Int. J. Sport Psychol., 2024; 55: 640-668
doi: 10.7352/IJSP.2024.55.640

The "Athlete Killer" Hidden in the Internet: The Impact of Cyber-violence on High-Level Athletes' Perceived Performance

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This study, involving 245 high-level athletes who have suffered from cyber-violence, explores the factors affecting their perceived competition performance. It aims to provide suggestions and ideas for the prevention and management of cyber-violence against athletes. The analysis using Structural Equation Modeling (SEM) shows that cyber-violence significantly impacts high-level athletes' depressive mood and perceived competition performance. Depressive mood plays a significant mediating role between cyber-violence and perceived competition performance. The analysis using fuzzy-set Qualitative Comparative Analysis (fsQCA) reveals a diverse set of conditions affecting athletes' perceived competition performance. The study finds that, apart from cyber-violence and depressive mood, demographic characteristics such as gender and age are also important factors. The study discusses relevant literature and offers substantial suggestions for managing cyber-violence.

KEY WORDS: Cyber-violence, Depressive Mood, Perceived Competition Performance, High-Level Athletes, Fuzzy-set Qualitative Comparative Analysis(fsQCA).

1. Introduction

The internet is a double-edged sword. On one hand, it makes life more convenient and faster for people; on the other, the freedom of speech on the internet leads to frequent occurrences of cyber-violence. A June 2023 survey by China Youth Daily and Wenjuan.com found that 65.3% of 1000 Chinese youths surveyed had experienced or knew someone who had experienced

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cyber-violence, and 71.9% believed it was becoming more frequent (Wu, 2023). Since the proliferation of the internet, cyber-violence has gradually become a societal issue, sparking widespread discussion and adversely affecting the entire sports field. Cyber-violence, defined as advocating violence or using provocative language on the internet to vent emotions (Hou & Li, 2017), is seen as an extension of social violence into cyberspace (Li, Zeng, & Teng, 2017). Different from traditional bullying, it can quickly spread online and reach a large audience (Patchin & Hinduja, 2015). The problem has worsened with the internet's growth, especially after the Tokyo Olympics, where negative comments about high-level athletes proliferated on social media platforms (Wang, 2022). For instance, Chinese gymnast Guan Chenchen faced appearance-based attacks online after gaining weight post her Olympic victory. In this context, the focus on and rectification of cyber-violence against high-level athletes has become a public concern.

In 2019, the International Olympic Committee published a consensus statement on elite athletes' mental health, finding that the prevalence of mental health disorders among high-level athletes ranged from 5% to 35%, including symptoms like depressive mood, suicide, attention deficits, and other behavioral addictions (Wang, 2022). Many scholars have studied depressive mood in this context. Lane (2001) suggested that depressive mood is the most critical emotional dimension, characterized by demotivation. Blain-Arcaro & Vaillancourt (2017) found that cyber-violence adversely affects mental health. Previous literature indicates a positive correlation between positive emotions and good perceived competition performance (Vast, Young, & Thomas, 2010; Chapman, Lane, Brierley, & Terry, 1997). Perceived competition performance, defined by Chun, Lee, Kim, Cho, & Lee (2023) as athletes' perception of their physical ability, performance capacity, tactical skill level, confidence, and preparation, significantly influences motivation, confidence, actual performance, and competition results (Cohn, 1991). Studies by Brandt, Bevilacqua, & Andrade (2017) and Ruiz & Hanin (2011) found that negative emotions, like depressive mood, adversely affect perceived performance. Nowadays, cyber-violence has become a persistent problem affecting athletes' mental health, not only impacting their performance but also posing a threat to their lives (Bao, 2021; Wang, 2020). Thus, studying cyber-violence and providing timely psychological guidance to high-level athletes to ensure stable performance is urgent. This study focuses on the impact of cyber-violence on high-level athletes' perceived performance and the mediating role of depressive mood, holding theoretical and practical significance in preventing cyber-violence and maintaining stable emotions in athletes' training and competition.

This research, based on Structural Equation Modeling (SEM), considers depressive mood as a mediating variable to explore the impact of cyber-violence on high-level athletes' perceived performance. By combining fuzzy-set Qualitative Comparative Analysis (fsQCA), it examines different configurations affecting perceived performance, aiming to increase individual, social, and national attention to cyber-violence against high-level athletes. This attention is crucial to protect their physical and mental health, promote social harmony, and provide theoretical foundations for future studies. The research also offers developmental suggestions for the prevention and management of cyber-violence.

2. Literature Review

2.1 Literature Review

Cyber-violence is an emerging social and public health issue that continuously affects victims more severely than perpetrators (Siddiqua, Sahni, & Faruk, 2020). Owen (2017) defines cyber-violence as online behaviors that attack or harm a person's physical, psychological, or emotional health. It negatively impacts individuals' mental and physical well-being and is one of the main causes of social instability (Sincek, Duvnjak, & Mili, 2017). Hence, numerous scholars have researched cyber-violence. Hinduja & Patchin (2008) and Marczak & Coyne (2010) studied its impact on academic performance, showing that cyber-violence negatively affects attention, isolation, and learning outcomes. Ortega, Elipe, Mora-Merchán, Calmaestra, & Vega (2009) examined its emotional impact on victims, finding most victims in their sample felt depressed due to cyber-violence. In the era of self-media, athletes, often in the spotlight, are more likely to become victims of cyber-violence. Therefore, this study attempts to understand the impact of cyber-violence on high-level athletes' depressive mood and perceived competition performance, proposing the following hypotheses:

H1: Cyber-violence has a significant positive impact on depressive mood.

H2: Cyber-violence has a significant positive impact on perceived competition performance.

2.2 Perceived Competition Performance

Sports psychologists believe that athletes' competition performance is influenced by their confidence (Machida, Otten, Magyar, Vealey, & Ward, 2017; Beaumont & Maynard, 2015). There is a significant relationship between athletes' arousal level and perceived performance in competition (Chun, Lee, Kim, Cho, & Lee, 2023). When athletes are confident, they maintain a pleasant mood

in training and competition, which promotes good performance (Besharat & Pourbohlool, 2011). Kim (2017) found that sports confidence mediates between athletes' belief in their abilities and judokas' perceived performance. Besharat & Pourbohloul's (2011) study on Iranian athletes showed that athletes' confidence moderated the relationship between competitive anxiety and competition performance. For high-level athletes, perceived competition performance affects the formation of motivation and confidence in competitions and has a significant impact on actual performance and results (Cohn, 1991). Hence, this study aims to research perceived competition performance to ensure athletes' good state in training and excellent performance in competitions.

2.3 Depressive Mood

The hallmark of a depressive episode is persistent negative affect (Joormann & D'Avanzato, 2010). Shankman et al. (2005) view the presence of depressive symptoms as a specific risk factor for clinical depressive mood. Emotional downturns in healthy populations are among the most common emotional issues, significantly impacting individuals' physical and mental health (Yang, Huangfu, Tong, & He, 2022). There is a significant link between cyber-violence and depressive mood; cyber-violence affects emotional health, leading to depressive symptoms (Buelga, Martínez-Ferrer, Cava, & Ortega-Barón, 2019; Tokunaga, 2010). Thus, in this internet-developed era, researching depressive mood is particularly important. Lee et al. (2020) found that depressive mood mediates between humor expression and suicidal ideation. Bauman, Toomey, & Walker (2013) showed that depressive mood modulates the link between traditional victimization and suicide attempts. Clearly, the onset of depressive mood can cause serious mental health problems for high-level athletes, leading to irreversible consequences. Therefore, this study, referencing prior literature, aims to research the impact of cyber-violence on high-level athletes' depressive mood, proposing the following hypotheses:

H3: Depressive mood has a significant positive impact on perceived competition performance.

H4: Depressive mood significantly mediates between cyber-violence and perceived competition performance.

2.4 Fuzzy-Set Qualitative Comparative Analysis(FsQCA)

fsQCA is a set analysis method based on Boolean algebra and set theory principles. Its core idea is to use truth tables and logical minimization to ex-

tend patterns presented in case data (Fiss, 2011). Its advantage is in exploring different factor combinations that lead to a result, i.e., the "equifinality" of complex causal relationships (Fiss, 2007). At present, fsQCA has been widely applied in network management, social media, sports, and other fields, yielding positive results. Moreno, Prado-Gascó, Hervás, Núñez-Pomar, & Sanz (2016) used fsQCA and SEM to analyze the relationship between service quality, perceived value, satisfaction, emotion, and future intentions among professional basketball game spectators. Xie & Tsai (2021) used SEM and fsQCA to study the impact of negative information-related events on the intention to discontinue social media use, providing a new method for social media research. Navarro-Mateu, Alonso-Larza, Gómez-Domínguez, Prado-Gascó, & Valero-Moreno (2020) used SEM and fsQCA to analyze how emotional intelligence and perceived self-efficacy affect students' stress, providing an innovative perspective for related research and enabling contributions to the literature on stress perception. Therefore, this study will also use SEM and fsQCA to study the influencing factors of high-level athletes' perceived competition performance and try to build a multiple causal model to open up new methods for related research.

3. Model Construction

To explore the different path combinations leading to high-level athletes' perceived competition performance due to multiple interacting factors, this study constructs the conceptual model shown in Figure 1. The study will use Structural Equation Modeling (SEM) to explore the impact of cyber-violence and depressive mood on high-level athletes' perceived competition performance and the mediating role of depressive mood between cyber-violence and perceived performance (Model A). Additionally, it will use fuzzy-set Qualitative Comparative Analysis (fsQCA) to explore the impact of demographic characteristics on perceived performance (Model B). Finally, the study will combine all dimensions of cyber-violence and depressive mood and use fsQCA to test the factors enhancing perceived performance (Model C).

4. Research Method

4.1 Research Tools

The study's survey is designed mainly using a five-point Likert scale (strongly disagree=1; disagree=2; neutral=3; agree=4; strongly agree=5). The survey consists of two parts: the first

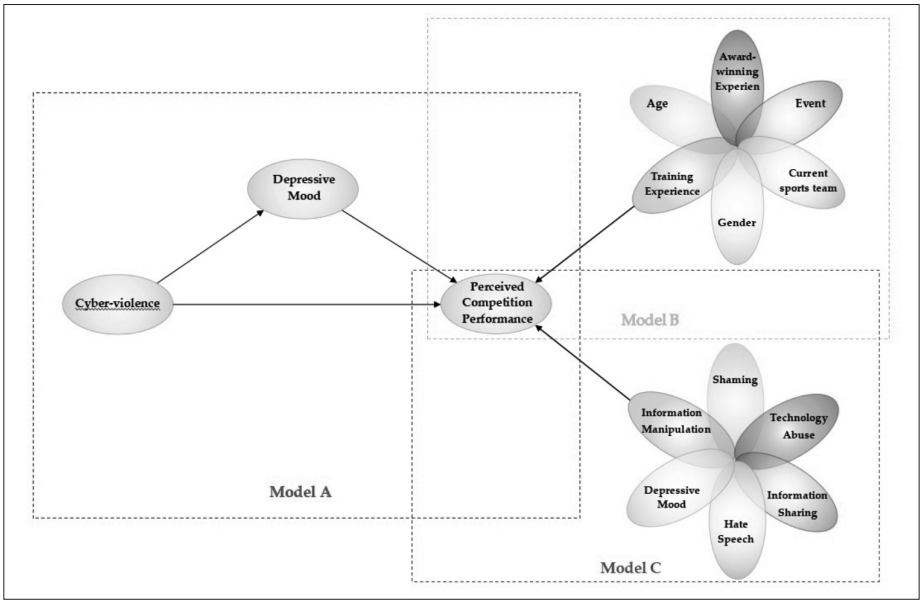

Fig. 1. - Research model.
Note: Model A is the SEM relationship between cyberbullying, depressive moods, and perceived competition performance. Model B is the demographic fsQCA combination that affects perceived competition performance. Model C is the fsQCA combination of various dimensions of cyberbullying and depressive moods that affect perceived competition performance.

part includes demographic information like gender, age, sport, current sports team, award history (best performance), and training experience. The second part includes 47 items covering the variables in the conceptual model. To ensure the questionnaire's validity and scientific nature, the cyber-violence scale refers to the "The Committing and Experiencing Cyber-Violence Scale—2021 (CECVS-2021)" developed by Çetin, Yaman, & Peker (2011), which includes 5 dimensions, namely, humiliation (13 items), information manipulation (7 items), technical abuse (7 items), information sharing (4 items), and hate speech (3 items). The depressive mood scale is based on the "Depressive Mood Scale" by Herrero & Meneses (2006), comprising 7 items. The perceived competition performance scale refers to the "Motivational Orientation Scales" by Nicholls, Cobb, Wood, Yackel, & Patashnick (1990), consisting of 6 items. These scales were modified and supplemented according to the study's objectives.

4.2 Data Collection

The questionnaire survey in this study, involving human participants, was conducted after receiving review and approval from the local institutional ethics committee (Decision No: 2024052). The study employed random sampling to select high-level athletes who had experi-

enced cyber-violence from national, provincial, city, and university teams from July to October 2023. The sample included athletes from individual sports like taekwondo, karate, judo, tennis, table tennis, and pair sports like diving, figure skating, as well as team sports like basketball, handball, and volleyball. Before the survey, three members of the research team clearly explained the study's purpose and usage. The first page of the survey questionnaire included an informed consent form, which presented details about the study's purpose, risks and benefits, confidentiality and privacy, and voluntary participation. If respondents had objections to the content of the informed consent, they could opt for the 'disagree' option, terminating the survey. With the consent and assistance of team leaders, coaches, and athletes, and after confirming that the athletes had indeed experienced cyber-violence, 269 questionnaires were distributed, and 269 were collected. After excluding 24 invalid questionnaires, the final valid sample size was 245. The specific demographic results of the survey subjects are shown in Table II.

TABLE I

Variable	Indicators	Frequency (n)	Valid percentage (%)
Gender	Male	148	60.4
	Female	97	39.6
Age	16-18 years old	66	26.9
	19-21 years old	102	41.6
	22-24 years old	53	21.6
	25-27 years	16	6.5
	Over 27 years old	8	3.3
Event	Individual events	95	38.8
	Doubles events	69	28.2
	Team events	81	33.1
Current Sports Team	National team	14	5.7
	Provincial team	70	28.6
	Municipal team	71	29.0
	University team	90	36.7
Awarding-winning Experience	World-class level	9	3.7
	National level	58	23.7
	Provincial level	93	38.0
	Municipal level	85	34.7
Training Experience	Less than 1 year	14	5.7
	1-3 years	45	18.7
	4-6 years	87	35.5
	7-9 years	53	21.6
	More than 9 years	46	18.8
Total		**245**	**100**

TABLE II
Confirmatory Factor Analysis and Reliability Analysis

Factor	Indicator	β	AVE	CR	α
Shaming	I am widely talked about online.	0.910	0.892	0.991	0.991
	The nicknames used for me when I am mentioned or referred to online make me uncomfortable.	0.908			
	They use aggressive expressions and symbols when talking to me or about me online.	0.937			
	I have been ridiculed online.	0.934			
	I received anonymous negative comments online (e.g., on video comments, TikTok, Weibo, etc.).	0.929			
	Some of the content I posted online has been disparaged.	0.950			
	They wrote aggressive comments under my online posts.	0.952			
	They used insulting emojis towards me online.	0.971			
	They spread rumors about me online.	0.956			
	They wanted to, or have already excluded me from a certain group online.	0.953			
	I have been publicly evaluated online (e.g., proclaimed as the prettiest/ugliest/most boring).	0.954			
	They mocked my possessions online (phone, clothes, shoes...).	0.960			
	They tried to humiliate me online under the guise of jokes, pranks, or false praise.	0.961			
Information Manipulation	They contacted me online but didn't want to tell me who they were.	0.938	0.881	0.981	0.981
	They contacted me through profiles with fabricated identities (appearing as someone else, fake profiles).	0.931			

(Continued)

(Continued) - TABLE I

Factor	Indicator	β	AVE	CR	α
	Despite my reluctance, I was forced to talk about "sex" online.	0.939			
	I shared someone else's photos (without their permission) online, which abstractly depicted "sexual" content.	0.957			
	They talked to me online so they could obtain private information or services from me (money, game characters, photos).	0.950			
	They used the internet to find private information about me (address, phone number).	0.932			
	They shared screenshots of my private conversations without my permission.	0.923			
Technology Abuse	They accessed my online profile without my permission.	0.912	0.899	0.984	0.984
	They breached my online profile to post undesirable content or delete my previous posts in my name.	0.957			
	They intentionally sent me viruses through social media messages.	0.955			
	I was threatened and extorted online.	0.953			
	They demanded money from me online, so they wouldn't embarrass me.	0.968			
	They deceived me over the internet and took my personal information or money.	0.969			
	They hacked into my social media or gaming profiles.	0.922			
Information Sharing	They posted private, sensitive, or embarrassing information about me online.	0.956	0.899	0.973	0.973
	They shared my videos online without my permission.	0.945			

(Continued)

(Continued) - TABLE I

Factor	Indicator	β	AVE	CR	α
	They shared my photos online without my permission.	0.947			
	My photos were edited in an offensive way.	0.945			
Hate Speech	They mocked me for being a member of a certain group (e.g., "four eyes", "skinny dog", "fatty", etc.).	0.947	0.919	0.971	0.971
	I was offended online just for being a member of a certain group (e.g., derogatory comments like stupid, slow, etc.).	0.979			
	They wrote online that me and my group members should be attacked, expelled, or destroyed for being a member of a certain group (e.g., expelling immigrants, sending women to the kitchen, sending disabled people to special schools...).	0.949			
Depressive Mood	Even with the help of family or friends, I can't shake off depressive mood.	0.941	0.911	0.986	0.986
	I have difficulty concentrating.	0.961			
	I feel despondent.	0.976			
	I feel like I have done everything I can.	0.941			
	I have trouble sleeping.	0.940			
	I can't enjoy life.	0.957			
	I am very sad.	0.965			
Perceived Competition Performance	My performance in competitions is worse than ever before.	0.941	0.905	0.983	0.983
	My athletic ability is declining.	0.967			
	I am very dissatisfied with my athletic ability.	0.953			
	I am unsure if I can maintain good competition performance.	0.968			
	I don't have the best competition ability.	0.962			
	I am not the best athlete.	0.915			

4.3 Data Analysis Method

After eliminating irregular and missing data from the sample, the data was imported into jamovi 2.3, AMOS 24.0, and fsQCA software. First, descriptive statistical analysis was conducted on demographic variables, and the validity of the scales was verified using Confirmatory Factor Analysis (CFA) and Cronbach's α coefficient (Reliability analysis). Then, Pearson's correlation coefficient analysis was used to verify the correlation between dimensions, and Standard Deviation, Skewness, and Kurtosis were used to verify the normal distribution of the data. After confirming the effectiveness of the scales and data, the direct/indirect impact of cyber-violence on high-level athletes' depressive mood and perceived competition performance was tested using a structural equation model. Finally, fsQCA was used to verify the combined factors of perceived competition performance.

5. Results

5.1 Model Testing And Reliability And Validity Testing

To test the structural validity of the scales, confirmatory factor analysis (CFA) was used. The results, as shown in Table 2, were χ^2=2382.490, p<0.001, df=1013, IFI=0.938, TLI=0.934, CFI=0.938, RMSEA=0.047, SRMR=0.024. With RMSEA<0.08, SRMR<0.1, TLI, CFI >0.9, and each measurement item's standardized factor loading coefficient greater than 0.5, the average variance extracted (AVE) values above 0.5, and composite reliability (CR) values above 0.7, the data of the measurement scales have excellent convergent validity (Hair, Anderson, Tatham, & Black, 2004). The reliability analysis results show that all latent variables' Cronbach's α values are greater than 0.7, indicating that the measurement items in the latent variables meet statistical requirements and are consistent.

5.2 Correlation Analysis and Normality Test

As shown in Table 3, Pearson's Correlation Analysis was used to explore the relationships between variables. The results indicated significant correlations among the variables, with correlation coefficients below 0.8, suggesting no issues of multicollinearity among all variables. Then, discriminant validity was confirmed by Fornell & Larcker (1981)'s criterion of >r. Finally, the normal distribution of the data was verified as Standard Deviation ≤±2, Skewness ≤±2, Kurtosis ≤±4, according to Hong, Malik, & Lee (2003).

5.3 Hypothesis Testing For Model A

To test whether the model setting and sample data fit the statistical requirements, this study conducted data verification after building the model.

TABLE III
Results of Correlation Analysis and Normal Distribution

	A	B	C	D	E	F	G	AVE
A	1							0.944
B	0.637**	1						0.939
C	0.761**	0.612**	1					0.948
D	0.724**	0.669**	0.695**	1				0.948
E	0.650**	0.472**	0.682**	0.594**	1			0.959
F	0.606**	0.538**	0.555**	0.596**	0.560**	1		0.954
G	-0.488**	-0.438**	-0.380**	-0.485**	-0.424**	-0.560**	1	0.951
SD	1.192	1.171	1.146	1.102	1.179	1.207	1.248	
Skewness	1.162	0.804	0.855	0.804	1.048	0.555	-0.609	
Kurtosis	0.297	-0.188	-0.113	-0.073	0.385	-0.631	-0.713	

Note. **p<0.01, A= Shaming, B= Information Manipulation, C= Technology Abuse, D= Information Sharing, E=Hate Speech, F=Depressive Mood, G= Perceived Competition Performance.

The results showed that χ^2=2384.713***, df=1014, IFI=0.938, TLI=0.934, CFI=0.938, RMSEA=0.074, SRMR=0.024. This meets the criteria of RMSEA<0.08, SRMR<0.06, IFI, TLI, CFI>0.9, thus it is inferred that the fit of the data with the hypothesized model in this study is relatively good, and the hypothesized causal model can be accepted (Browne & Cudeck, 1992; Hu & Bentler, 1999).

As shown in Table 4 and Figure 2, the hypothesis testing results revealed that humiliation (β=0.17, p<0.05), information manipulation (β=0.159, p<0.05), information sharing (β=0.226, p<0.01), and hate speech (β=0.241, p<0.01) have a significant positive direct impact on depressive mood, supporting hypotheses H1-1, H1-2, H1-4, and H1-5. Technical abuse (β=0.012, p>0.05) does not have a significant direct impact on depressive mood, thus H1-3 is not supported. Depressive mood (β=-0.353, p<0.001), humiliation (β=-0.224, p<0.01), and technical abuse (β=0.219, p<0.05) have a significant positive direct impact on perceived competition performance, supporting hypotheses H3, H2-1, and H2-3. Information manipulation (β=-0.098, p>0.05), information sharing (β=-0.139, p>0.05), and hate speech (β=-0.115, p>0.05) do not have a significant direct impact on perceived competition performance, thus hypotheses H2-2, H2-4, and H2-5 are not supported.

To verify the mediating role of depressive mood, this study used structural model path testing and bias-corrected non-parametric percentile Bootstrap method (Bootstrapping (10,000 resamples), 95% confidence interval).

TABLE IV
path analysis result

	Path	B	β	S.E.	t	Result
H1-1	Shaming → Depressive Mood	0.178	0.170	0.083	2.155*	Adopted
H1-2	Information Manipulation → Depressive Mood	0.163	0.159	0.073	2.236*	Adopted
H1-3	Technology Abuse → Depressive Mood	0.012	0.012	0.088	0.141	Rejected
H1-4	Information Sharing → Depressive Mood	0.238	0.226	0.087	2.741**	Adopted
H1-5	Hate Speech → Depressive Mood	0.244	0.241	0.071	3.416***	Adopted
H2-1	Shaming → Perceived Competition Performance	-0.246	-0.224	0.094	-2.619**	Adopted
H2-2	Information Manipulation → Perceived Competition Performance	-0.106	-0.098	0.083	-1.274	Rejected
H2-3	Technology Abuse → Perceived Competition Performance	0.240	0.219	0.100	2.410*	Adopted
H2-4	Information Sharing → Perceived Competition Performance	-0.155	-0.139	0.099	-1.555	Rejected
H2-5	Hate Speech → Perceived CompetitionPerformance	-0.123	-0.115	0.082	-1.492	Rejected
H3	Depressive Mode → Perceived Competition Performance	-0.371	-0.353	0.075	-4.960***	Adopted

χ^2=2384.713***, *df*=1014, IFI=0.938, TLI=0.934, CFI=0.938, RMSEA=0.074, SRMR=0.024

Note. *p<0.05, **p<0.01, ***p<0.001

The prerequisite for testing the mediating effect is that the direct effects of the path a and path b must be established. Since there is no direct effect of technical abuse on depressive mood, the mediation effect of technical abuse → depressive mood → perceived competition performance is not tested. As shown in Table 5, the results of the mediation effect of depressive mood between cyber-violence and perceived competition performance showed that the range between Lower and Upper does not contain 0, indicating a significant positive (+) mediating role of depressive mood between humiliation and perceived competition performance (H4-1 supported), between information manipulation and perceived competition performance (H4-2 supported), between information sharing and perceived competition performance (H4-3 supported), and between hate speech and perceived competition performance (H4-4 supported).

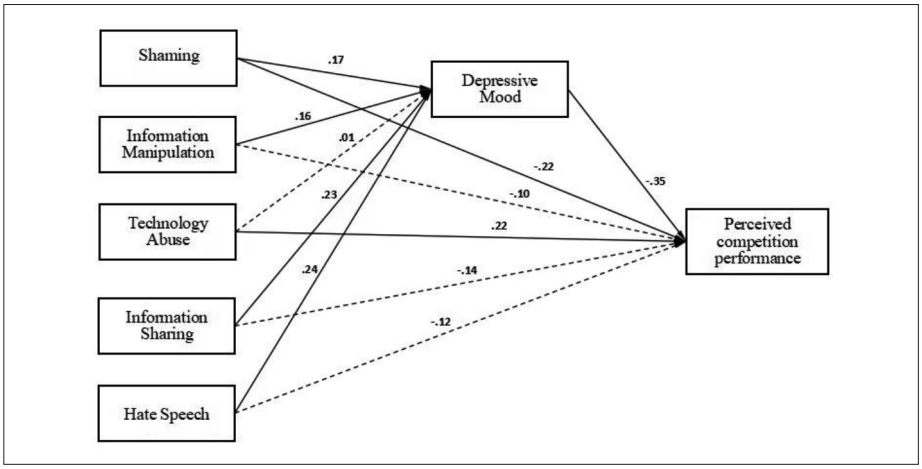

Fig. 2. - Structural equation model path test results.
Note: Solid lines represent significant effects, dashed lines represent non-significant effects, and the numbers represent the influence of direct effects. Indirect effects are the product of direct effects (for example, the influence of depressive mood between shame and perceived competition performance is 0.17 * -0.35 = -0.060).

TABLE V
Mediating Effect of depressive mood

	Path	B	β	Lower	Upper	Result
H4-1	Shaming → Depressive Mood → Perceived Competition Performance	-0.066	-0.060	-0.149	-0.014	Adopted
H4-2	Information Manipulation → Depressive Mood → Perceived Competition Performance	-0.061	-0.056	-0.161	-0.005	Adopted
H4-3	Information Sharing → Depressive Mood → Perceived Competition Performance	-0.089	-0.081	-0.182	-0.028	Adopted
H4-4	Hate Speech → Depressive Mood → Perceived Competition Performance	-0.091	-0.084	-0.187	-0.028	Adopted

χ^2=2384.713***, *df*=1014, IFI=0.938, TLI=0.934, CFI=0.938, RMSEA=0.074, SRMR=0.024

Note. Bootstrapping (10,000 resamples)

5.4 Fuzzy-Set Qualitative Comparative Analysis (FsQCA)

5.4.1 Data Calibration

Since fsQCA analysis is based on Boolean algebra logic, in fsQCA, the outcome variable and each condition variable are considered as separate sets,

with each case having a membership score in these sets. The data is required to be in the range of [0,1] in sets, where '1' represents full membership, and '0' represents no membership. However, the original sample data did not meet this condition, hence, the collected data was calibrated to assign set membership scores. Following existing research and based on theoretical and empirical knowledge, direct calibration was used to convert data into fuzzy set membership scores (Ragin & Fiss, 2008). This study adopted the calibration standards of Tao, Zhang, & Zhao (2021) and the actual situation of the cases, calibrating all variable cross-points at the 0.5 percentile, full non-membership calibration at the 0.05 percentile, and full membership calibration at the 0.95 percentile. Demographic features were calibrated following Luo & Yao (2023) standards, with gender calibrated using 0.05 (full non-membership) and 0.95 (full membership) standards. For age, gender, and project, the maximum, minimum, and average values in each category were used as full membership threshold, full non-membership threshold, and the midpoint for calibration, respectively. Calibration information for each condition and outcome is shown in Table VI.

TABLE VI
Condition and outcome calibration in the model

Category	**Condition and Outcome**	**Calibration**		
		Full Member	**Intersection**	**Full Non-Member**
Outcome Variable	Perceived Competition Performance	5	4	1.17
Condition Variable	Shaming	4.69	1.31	1
	Information Manipulation	4.94	2	1
	Technology Abuse	4.29	1.86	1
	Information Sharing	4.2	2	1
	Hate Speech	5	2	1
	Depressive Mood	4.83	2.29	1
	Gender	0.05	-	0.95
	Age	5	2.18	1
	Event	3	1.94	1
	Current Sports Team	4	2.96	1
	Award-winning Experience	4	3.04	1
	Training Experience	5	3.29	1

5.4.2 Analysis of Necessary Conditions

As shown in Table 7, the consistency of all conditions is less than 0.9. Therefore, it can be concluded that there are no necessary conditions affecting the perceived competition performance of high-level athletes. Moreover, the perceived competition performance of high-level athletes is influenced by various factors, and the impact mechanism on their perceived performance is explained through a combination analysis of variables.

5.4.3 Sufficient Condition Analysis of Model B Demographic Features

This study sets the consistency threshold to 0.8 and PRI consistency threshold to 0.7, with a case frequency threshold of 1, retaining at least 80% of the sample, following the research of Fiss (2011) and Du & Jia (2017). According to the standard by Tao, Zhang, & Zhao (2021), if both the consistency level of a single configuration and the overall configuration are above 0.75, it indicates that the identified configurations of antecedent conditions for high-level athletes' perceived competition performance are satisfactory. The presence of conditions is indicated by a black circle (●), and the absence of conditions is indicated by a crossed circle (⊗). Core elements in a configuration are marked with a large circle, peripheral elements with a small circle, and spaces represent indifferent states, meaning the causal conditions may or may not be present.

5.4.4 Model B: Sufficient Condition Analysis with Demographic Features as Conditional Factors

In the configuration analysis results of Table 8, the overall coverage is 0.485, and the overall consistency is 0.751. Both single consistency and overall consistency have reached the standard of above 0.75, verifying that the following five configurations can enhance the perceived competition performance of high-level athletes.

Configuration 1 shows that female athletes perceive higher competition performance in the absence of award history and training experience. Configuration 2 indicates higher perceived competition performance by female athletes regardless of age, project, and training experience. Configuration 3 shows variations in perceived competition performance among female athletes based on the sports team, disregarding age and training experience. Configuration 4 demonstrates that older high-level athletes with no project, sports team, or award history have higher perceived competition performance. Configuration 5 indicates that older female athletes in pair or team

TABLE VII
Necessary Condition Analysis In The Model

Condition Variable	Actual Behavior		~ Actual Behavior	
	Consistency	Coverage	Consistency	Coverage
Shaming	0.441	0.545	0.674	0.727
~Shaming	0.780	0.732	0.579	0.475
Information Manipulation	0.490	0.567	0.699	0.706
~ Information Manipulation	0.746	0.740	0.571	0.494
Technology Abuse	0.424	0.549	0.619	0.700
~ Technology Abuse	0.768	0.698	0.601	0.477
Information Sharing	0.478	0.541	0.723	0.714
~ Information Sharing	0.747	0.755	0.535	0.472
Hate Speech	0.436	0.562	0.653	0.735
~ Hate Speech	0.794	0.724	0.611	0.486
Depressive Mood	0.415	0.517	0.718	0.780
~ Depressive Mood	0.823	0.770	0.555	0.453
Gender	0.489	0.642	0.418	0.480
~ Gender	0.604	0.543	0.688	0.540
Age	0.534	0.684	0.567	0.633
~ Age	0.713	0.654	0.717	0.573
Event	0.568	0.624	0.580	0.557
~ Event	0.597	0.619	0.609	0.551
Current Sports Team	0.637	0.609	0.706	0.589
~Current Sports Team	0.570	0.690	0.531	0.561
Award-winning Experience	0.594	0.616	0.666	0.603
~ Award-winning Experience	0.617	0.679	0.576	0.553
Training Experience	0.326	0.844	0.310	0.701
~ Training Experience	0.884	0.595	0.931	0.547

sports, without a sports team, have higher perceived competition performance. The scatterplot of all configurations is shown in Figure 3.

5.4.5 Sufficient Condition Analysis of Model C: cyber-violence and depressive mood Variables

In the configuration analysis results of Table 9, the overall coverage is 0.734, and the overall consistency is 0.814. The overall consistency has reached

TABLE VIII
Configuration assessment of model b

	Configuration 1	**Configuration 2**	**Configuration 3**	**Configuration 4**	**Configuration 5**
Gender	●	●	●		●
Age		⊗	⊗	●	●
Event		⊗		⊗	●
Current Sports Team			●	⊗	⊗
Award-winning Experience	⊗			⊗	
Training Experience	⊗	⊗	⊗	⊗	⊗
Raw coverage	0.295	0.256	0.284	0.235	0.155
Unique coverage	0.037	0.009	0.025	0.095	0.010
Consistency	0.764	0.837	0.803	0.842	0.887
Overall coverage			0.485		
Overall consistency			0.751		

Note: ● or ● indicates presence, ⊗ or ⊗ indicates absence, ● or ⊗ indicates a core condition, ● or ⊗ indicates a peripheral condition, and a blank space represents an indifferent state. In the case of gender, ● indicates female, ⊗ indicates male.

the standard of above 0.75, verifying that the following six configurations can enhance the perceived competition performance of high-level athletes.

Configuration 1 shows that athletes have higher perceived competition performance in the absence of information manipulation, information sharing, hate speech, and depressive mood. Configuration 2 indicates higher performance in the absence of information manipulation, technical abuse, information sharing, and depressive mood. Configuration 3 shows higher performance in the absence of humiliation, information sharing, hate speech, and depressive mood as core elements. Configuration 4 demonstrates higher performance without humiliation, technical abuse, hate speech, and depressive mood. Configuration 5 indicates higher performance without humiliation, technical abuse, information sharing, and depressive mood. Configuration 6 shows higher performance without humiliation, information manipulation, information sharing, and depressive mood. Configuration

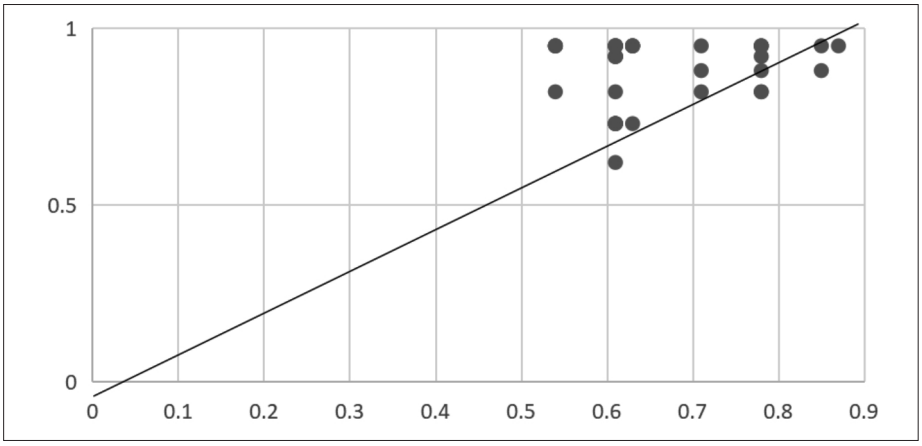

Fig. 3. - Explanation in the model B.
Note: The data points above the diagonal represent the necessity of each factor, while the data points below the diagonal represent the non-necessity of each factor.

TABLE IX
Configuration assessment of model C.

	Configuration 1	**Configuration 2**	**Configuration 3**	**Configuration 4**	**Configuration 5**	**Configuration 6**	**Configuration 7**
Shaming			⊗	⊗	⊗	⊗	⊗
Information Manipulation	⊗	⊗				⊗	⊗
Technology Abuse		⊗		⊗	⊗		⊗
Information Sharing	⊗	⊗	⊗		⊗	⊗	
Hate Speech	⊗		⊗	⊗			
Depressive Mood	⊗	⊗	⊗	⊗	⊗	⊗	⊗
raw coverage	0.529	0.534	0.536	0.581	0.533	0.546	0.531
unique coverage	0.013	0.014	0.011	0.051	0.003	0.022	0.002
consistency	0.863	0.854	0.867	0.830	0.868	0.870	0.865
Overall coverage				0.734			
Overall consistency				0.814			

Note: ● or ● indicates presence, ⊗ or ⊗ indicates absence, ● or ⊗ indicates a core condition, ● or ⊗ indicates a peripheral condition, and a blank space represents an indifferent state. In the case of gender, ● indicates female, ⊗ indicates male.

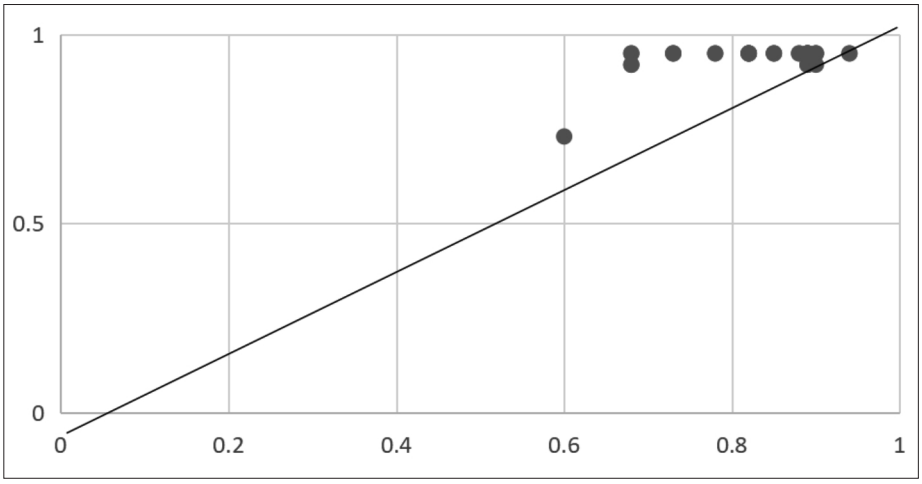

Fig. 4. - Explanation in the model C.
Note: The data points above the diagonal represent the necessity of each factor, while the data points below the diagonal represent the non-necessity of each factor.

7 indicates higher performance in the absence of humiliation, information manipulation, technical abuse, and depressive mood. The scatterplot of all configurations is shown in Figure 4.

6. Discussion

This study explored the structural relationship between cyber-violence, depressive mood, and perceived competition performance of high-level athletes through SEM, and examined their configurational relationships using fsQCA. Based on the results, a detailed discussion is conducted in the following three aspects:

(1) Cyber-violence has a partially significant positive impact on depressive mood, and depressive mood has a significant negative impact on perceived competition performance. Depressive mood plays a significant mediating role between cyber-violence and perceived competition performance.

Muzamil & Shah (2016) explored factors affecting academic performance in middle school students. Their results indicated that cyber-violence has a significant negative impact on students' academic performance, similar to the findings of this study. Currently, athletes, as one of the main victim

groups of cyber-violence, experience negative impacts such as emotional distress, lowered self-esteem, and reduced motivation and interest in sports (Jewett, Kerr, MacPherson, & Stirling, 2020; Nery, Neto, Rosado, & Smith, 2020).

Cyber-violence causes invisible harm, often more impactful than some physical injuries. After a first-round loss at Wimbledon, professional tennis player Eugenie Bouchard received negative comments on social media, which greatly affected her subsequent game performance (MacPherson & Kerr, 2023). In August 2022, a 16-year-old athlete from Florida committed suicide due to cyber-violence (Kennedy, 2022). It is evident that cyber-violence not only affects athletes' mental health and competition performance but also threatens their lives.

Reviewing existing research results, to ensure athletes' good mental state and perceived competition performance, governments should strengthen the construction of relevant laws and regulations, clarify the illegality of cyber-violence and corresponding punishments, and establish reporting platforms. There should also be increased social supervision and public opinion guidance to encourage public monitoring of cyber-violence. Additionally, the media has a responsibility to correctly guide public opinion, act as opinion leaders, resolve conflicts, and promote harmonious and stable social development.

Lee & Yoo (2022) showed that depressive mood in children and adolescents mediates between victimization and aggression in cyber-violence. Arruza et al. (2009) found that depressive mood as a mediator negatively impacts athletes' perceived competition performance. Kim (2017) found that depressive mood mediates between youth violence victimization and discriminatory behavior. These results are similar to those of this study. With the proliferation of the internet and easier access to freedom of speech, when athletes become the subject of discussion or controversy due to hot issues, cyberbullies or low-quality netizens may excessively criticize them, exacerbating social conflicts. This can cast a significant psychological shadow on athletes, affecting their stable performance in training or competitions (Yao, 2020).

According to the literature reviewed, there are many studies on cyberbullying against female athletes, but they only investigated the impact of cyberbullying from a single dimension. Our study refines the dimensions of cyberbullying, examining its effects on high-level athletes' perceived performance across multiple dimensions such as humiliation, information manipulation, technology abuse, hate speech, and information sharing. This approach makes the results more comprehensive and persuasive. Additionally, individual dimensions of cyberbullying significantly impacted the depression

and perceived performance of high-level athletes in our study. This shows that our results differ from previous literature by breaking down cyberbullying into multiple dimensions, which more precisely demonstrates the different forms of cyberbullying and their harmful effects on perceived performance, providing new research findings for the field. Furthermore, the tool for investigating cyberbullying used in this study is rarely mentioned in the literature and has previously targeted children or young people. Our study, focusing on high-level athletes, adds foundational research to the field concerning athletes experiencing cyberbullying.

Based on the results of this study, it provides references for the government to manage all acts of humiliation, information manipulation, information sharing, hate speech, and technology abuse against athletes on the internet, aiming to prevent such adverse behaviors timely. It also contributes to the government and sports team management's joint efforts to protect athletes' emotions, ensuring a conducive training and competition environment, and continuously improving athletes' perceived performance. Therefore, in preventing and stopping cyber-violence, on the one hand, governments and relevant internet management organizations need to establish and implement strategies for preventing and intervening in cyber-violence, promptly stopping inappropriate behavior online. On the other hand, sports teams need to pay timely attention to athletes' psychological and physical states in training and daily life, providing appropriate relaxation time to ensure their stable performance.

(2) This study constructed an asymmetrical Model B based on demographic characteristics. The results showed that in Configurations 1 and 2, female athletes are more likely to have higher perceived competition performance in the absence of age, project, award history, and training experience. Configuration 3 indicates that the perceived competition performance of female athletes varies based on their sports team, regardless of age and training experience. Configuration 5 shows that older female athletes in pair or team sports have higher perceived competition performance.

Research by Eronen, Nurmi, & Salmela-Aro (1998) suggested that strong psychological qualities are essential for good performance in high-level competitions. Amjad, Irshad, & Gul (2018) found that male athletes in team sports like cricket and volleyball experience higher anxiety and fear of failure than female athletes, who have higher psychological resilience. Kumar (2016) reported that anxiety hinders athletes' perceived performance, with male basketball players experiencing higher sports competition anxiety than female players. This suggests that in team sports, male athletes are more prone to fear of failure, and female athletes have stronger mental qualities.

Therefore, compared to male athletes, female athletes have higher perceived competition performance, aligning with the findings of this study.

In Configuration 4, older high-level athletes without project, sports team, or award history have higher perceived competition performance. Torres-Unda et al. (2013) found that "older athletes have better perceived competition performance than younger athletes," similar to this study. Psychological qualities significantly impact performance in competitions (Bali, 2015). Older athletes generally have richer competition experience and stronger psychological resilience to unexpected situations, leading to better perceived competition performance. Thus, gender and age are crucial factors affecting the perceived competition performance of high-level athletes. To achieve success, athletes need not only personal effort and coaching guidance but also the support of experienced team members. This approach has formed a virtuous cycle in cultivating sports talents, leveraging the strengths of older athletes to help younger ones achieve excellent competition results more quickly.

A review of existing literature shows that there are few studies that conduct a detailed comparison of demographic variables such as gender, age, and sports teams among athletes. Although the research by Bartolomei, Grillone, Di Michele, & Cortesi (2021) indicates some differences in the strength and power between male and female athletes, and Nicholls, Polman, Levy, & Backhouse (2009) highlighted the importance of sports experience, noting that older athletes have more experience and greater psychological resilience, there has been no study to date that has demonstrated the impact on athletes' perceived performance through a configurational approach. Therefore, this study combines demographic variables such as gender, age, event, sports team, awards history, and training experience to provide a more comprehensive and in-depth combinational prediction of high-level athletes' perceived performance, offering new theoretical insights for enhancing the performance of high-level athletes.

Additionally, the study findings reveal that female athletes have higher perceived performance than male athletes, and older high-level athletes possess higher perceived performance. This research provides practical references for optimizing athlete composition within sports teams. In terms of selection, considerations could include balancing the gender and age proportions of athletes. In training, it could be beneficial to consider the age of athletes and adopt a mentoring approach, facilitating mutual progress and contributing substantively to the team's success.

(3) This study combined all dimensions of cyber-violence and depressive mood and used fsQCA to examine factors enhancing high-level athletes' per-

ceived competition performance. From the results in Table 9, it's evident that the absence of various forms of cyber-violence, such as humiliation and information manipulation, improves high-level athletes' perceived competition performance. Additionally, depressive mood was present in all seven configurations that could potentially reduce perceived performance, indicating that depressive mood is the most significant factor in lowering athletes' perceived competition performance. Thus, to enhance high-level athletes' perceived competition performance, the absence of depressive mood is crucial.

Research by Janover & Terry (2002) showed that pre-competition depressive states affect swimming performance. McDermott & Lachlan (2021) found that verbal humiliation negatively impacts performance both psychologically and emotionally. These findings are similar to this study's results. Jewett, Kerr, MacPherson, & Stirling (2020) suggested that cyber-violence in sports, related to sports performance, athlete behavior, or the team, represents a form of peer interpersonal conflict and severely impacts athletes' mental health and welfare. Taiwanese athlete Huang Yuting, impacted by ongoing cyber-violence, decided to end her professional career (Zhao, 2022). Hence, cyber-violence and depressive mood significantly and negatively affect high-level athletes' perceived competition performance.

The above studies all indicate that cyberbullying and depressive moods have a negative impact on the perceived performance of high-level athletes. This research builds on SEM and adds findings from fsQCA, which were not verified in previous literature. Moreover, the results deepen our understanding of the causal relationships between cyberbullying, depressive mood, and perceived performance (Mithas, Xue, Huang, & Burton-Jones, 2022). The fsQCA results show that depressive mood is present in all configurations, highlighting its significant impact on high-level athletes' perceived performance. These findings are meaningful for coaches and sports team management to focus on the mental health of athletes.

We also suggest that victims of cyber-violence can talk to family and friends or seek help from a psychologist if needed; they can also report incidents or gather evidence for legal action. Meanwhile, governments should encourage active participation in online ecological governance, supervising illegal and inappropriate online behavior, and building a safe and healthy online environment.

7. Conclusions and Suggestions

This study, by using SEM and fsQCA, explored the impact of cyber-violence on depressive mood and perceived competition performance

in high-level athletes. The study found that cyber-violence affects athletes' depressive mood and perceived competition performance, with depressive mood mediating this effect. Additionally, diverse conditional configuration pathways emerge when combining various factors, indicating that besides cyber-violence and depressive mood, gender and age are important factors affecting high-level athletes' perceived competition performance. Based on these findings, governments should strengthen online management mechanisms, implement comprehensive governance measures, strictly punish cyberbullies, and provide psychological safety for athletes. Society should assist in monitoring cyber-violence, providing feedback, and fostering a harmonious, safe online atmosphere, ensuring a favorable environment for athletes.

This study has two limitations to consider in future research. First, the study's subjects cannot be generalized to all athletes but are limited to those in certain common sports. Future research could expand the range of subjects, including those in lesser-known sports, and further analyze the impact of cyber-violence on athletes' perceived competition performance. Second, the decline in high-level athletes' perceived competition performance might be related to physiological factors, in addition to psychological ones. Future research could explore the impact mechanisms of athletes' perceived competition performance from a physiological perspective.

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Manuscript submitted February 2024. Accepted for pblication June 2024.