Research Article

Educational Administration Theory and Practice

"The Relationship Between Cognitive Abilities and Aggression Level using SLCT and DLST among Boxing Players: An Empirical Study"

Anil Mili[1], Heta Meto[2], Yuhey Chikro[3], Rinima Meto[4], Kshetrimayum Rojeet Singh[5], Pakpa Yengkhom[6]*

[1]Associate Professor, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India
[2]PhD Scholar, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India
[3]PhD Scholar, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India
[4]MA Sports Psychology, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India
[5]Assistant Professor, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India
[6]*PhD Scholar, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India*

*Correspondent Author – Pakpa Yengkhom
PhD Scholar, Department of Physical Education, Rajiv Gandhi University, Arunachal Pradesh, India

ARTICLE INFO	ABSTRACT
	The aim of this study was to assess the relationship between cognitive ability and aggression levels among male boxing players. The study population consisted of 80 male boxers (ages 18-24) from different clubs and training centres, competing at the state or national level. The gathered data were statistically analysed using descriptive analysis and Bivariate (Pearson correlation) analysis. Results: The findings of the present study imply that there is no significant association between aggression levels and the Six-Letter Cancellation Test (SLCT). The Pearson correlation between aggression and the Digit/Letter Substitution Test (DLST) showed a modest negative relationship of -0.259, and the Pearson correlation between aggressiveness and overall cognitive ability was -0.142, indicating no substantial link between aggression and cognitive ability. Conclusion: The absence of a relationship between aggression and cognitive ability may be due to the nature of the sport or conditioned learning. The inverse correlation between aggression and the substitution tests of numbers or letters may be attributed to personality traits or levels of aggression, which could decrease mental flexibility and general cognitive ability. These results contribute to the complex body of literature on the links between aggression and cognitive ability, highlighting the possibility that different aspects of cognitive ability may be differentially associated with aggression. This underscores the need for further research to fully understand these relationships. **Keywords**; Cognitive psychology, Six-Letter Cancellation Test, Digit/Letter Substitution Test, Sports performance, Sports science, Exercise Psychology, Psychophysiology.

Introduction

It takes a special blend of physical skill and mental sharpness to succeed in the hard and demanding sport of boxing. The physiological and psychological components of boxing have been thoroughly studied in the past, but little research has been done on how a boxer's cognitive skills affect how aggressive they are. In order to shed light on the cognitive factors that affect an athlete's approach to the sport, this study paper looks into how cognitive skills and aggression levels interact among boxing players.

In the context of boxing, aggression is a complicated concept that includes controlled assertiveness, planned aggression, and emotional intensity (Panksepp & Zellner, 2004). There may be significant training and performance benefits from knowing how particular cognitive abilities may affect how anger is expressed and controlled in the ring. Coaches, trainers, and sports psychologists can customise their interventions to optimise a boxer's mental game, resulting in enhanced strategic decision-making and higher performance outcomes, by examining the cognitive underpinnings of aggression (Bebetsos et al., 2007).

The empirical study takes a comprehensive approach, integrating both self-reported measures of aggression and standardised cognitive exams to evaluate the link between these two important components. To guarantee the generalizability of the results, a carefully chosen sample of boxers will be recruited from a range of skill levels. The study intends to uncover potential correlations and relationships between cognitive ability and aggression level through meticulous data analysis, shedding light on the underlying systems that control a boxer's violent inclinations.

This study aims to investigate the potential impact of cognitive dominance on a boxer's overall performance, including its function in tactical planning, resilience in the face of difficulty, and adaptation in critical fighting scenarios. Additionally, considering how cognitive talents affect aggression levels (Martinez, 2017; Schneider & Chein, 2003) may provide helpful insights into the phenomenon of "choking" under pressure, as increased aggression in high-stakes competitive contexts may be a double-edged sword.

This study examines the relationship between boxing players' cognitive skills and degrees of aggression. The goal of the study is to comprehend how particular cognitive elements affect a boxer's approach to aggression, which in turn affects their performance and tactical judgement in the ring. It is possible to improve training and raise overall performance in combat sports competition by looking at these links.

Materials and Methods

For the study, a purposive sampling technique was employed to produce well-matched groups and because it aids in reflecting the overall population and it entailed more control over critical elements, allowing the researcher to use the best knowledge about the sample participants that were previously accessible, and ensuring that the sample's population were correctly represented. A total of 80 male boxers, age 18-24 years were included in the study. Institutional ethical clearance was taken for the study. The study's population consisted from different clubs and training centres of SAI (Sports Authority of India) including NCOE (National Centre of Excellence) competing at the state or national level in boxing sports hailing from Arunachal Pradesh, India. Furthermore, the study also followed the guidelines of Helsinki Declaration("World Medical Association Declaration of Helsinki," 2013).

Tools used for data collection

1. Six Letter Cancellation Test:

Six-letter cancellation test (SLCT) aims to measure the psychomotor performance. SLCT is a paper and pencil test that uses cancellation task that measures cognitive functions such as selective and focused attention, visual scanning as well as activation and inhibition of rapid responses. It consists of a test worksheet that specifies six target letters to be cancelled and has a 'working section,' which consists of letters of the alphabet, arranged randomly in 22 rows and 14 columns. The participants are asked to cancel as many of the six target letters as possible in a specified time of 90 seconds. The total number of cancellations and wrong cancellations are scored, and the net scores are calculated be deducting wrong cancellation from the attempt. This test has been evaluated for its reliability and validity based on standard criteria. Reliability has been ascertained based on (a) temporal stability and (b) internal consistency. The content validity of this test is adequate for the purpose for which it is intended. The normal value for healthy Indian adults for SLCT is 38 ± 6. SLCT has been used in thesis 'Impact of various styles of mantra chanting in novices based on physiological and cognitive variables' by Kidambi Acharya in the year 2020.

2. Digit/Letter Substitution Test

Digit Letter Substitution Test (DLST), one of the subtests from Wechsler Intelligence Scale (Wechsler, 1955,1981). The goal of the DLST is to assess visual scanning, mental flexibility, sustained attention, and information processing speed psychomotor. DSLT has been used in similar type of design on Indian population. For example, Vineet Kumar Sharma in his thesis 'Effect of Surya namaskar with breathing and mantras on selected psycho physiological variables' published in 2017 used DSLT. DSLT worksheet consists of an array of random digits, 1-9, in 8 rows and 12 columns. The coding sheet has instructions about the test with example of substituting a specific letter for each digit 1-9, the same coding applying to an entire test group. Subjects were instructed to choose their own letter replacement approach, whether horizontally, vertically, or by randomly selecting a digit from the array one by one. They were instructed to substitute as many target numerals as they could in the allotted 90 seconds.

3. Sports Aggression Inventory

Sports Aggression Inventory (SAI), constructed and standardized by Prof. Anand Kumar Shrivastava and Prem Shankar Shukla (1988). The Sports Aggression Questionnaire was consisting of 25 questions in which 13 questions are keyed 'yes' and 12 questions are keyed 'no'. Subjects were oriented and explained regarding the purpose and the procedure of the questionnaire. Sports Aggression Inventory consists of 25 items in which 13 items are keyed ‚YES' and 12 are keyed ‚NO'. The statements which are keyed ‚YES' are 1,4,5,6,9,12,14,16 ,18,21,22,24 and 25 and the statements which are keyed ‚NO' are 2,3,7,8,10,11,13,15,17,19,20 and 23.

Statistical tools

The data was interpreted using descriptive analysis and Bivariate Pearson correlation. SPSS 21 was used to analyze the scores obtained on the various Digit/Letter Substitution, Cognitive Ability, and Aggression tests. The significance threshold was set at 0.05.

Results

Table No 1: Descriptive analysis of Six letter cancellation test, Digit/ Letter substitution test, Cognitive ability and Aggression of Boxing Players (N=80)

Variables	Mean	Standard Deviation	Min.	Max.
Aggression	12.25	2.52	7.00	18.00
Six letter cancellation tests	34.92	9.84	10.00	58.00
Digit/ Letter substitution test	43.70	11.44	16.00	68.00
Cognitive Ability	78.62	17.05	40.00	117.00

Table-1 revealed that the mean and standard deviation values of Aggression 12.25±2.52, Six letter cancellation test 34.92±9.84, Digit/ Letter substitution test 43.70±11.44 and Cognitive Ability 78.62±17.05 of male boxing players respectively. In the same categories, the minimum and maximum values for Aggression (7.00; 18.00), Six letter cancellation test (10.00; 58.00), Digit/ Letter substitution test (16.00; 68.00) and Cognitive Ability (40.00; 117.00).

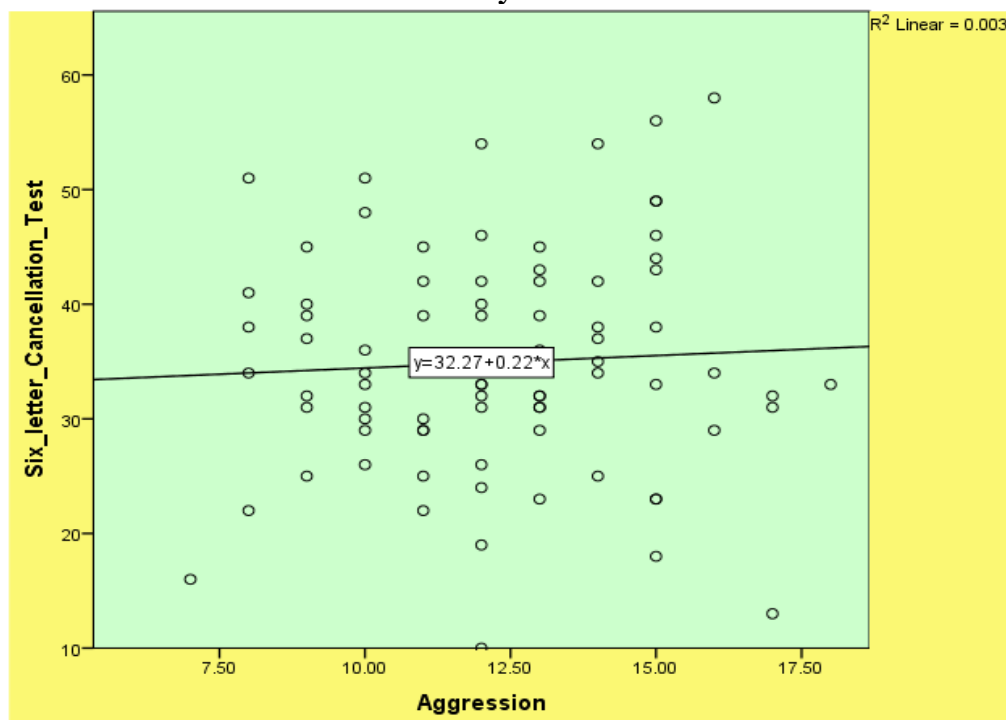**Figure-1: - Relationship between Aggression and Six Letter Cancellation Test of Male Boxing Players**

Table No 2: Correlation between Six letter cancellation test, Digit/ Letter substitution test and Aggression

		Six Letter Cancellation Test	Digit/Letter Substitution Test
Aggression	Pearson Correlation	.056	-.259*
	Sig. (2-tailed)	.624	.020
	N	80	80

The Pearson correlation between aggression and the Six Letter Cancellation Test was .056 (see table no-2), which is very close to zero. This suggests that there is no meaningful relationship between aggression and scores on the Six Letter Cancellation Test (see Fig 1). This conclusion is supported by the fact that the significance level (p-value) is .624, which is much greater than the typical threshold of .05 for statistical significance.

However, the Pearson correlation between aggression and the Digit/Letter Substitution Test was -.259, which is a small negative correlation (see table no-2). This suggests that there is a slight inverse relationship between aggression and scores on the Digit/Letter Substitution Test (see fig-2) – that is, as aggression levels increase, scores on the Digit/Letter Substitution Test decrease, and vice versa. The correlation is statistically significant (p = .020), as it is less than .05. This might suggest that higher aggression levels are somewhat associated with lower cognitive ability as measured by the Digit/Letter Substitution Test, though the correlation is small, and so the effect size is also small (see Fig 2).

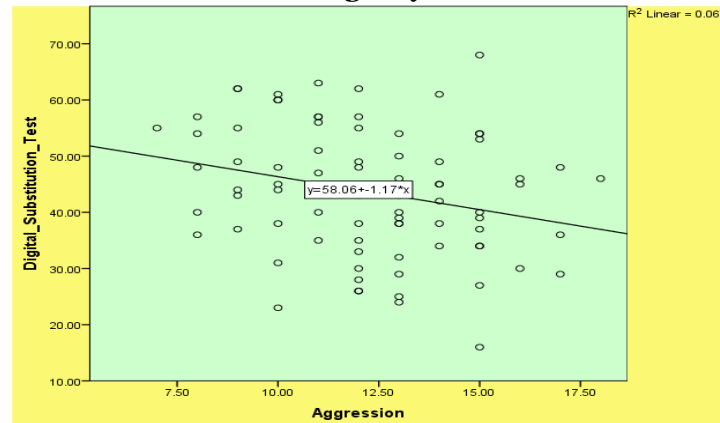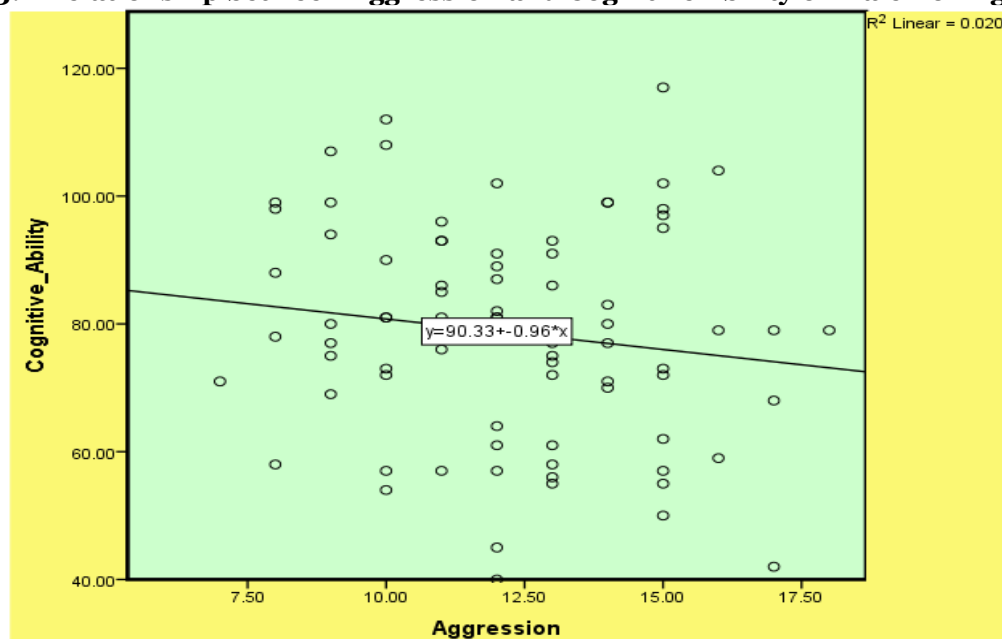**Figure-2: - Relationship between Aggression and Digit/Letter Substitution Test of Male Boxing Players**

Table No 3: Correlation between Aggression and Cognitive Ability

Correlations		
		Cognitive Ability
Aggression	Pearson Correlation	-0.142
	P value	.210
	N	80
*. Correlation is significant at the 0.05 level (2-tailed)		

Furthermore, the relationship between aggression and cognitive ability was -0.142 (see table no 3), which is very close to zero. This suggests that there is no meaningful relationship between aggression and cognitive ability (see Fig 3). This conclusion is supported by the fact that the significance level (p-value) is .210, which is much greater than the typical threshold of .05 for statistical significance.

Figure-3: - Relationship between Aggression and Cognitive Ability of Male Boxing Players

Discussion

The present study was conducted to explore the relationship between cognitive ability and aggression among the male boxers. The findings provided a nuanced view of this relationship, indicating that aggression levels in boxing players do not demonstrate a clear relationship with cognitive ability as measured by the Six Letter Cancellation Test (SLCT), a neuropsychological assessment test which measures visual motor speed, visual scanning, and attention. The SLCT showed no meaningful correlation with aggression levels. This outcome concurs with several previous studies that also found no significant relationship between aggression and certain cognitive abilities(Chen et al., 2019). The finding of the present study implies that there is no relevant association between aggression and SLCT scores. For instance, research conducted by Simonetti et al., (2021) did not reveal a significant link between aggression and cognitive performance in tasks that required executive function and attention, like the SLCT (Lee & Hoaken, 2007). This may suggest that the specific cognitive skills measured by this test are not notably impacted by or associated with aggression levels in our cohort of boxing players. Overall, the findings indicated no relationship between aggression level and cognitive ability in boxing player players.

In contrast, the DLST displayed a slight negative correlation with aggression, suggesting that increased aggression is associated with lower cognitive ability as assessed by this test. A modest negative connection exists between hostility and the digit/letter substitution test. This finding is consistent with several other studies that have noted a negative association between aggression and cognitive performance(Yazici & Mergan, 2022). One such study by Lee & Hoaken (2007) found that individuals displaying higher levels of aggressive behaviour tended to perform poorer on certain cognitive tasks that required abstract reasoning and quick decision making, like those required in the DLST (Hogan et al., 2007).

A recent meta-analysis (Morgan et al., 2022) highlighted a moderate inverse relationship between aggression and cognitive ability, particularly in cognitive tasks demanding speeded responses or complex problem-solving tasks (Dorris et al., 2012; Skitka et al., 2021). This suggests that the skills evaluated by the DLST may be more affected by, or correlated with, aggression levels than those measured by the SLCT. The similar research conducted by Paschall & Fishbein (2002) on cognitive performance and violence from a public health standpoint shows that Aggression and violent behaviour (AVB) may be caused by impairments in executive cognitive functioning (ECF), according to a huge body of research from many different domains.

Another similar research done by Sofia & Cruz, (2015) studied on Self-control as a mechanism for controlling aggression: A study in the context of sport competition. Self-control is one of the most significant aspects of human nature, and it has been connected to a wide range of advantages for both the individual and society (Denson et al., 2011). Furthermore, both empirically and conceptually, self-control has been regularly recognized as a major tendency in the management of aggressive behavior (Coyne & Wright, 2014; Denson et al., 2011). Using sport as a natural setting to research human aggression, this study investigated individual differences in violent and anti-social behaviors as a function of self-control capacity and gender. The Results suggested that athletes with higher levels of self-control appear to be better at regulating aggression, whereas male athletes are more aggressive. These findings not only corroborate prior laboratory findings, but also point to the relevance of improving self-control capacity as a method for controlling aggression in the sports environment.

However, it is worth noting that the correlation observed in the present study was small, indicating a relatively minor effect size. While there is some association between increased aggression and lower cognitive ability, as measured by the DLST, which assesses executive functioning and processing speed, the mechanism behind changes in the prefrontal cortex (PFC) may underlie this association. The PFC, crucial for executive functions such as decision-making, problem-solving, and impulse control, plays a significant role in the relationship between aggression and cognitive functions. Decreased activity or impaired function of the PFC, which regulates the amygdala, can result in increased aggression (Siever, 2008). Understanding the factors that enhance PFC function may lead to new findings. One potential area of investigation is the integration of nutritional influences, such as Omega-3 fatty acids, which may enhance PFC function and elucidate the mechanisms in greater depth (Dighriri et al., 2022) and may help in optimization of performance (Meto et al., 2024).

Limitation & Future direction: Future research should consider a larger sample size to explore these findings in greater depth and to elucidate the possible mechanisms, accounting for underlying confounders to justify the observed relationships. Similar studies in different sports contexts could also be conducted, as this study was limited to male boxers. The use of a purposive sampling technique may also limit the generalizability of the findings. Additionally, the study's reliance on bivariate correlation presents a limitation. Future research should investigate whether the heightened physical and psychological stress associated with increased aggression levels leads to impaired cognitive function. It may also be beneficial to examine whether individual differences in traits such as impulsivity or risk-taking behavior influence both aggression and cognitive performance.

Conclusions

Within the study's limitations, the findings revealed no significant statistical difference between cognitive ability and aggression level among male boxing players. Specifically, there was no relevant association between aggression and Six Letter Cancellation Test scores. The Pearson correlation between aggression and the Digit/Letter Substitution Test indicated a modest negative connection, with a correlation coefficient of -0.142, suggesting an almost nonexistent link between aggression and cognitive ability. The lack of a relationship between aggression and cognitive ability could be attributed to the nature of the sport or conditioned learning, while the inverse correlation observed in the digit/letter substitution tests may be due to personality traits or levels of aggression, which can reduce mental flexibility and overall cognitive ability. These results contribute to the complex body of literature on the links between aggression and cognitive ability, highlighting that different aspects of cognitive ability may be differentially associated with aggression. This underscores the need for further research to fully understand these relationships.

Declaration Of Interest Statement; None

References:

1. Bebetsos, E., Theodorakis, N. D., & Tsigilis, N. (2007). Relations between role ambiguity and athletes' satisfaction among team handball players. *The Sport Journal*, *10*(4), NA. Gale OneFile: Health and Medicine.
2. Chen, X., Zhang, G., Yin, X., Li, Y., Cao, G., Gutiérrez-García, C., & Guo, L. (2019). The Relationship Between Self-Efficacy and Aggressive Behavior in Boxers: The Mediating Role of Self-Control. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.00212
3. Coyne, M. A., & Wright, J. P. (2014). The stability of self-control across childhood. *Personality and Individual Differences*, *69*, 144–149. https://doi.org/10.1016/j.paid.2014.05.026
4. Denson, T. F., Capper, M. M., Oaten, M., Friese, M., & Schofield, T. P. (2011). Self-control training decreases aggression in response to provocation in aggressive individuals. *Journal of Research in Personality*, *45*(2), 252–256. https://doi.org/10.1016/j.jrp.2011.02.001
5. Dighriri, I. M., Alsubaie, A. M., Hakami, F. M., Hamithi, D. M., Alshekh, M. M., Khobrani, F. A., Dalak, F. E., Hakami, A. A., Alsueaadi, E. H., Alsaawi, L. S., Alshammari, S. F., Alqahtani, A. S., Alawi, I. A., Aljuaid, A. A., & Tawhari, M. Q. (2022). Effects of Omega-3 Polyunsaturated Fatty Acids on Brain Functions: A Systematic Review. *Cureus*. https://doi.org/10.7759/cureus.30091
6. Dorris, D. C., Power, D. A., & Kenefick, E. (2012). Investigating the effects of ego depletion on physical exercise routines of athletes. *Psychology of Sport and Exercise*, *13*(2), 118–125. https://doi.org/10.1016/j.psychsport.2011.10.004
7. Hogan, J., Barrett, P., & Hogan, R. (2007). Personality measurement, faking, and employment selection. *Journal of Applied Psychology*, *92*(5), 1270–1285. https://doi.org/10.1037/0021-9010.92.5.1270
8. Lee, V., & Hoaken, P. N. S. (2007). Cognition, Emotion, and Neurobiological Development: Mediating the Relation Between Maltreatment and Aggression. *Child Maltreatment*, *12*(3), 281–298. https://doi.org/10.1177/1077559507303778
9. Martinez, S. G. (2017). *Aggression and boxing performance: Testing the channeling hypothesis with multiple statistical methodologies* [Wright State University]. http://rave.ohiolink.edu/etdc/view?acc_num=wright1491929510847969
10. Meto, H., Mili, A., Rajpoot, Y. S., Singh, K. R., Tsering, S., Ramchiary, S. K., Govindasamy, K., & Gogoi, H. (2024). The role of Withania somnifera (ashwagandha) supplementation in modulating physical and physiological performance responses to regular football training. *Fizjoterapia Polska*, *24*(2), 115–123. https://doi.org/10.56984/8ZG56082YM
11. Morgan, C. A., Chang, Y.-H., Choy, O., Tsai, M.-C., & Hsieh, S. (2022). Adverse Childhood Experiences Are Associated with Reduced Psychological Resilience in Youth: A Systematic Review and Meta-Analysis. *Children*, *9*(1). https://doi.org/10.3390/children9010027
12. Panksepp, J., & Zellner, M. (2004). Towards a neurobiologically based unified theory of aggression. *Revue Internationale de Psychologie Sociale/International Review of Social Psychology*, *17*, 37–61.
13. Paschall, M. J., & Fishbein, D. H. (2002). Executive cognitive functioning and aggression: A public health perspective. *Aggression and Violent Behavior*, *7*(3), 215–235. https://doi.org/10.1016/S1359-1789(00)00044-6
14. Schneider, W., & Chein, J. M. (2003). Controlled & automatic processing: Behavior, theory, and biological mechanisms. *Cognitive Science*, *27*(3), 525–559. https://doi.org/10.1016/S0364-0213(03)00011-9
15. Siever, L. J. (2008). Neurobiology of Aggression and Violence. *American Journal of Psychiatry*, *165*(4), 429–442. https://doi.org/10.1176/appi.ajp.2008.07111774
16. Simonetti, A., Kurian, S., Saxena, J., Verrico, C. D., Soares, J. C., Sani, G., & Saxena, K. (2021). Cognitive correlates of impulsive aggression in youth with pediatric bipolar disorder and bipolar offspring. *Journal of Affective Disorders*, *287*, 387–396. https://doi.org/10.1016/j.jad.2021.03.044

17. Skitka, L. J., Hanson, B. E., Morgan, G. S., & Wisneski, D. C. (2021). The Psychology of Moral Conviction. *Annual Review of Psychology*, *72*(1), 347–366. https://doi.org/10.1146/annurev-psych-063020-030612
18. Sofia, R. M., & Cruz, J. F. A. (2015). Self-control as a mechanism for controlling aggression: A study in the context of sport competition. *Personality and Individual Differences*, *87*, 302–306. https://doi.org/10.1016/j.paid.2015.08.025
19. World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. (2013). *JAMA*, *310*(20), 2191. https://doi.org/10.1001/jama.2013.281053
20. Yazici, Ö. F., & Mergan, B. (2022). The Predictive Role Of Cognitive Flexibility And Cognitive Control On Aggression and Anger İn Sports. *Akdeniz Spor Bilimleri Dergisi*, *5*(3), 522–536. https://doi.org/10.38021/asbid.1150357