Watson, 2005; Maxwell et al., 2009). For instance, Maxwell et al. (2009) suggest ed that experience in sport tends to reduce aggressiveness and angry behaviour s, consistent with cathartic concepts (Bushman, 2002; Freud, 1920/1959; Lorenz, 2002), but not for collision sports (such as rugby) in which aggression may be adaptive for success, and thus consistent with the social learning theory (Bandura et al., 1963, 1983). Ultimately, while the current literature has extensively studied the relationship between aggression and martial arts, it has done so less in comparison to other sports.

Additionally, more studies are needed on the relationship between aggression (understood as an individual trait outside the game) and the characteristics of sports participation. Analyzing aggression and sports from different perspectives can help deeper the understanding of this topic. Consequently, it can guide researchers in investigating specific aspects in the future to find new perspectives. Furthermore, understanding the role of aggression in sports can also help the entire sports community, particularly coaches, who play a pedagogical role for their athletes and can influence participants' behaviour both within and outside the sports context. An athlete who is aware of this topic may be better able to control their aggressive behaviour. Therefore, the present study aimed to measure aggression in a more heterogeneous population concerning the sport practiced to determine whether some specific conditions or contexts influence the development of aggressive behaviour in participants (i.e., gender, age, structural characteristics of the sport, years of training and level of participation).

2. Material and method

2.1. Study design

The present study was a cross-sectional analysis performed between March 2022 and May 2022. The University of Florence endorsed the study, which was approved by the Bioethics Committee (Prot. n.0173384), receiving implementation approval. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines (von Elm et al., 2007). Informed consent was obtained from all subjects involved in the study.

2.2. Inclusion criteria of participants

The inclusion criteria was being an adult from 18 to 65 years of age and to be registered an athlete within a sports federation among the Florentine area.

Potential participants' requests for availability to participate were made via email or phone call to the sports clubs in the Florentine area that have registered athletes of the required age group.

2.3. Instrument

Aggressive behaviour s have been evaluated using the Buss-Perry Aggression Questionnaire (BPAQ) (Buss and Perry, 1992). The BPAQ, a self-rating scale, was published in 1992 and is one of the most widely used tools for measuring aggression. The BPAQ scale has been validated extensively, but the validation focused on various narrowly selected populations, typically on samples of college students. In particular, the Italian version of the questionnaire was validated on a sample of young adults (Fossati et al., 2003).

In consideration of our sample characteristics, some questions were modified. For this reason, we translated the questionnaire from English into Italian. We then independently translated it back into English by an English professor with professional experience translating psychology-related scientific texts. A small sample of individuals was then involved in a focus group phase to provide feedback and comments on the comprehensibility of the questions. No significant differences were found between the back-translation and the original version, demonstrating that the translated items had the same or very similar meanings

as the original English items.

The BPAQ has 29 items, subdivided into four factors (which resulted from factor analysis).

1. Physical aggression (9 items); range 9–45
2. Verbal aggression (5 items); range 5–25
3. Anger (7 items); range 7–35
4. Hostility (8 items); range 8–40

Before self-administering of the BPAQ, participants were asked to provide their age, gender, type of sport currently played, and sports played in the past. These sports were divided into three categories.

- non-contact sports (e.g., gymnastics, swimming),
- partial contact sports (e.g., soccer, rugby),
- full contact sport (MA/CS, e.g., Brazilian jiu-jitsu, boxing, thai boxe).

Moreover, to investigate the expertise in a specific sport, participants were asked about the level of the sport (competitive or amateur) and their years of practice: we arbitrarily distinguished between beginners and experts based on years of experience, i.e., less/more than four years of playing the same sport, respectively. Instead, we consider "amateur sport" to be practiced by individuals to achieve and maintain mental and physical well-being and devoid of "competitive" aspects.

2.4. Statistical analysis

Statistical analysis was performed using SPSS 22 (Statistical Package for Social Science) (SPSS Inc. Chicago, IL, USA). Descriptive information for categorical measures was reported as frequency (percentages), and continuous measures were reported as means and standard deviations. Univariate analysis was performed to assess potential differences in the general score and all domains of the BPAQ based on several determinants (e.g., age, gender, type of sport, level of sport). Variance and linear regression were analyzed by modeling BPAQ, and all domains scored as the dependent measure. A regression model with backward stepwise selection was then employed to identify the independent factors associated with the continuous dependent measure. Results from linear regression were reported as Beta and 95% of Confidence Interval (CI). The significance level was set as $p < 0.05$. Confirmatory factor analysis (CFA) was used to assess the factor structure of the BPAQ (Table 1S). CFA is a statistical technique that tests whether the data fit a hypothesized model, in this case, the hypothesized factor structure of the instrument (Byrne, 2010). The CFA was conducted using maximum likelihood estimation (Byrne, 2010; Brown, 2006). The goodness-of-fit of the model was evaluated using several fit indices, including the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA) (Hu and Bentler, 1999). Values of TLI and CFI above 0.90 and RMSEA below 0.08 are generally considered acceptable fit indices (Hu and Bentler, 1999). A power analysis was performed to determine the appropriate sample size for a multiple regression model examining the influence of sport type, level of participation, years of experience, gender, and age on aggression scores. Using Cohen's $f^2 = 0.25$ (a medium effect size), a significance level of 0.05, and a power of 0.95, the required sample size was calculated. The analysis indicated that a minimum of 79 participants was needed to detect significant relationships between predictors and aggression levels.

3. Results

3.1. Sample characteristics

A total of 390 subjects were enrolled in the study (Table 1), more than half were males (n = 212). With regards to the number and type of sport, the majority of the sample currently practiced some sports (n = 295), mostly individual sports (n = 187) compared to team sports (n = 108), and non-contact sports (n = 120) compared to "full contact" (n = 71, i.e. MA/CS) and to "partial contact" sports (n = 104). Moreover, most subjects practiced their declared sport for over four years (n = 202). Finally, this group was divided equally between amateurs and competitive athletes. Furthermore, almost all subjects reported having practiced sports in the past (n = 374), with a prevalence of individual sports (n = 239), non-contact sports (n = 214), competitive practice (n = 214), and for longer than four years (n = 245).

Table 1
Sample's characteristics.

Characteristics	Total Sample ($n = 390$) N (%) or Mean ± SD
General Information	
Age	30.19 ± 9.70
Gender (male)	$n = 212$ (54.4%)
Current Sport practice	*Yes n=295 (75.6%)*
Team sport	*n=108 (36.6%)*
Individ*ual sport*	*n=187 (63.4%)*
Type of sport	
partial contact (soc*cer, rugby)*	*n=104 (35.3%)*
full contact *(MA/CS)*	*n=71 (24.1%)*
n*on-contact*	*n=120 (40.7%)*
Practice time	
⊦4; 4 years	*n=93 (31.5%)*
>4 years	*n=202 (68.5%)*
Level of sport	
Amateur	*n=146 (49.5%)*
Competitive	*n=149 (50.5%)*
Past sport practice	*Yes n=374 (95.9%)*
Team sport	*n=134(35.9%)*
Individ*ual sport*	*n=239 (64.1%)*
Past type of sport	
partial contact (soc*cer, rugby)*	*n= 106 (28.3%)*
full contact spo*rt (MA/CS)*	*n=54 (14.4%)*
n*on-contact*	*n=214 (57.2%)*
Past practice time	
⊦4; 4 years	*n=129 (34.5%)*
>4 years	*n=245 (65.5%)*
Level of sport	
Amateur	*n=160 (42.8%)*
Competitive	*n=214 (57.2%)*
BPAQ	
Total Score	67.12 ± 15.97
Anger	15.41 ± 5.37
Hostility	19.78 ± 6.29
Physical aggression	17.80 ± 6.32
Verbal aggression	14.13 ± 3.43

Abbreviations.
MA/CS: Martial art, combat sport.
BPAQ: Buss-Perry Aggression Questionnaire.
SD: standard deviation.

3.2. Questionnaire validation results

Overall, the CFA results indicated a good fit of the data to the hypothesized model, with TLI = 0.753, CFI = 0.774, and RMSEA = 0.073. These fit indices suggest that the proposed factor structure of the instrument is an appropriate representation of the data. Factor loadings are listed in Table 1S.

3.3. BPAQ related results

As described in Table 2, no statistically significant differences were found in the total aggression score between the groups studied. However, interesting results are found if we consider the four sub-tracts of the BPAQ. Looking at gender, males showed significantly higher levels of physical aggression ($p < 0.001$) but lower scores for hostility ($p = 0.02$) and anger ($p < 0.05$) than females. Regarding current sports

Table 2
Univariate analysis of BPAQ Aggression score.

Total sample N = 390	Total score		Physical Aggressive		Hostility		Verbal aggressive		Anger	
	Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value	Mean ± SD	p-value
Age										
Gender		0.43		**0.001***		**0.02***		0.84		**0.048***
Male	67.70 ± 16.17		19.58 ± 6.32		19.10 ± 6.21		14.09 ± 3.65		14.92 ± 5.21	
Female	66.44 ± 15.75		15.69 ± 6.65		20.59 ± 6.29		14.16 ± 3.15		16.00 ± 5.52	
Current Sport practice (N = 295)		0.70		0.43		0.87		0.40		0.89
Team sport	66.81 ± 16.11		17.78 ± 6.76		19.59 ± 6.07		13.91 ± 3.37		15.54 ± 5.54	
Individ*ual sport*	67.57 ± 16.47		18.40 ± 5.96		19.47 ± 6.27		14.27 ± 3.63		15.44 ± 5.37	
Type of sport		0.96		**0.006***		0.21		0.642		0.401
Partial contact sport	66.94 ± 16.36		17.89 ± 5.86		19.53 ± 6.21		13.90 ± 3.89		15.62 ± 5.60	
Full contact sport	67.55 ± 16.36		20.23 ± 6.68		18.48 ± 6.03		14.11 ± 3.79		14.73 4.53	
Non-contact sport	67.46 ± 16.99		17.19 ± 6.64		20.12 ± 6.22		14.35 ± 3.75		15.80 ± 5.74	
Practice time		0.40		0.54		0.31		0.068		0.362
≤ 4 years *experience*	68.47 ± 15.48		17.82 ± 6.06		20.05 ± 5.74		14.69 ± 3.41		15.90 ± 5.15	
> 4 years *experience*	66.76 ± 16.69		18.33 ± 6.66		19.27 ± 6.38		13.88 ± 3.57		15.28 ± 5.54	
Level of sport		0.83		0.71		0.77		0.55		0.31
Amateur	67.50 ± 16.41		18.03 ± 6.23		19.41 ± 6.09		14.26 ± 3.65		15.80 ± 5.60	
Competitive	67.10 ± 16.28		18.31 ± 6.73		19.62 ± 6.30		14.01 ± 3.51		15.16 ± 5.24	
Past sport practice		0.901		0.06		0.628		0.360		0.493
Team sport	67.40 ± 17.00		18.73 ± 6.37		19.59 ± 6.81		13.90 ± 6.68		15.18 ± 5.34	
Individ*ual sport*	67.17 ± 15.59		17.44 ± 6.29		19.92 ± 6.04		14.24 ± 3.34		15.58 ± 5.40	
Past type of sport		0.254		**0.001** *		0.917		0.598		0.875
Partial con*tact sport*	68.25 ± 16.90		19.63 ± 6.54		19.59 ± 6.48		13.83 ± 3.67		15.20 ± 5.40	
Full con*tact sport*	69.70 ± 16.37		20.06 ± 6.41		19.72 ± 6.43		14.33 ± 3.57		15.59 ± 5.97	
Non-con*tact sport*	66.11 ± 15.55		16.53 ± 5.87		19.90 ± 6.24		14.19 ± 3.34		15.49 ± 5.23	
Past practice time		0.267		0.395		0.065		0.383		0.111
≤ 4 years *experience*	68.51 ± 15.55		17.53 ± 6.14		20.62 ± 6.02		14.33 ± 3.67		16.03 ± 5.39	
> 4 years *experience*	66.57 ± 16.33		18.12 ± 6.44		19.35 ± 6.44		14.00 ± 3.35		15.10 ± 5.36	
Level of sport		0.350		0.447		0.182		0.799		**0.05***
Amateur	68.14 ± 15.99		17.63 ± 5.94		20.29 ± 6.23		14.16 ± 3.65		16.05 ± 5.54	
Competitive	66.57 ± 16.14		18.14 ± 6.62		19.41 ± 6.38		14.07 ± 3.33		14.95 ± 5.22	

* Statistical significant p-value ≤0.05.
Abbreviations.
BPAQ: Buss-Perry Aggression Questionnaire.
SD: standard deviation.

practice, there were no significant differences in the total scale or in the subdomain of the BPAQ aggression levels between participants who practiced individual and team sports, amateurs and agonists (i.e., competitive players), and beginners (<4 yrs experience) and experts (>4 yrs experience), also if we considered the sub-tracts of the questionnaire.

However, analyzing the type of sports, we found that subjects who practiced full contact sports (i.e., MA/CS) showed significantly ($p < 0.01$) higher levels of physical aggression (20.23 ± 6.68) than those who practiced partial contact (17.89 ± 5.86) and non-contact sports (17.19 ± 6.64). Regarding past sports practice, we found similar results to the previous ones: there were no statistically significant differences if we compared individuals with team players and experts with beginners. Then, in the past, those who have practiced full contact disciplines showed significantly ($p < 0.001$) higher levels of physical aggression (20.06 ± 6.4) than those who have practiced partial contact (19.63 ± 6.5) or non-contact sports (16.53 ± 5.87). Moreover, those who have practiced sports as an amateur showed higher levels of anger than those who have practiced at a competitive level, even if slightly significantly ($p = 0.05$).

3.4. Multivariate analysis

Table 3 contains the results of the final multivariate linear regression model. Younger age was positively associated with higher BPAQ total score (Beta = -0.32; 95%CI -0.53, −0.11, $p = 0.003$) and in all subdomains except for physical aggression. Regarding gender, a positive association was found only between female and higher levels of physical aggression but no significant association in the other subdomains nor the total score (Beta = −3.4; 95%CI -5.0, −1.8, $p = 0.001$). In consideration of the type of sport practiced and the past level of sport participation, we obtained a significant positive association between full contact sport (i.e., MA/CS) and physical aggression score (Beta = 2.1; 95%CI 0.16, 4.00, $p = 0.034$) and a negative correlation between higher level of past sport practiced and the Anger domain (Beta = −1.7; 95%CI -3.0, −0.42, $p = 0.009$) suggesting that amateur athletes were more aggressive that competitive ones.

4. Discussion

Research on the correlations between sport and aggression in athletes has primarily focused on martial arts and combat sports, aiming to determine the psychosocial effects of these disciplines on participants' behaviour. However, findings have been inconsistent (Vertonghen et al., 2014). Therefore, this study aimed to examine aggression levels in a more heterogeneous population of athletes, considering factors such as the specific sport practiced, sport type (individual/team; contact/non-contact), level of participation (amateur/competitive), duration of practice (experts/beginners), and previous sports participation.

The results of this study reveal significant differences in aggression scores concerning gender and age. Specifically, we observed higher levels of physical aggression in males than females, consistent with existing literature (Archer, 2004, 2009; Buss and Perry, 1992). Furthermore, we found a significant reduction in all questionnaire domains with advancing age, except for physical aggression. These

Table 3
Multivariate linear regression model.

Characteristic	Total score			Physical Aggressive			Hostility			Verbal aggressive			Anger		
	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value
Gender															
Male	–	–		–	–		–	–		–	–		–	–	
Female	−1.5	−5.4, 2.4	0.5	−3.4	−5.0, −1.8	**<0.001***	0.50	−1.0, 2.0	0.5	0.16	−0.72, 1.0	0.7	0.81	−0.51, 2.1	0.2
Age	−0.32	−0.53, −0.11	**0.003***	−0.04	−0.13, 0.04	0.3	−0.16	−0.24, −0.08	**<0.001***	−0.08	−0.12, −0.03	**0.002***	−0.09	−0.16, −0.02	**0.011***
Type of sport															
No contact	–	–		–	–		–	–		–	–		–	–	
Partial Contact	−1.6	−6.0, 2.7	0.5	0.60	−1.1, 2.3	0.5	−0.71	−2.4, 0.96	0.4	−0.62	−1.6, 0.35	0.2	−0.33	−1.8, 1.1	0.7
Full contact	0.37	−4.5, 5.3	0.9	2.1	0.16, 4.0	**0.034***	−0.91	−2.8, 0.96	0.3	0.11	−0.98, 1.2	0.8	−0.42	−2.1, 1.2	0.6
Past Level of sport															
Amateur				–	–		–	–		–	–		–	–	
Competitive				0.56	−0.93, 2.1	0.5	−0.94	−2.4, 0.50	0.2	−0.65	−1.5, 0.19	0.13	−1.7	−3.0, −0.42	**0.009***

* Significant p-value$\leq$0.05.

findings contribute new insights into research on the correlation between age and aggression, which has primarily focused on the trend of aggression from childhood to early adulthood (Loeber and Hay, 1997; Petersen et al., 2015). Moreover, it was observed that older adults tend to show aggression scores considerably lower than their absolute aggression levels when response bias and, in particular, social desirability are not controlled (Vigil-Colet et al., 2015). Regarding sport characteristics, we found that subjects who currently or have previously engaged in full contact sports (i.e., MA/CS) displayed significantly higher levels of physical aggression than those who are currently or have previously engaged in partial contact or non-contact sports. Again, these results are consistent with previous literature (Trivedi and Pinto, 2015; Lemieux et al., 2002).

However, this study distinguished between full-contact sports (i.e., martial arts and combat sports), where physical contact is the primary element, and partial-contact sports, where contact is present but not central (e.g., soccer and rugby). These observations highlight the prominent role of aggression in martial arts and combat sports compared to other sports, emphasizing the need for further investigation. In this regard, it seems useful for martial arts and combat sports coaches and athletes to become aware of this topic: first of all, due to coaches' potential educational role during training and competitions, as well as the need for increased attention and control over athletes' behaviour. Furthermore, we found that individuals who had previously engaged in competitive sports displayed lower levels of anger than those who had participated at an amateur level. This observation offers new perspectives on the literature examining the relationship between aggression and competitiveness, considering both the current level of participation (Basiaga-Pasternak et al., 2020; Sofia and Cruz, 2017) and aggression perceived as legitimate within the game (Sofia and Cruz, 2017). The present study cannot determine whether full-contact sports increase aggression or whether individuals with higher physical aggression are naturally drawn to these disciplines. Although strong data supporting either claim are lacking, it is reasonable to assume that people with higher physical aggression levels may be attracted to martial arts and combat sports, while additional factors (e.g., coaching approach, philosophical foundations of the discipline) may positively or negatively influence participants' behaviour and aggressive tendencies. Similarly, it remains unclear whether prior competitive experience reduces current anger levels in participants or wheter lower levels of anger (along with other psychological traits such as self-control) are prerequisites for competing at a higher level. On the other hand, we f ound no significant differences in aggression levels between individual and team players and between experts and beginners, both currently and in the past. Ultimately, the present study underlined the understanding of the relationship between sport and aggression by highlighting new perspectives that have yet to be extensively considered in previous research, such as sport-specific characteristics and participation modality. Concerning martial arts and combat sports, the results of this study provide a further contribution to an already substantial body of literature. Thus, participation in organized sports alone is insufficient to explain individual differences in aggressive behaviour. Rather, aggression among athletes may resemble that of the general population and is better explained by variables such as age, gender, sport type, competition level, and various psychological factors.

The present study had some limitations. First, the BPAQ is a self-administrated questionnaire that may lead to overestimating or underestimating the measured variable. However, the BPAQ questionnaire is the most widely used tool for aggression evaluation. Additionally, the sample was heterogeneous regarding gender and age due to non targeted sampling. However, this recruitment method has allowed us a good sample size. Integrating all martial arts and combat sports into a single category also represents a limitation. Finally, the cross-sectional study design does not allow for causal inferences or determinations of consequential relationships.

Further, longitudinal studies regarding martial arts and combat

sports are needed to understand the potential impact on practitioners' behaviour. Furthermore, future research could explore what happens when the physical aggression component is removed from martial arts training. Similarly, further research should focus on other mediating factors that may explain the appeal of these disciplines, including personality traits, socio-family background, biological characteristics, and the moral values and teachings of coaches. Likewise, it is crucial to examine the relationship between aggression and competitiveness alongside other aspects of personality traits such as self-control and anger management to gain a more comprehensive understanding of this topic. Finally, given the relevance of aggression as an individual trait and its implications in the world of sport and society, increasing awareness and discussion of this topic within the sports community would be beneficial. This knowledge could be valuable not only for coaches, who inevitably play an educational role, but also for athletes, parents, and spectators.

5. Conclusions

In conclusion, sport characteristics and participation modalities were not significantly correlated with aggression levels. Age and gender appear to be significant in aggression scores: males showed higher levels of physical aggression but lower hostility and anger than females. Moreover, younger age was positively associated with a higher BPAQ total score in all subdomains except for physical aggression. Subjects who practice - or have practiced - full-contact sports (i.e., martial arts and combat sports) showed significantly higher levels of physical aggression than those involved in partial contact or non-contact sports. Sport type (individual vs. team), practice duration (beginners vs. experts), and current participation level (amateurs vs. competitive) did not affect the aggression scores. However, previous participation at a competitive level was associated with lower current anger levels.

CRediT authorship contribution statement

Michael Mazzanti: Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. **Alice Masini:** Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Francesco Sanmarchi:** Writing – review & editing, Formal analysis, Data curation. **Laura Dallolio:** Writing – review & editing, Supervision, Conceptualization. **Gabriele Mascherini:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Ethical approval statement

The study was endorsed by the University of Florence and approved by the Bioethics Committee (Prot. n.0173384). Informed consent was obtained from each participant, and the study.

Data availability statement

Data are available based on corresponding authors requested.

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Declaration of competing interest

The authors declare no direct or indirect conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jbmt.2025.03.001.

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