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The Relationship Between Family Sports Behavior Environment and Non-Suicidal Self-Injury Among Chinese Middle School Students: The Chain Mediating Effect of Friendship Quality and School Bullying Victimization

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Article

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Abstract

This study aims to examine the relationship between the family sports behavior environment (FSBE) and non-suicidal self-injury (NSSI) among Chinese middle school students, with particular emphasis on the mediating role of friendship quality(FQ) and school bullying victimization (SBV) in this relationship.Method: A convenience sampling method was employed, with 968 middle school students as the survey subjects. Questionnaire surveys were conducted using the Family Sports Behavior Environment Scale, the Friendship Quality Questionnaire, the Victim Questionnaire, and Non-suicidal Self-injury Assessment Questionnaire. The obtained data were processed and analyzed using SPSS statistical software.Results: FSBE was significantly positively correlated with FQ, and SBV was significantly positively correlated with NSSI. SBV and NSSI were significantly negatively correlated with FSBE, and both SBV and NSSI were significantly negatively correlated with FQ. In terms of mediation analysis, FSBE could predict NSSI behaviors among middle school students through FQ (effect = -0.153, 95% CI [− 0.186, − 0.121]), SBV (effect = -0.034, 95% CI [− 0.051, − 0.018]), and the chained mediation effect of FQ and SBV (effect = -0.018, 95% CI [− 0.027 − 0.011]).Conclusion: FQ and SBV are chain-mediated between FSBE and NSSI among Chinese middle school students. A good family sports environment can positively enhance the level of FQ, which in turn effectively reduces the risk of SBV among Chinese middle school students and ultimately reduces their NSSI behaviors.

Introduction

Non-suicidal self-injury (NSSI) refers to behaviors in which individuals deliberately and actively inflict direct harm on their own bodies without any suicidal intent, primarily including cutting, burning, biting, and similar

actions. Such behaviors are not socially or culturally accepted[1]. As a maladaptive emotional regulation strategy, NSSI not only leads to the deterioration of social functioning and relational alienation but also serves as a high-risk factor for suicidal behavior[2]. Middle school students are in a critical transitional period of physical and psychological development and have been identified as a high-risk group for NSSI. Statistics show that the global lifetime prevalence of NSSI among adolescents is as high as 22% [3], while in China, the overall detection rate of NSSI in middle school students is 27.4% [4], with an increasing trend during this developmental stage[5]. Due to the high prevalence and significant risk associated with adolescent NSSI, it has become a serious public health issue worldwide[6]. Therefore, exploring the influencing factors behind NSSI in middle school students holds important practical significance for promoting their healthy development.

According to the Ecological Systems Theory, individual development is influenced by a series of environmental factors, such as family, school, and peers, and these environmental factors interact with individual psychological factors to influence individual development[7]. Studies have shown that parent-child relationship can significantly predict adolescents' internalizing and externalizing problem behaviors[8]; meanwhile, peer relationship[9] and school bullying[10] are also important predictors of adolescents' self-injury. Based on existing research findings, although family and peer systems may be important variables influencing middle school students' NSSI behaviors, few studies have integrated family and peer perspectives to systematically explore the associations between family sports behavior environment, friendship quality, school bullying victimization, and NSSI among middle school students. In view of this, this study intends to examine the relationship between FSBE and NSSI of Chinese middle school students, and further test the chain mediating role of friendship quality (a key variable of the peer system) and school bullying victimization (a risk factor of the peer system) in the relationship between the two, which will provide a theoretical framework and empirical evidence for the development of a targeted intervention program for middle school students' NSSI behaviors.

The Relationship Between FSBE and NSSI in Chinese Middle School Students

The Family Sports Behavior Environment (FSBE) refers to the patterns of interaction between parents and children in physical activities, as well as the rules and constraints parents set regarding their children’s physical activity[11]. A favorable FSBE serves as a crucial driver for adolescents’ participation in physical exercise, playing a key role in both initiating and maintaining exercise behavior. According to Self-determination Theory, the fulfillment of the three basic psychological needs of autonomy, relatedness, and competence can effectively promote the internalization of extrinsic motivation, thereby forming autonomous motivation[12]. Specifically, in the context of family interactions, parents can stimulate and cultivate their children’s intrinsic motivation to engage in physical exercise by participating in activities together and providing emotional support, behavioral modeling[13], and normative guidance[14]. This process not only encourages children to actively participate in physical exercise but also continuously satisfies their basic psychological needs. The fulfillment of these basic psychological needs can significantly enhance

adolescents' psychological well-being and reduce the risk of various problem behaviors[15], potentially decreasing the occurrence of NSSI in adolescents. It is noteworthy that existing studies often focus on the broad scope of physical activity and its association with adolescent NSSI behavior[16,17], while empirical research specifically examining the FSBE in relation to NSSI among Chinese middle school students remains relatively scarce. Based on the above theoretical and research foundations, this study proposes Hypothesis 1: FSBE negatively predicts NSSI in Chinese middle school students.

The Mediating Role of FQ

Friendship quality (FQ) refers to the degree of mutual companionship, support and close interaction between friends[18], which is an important indicator of friendship relationship, reflecting the individual's subjective feelings and evaluation of friendship[19]. After entering adolescence, adolescents' interactions with peers become increasingly close, and the influence of peer friendship on their development becomes more and more obvious. Research has shown that good peer relationships can enable individuals to obtain support and help from others[20], satisfy their social needs, gain positive emotional experiences, and inhibit the occurrence of problematic behaviors[21]. According to Social Support Theory, friendship, as an important social support resource, is an important protective factor for adolescents' self-development[22]. High FQ means that individuals can obtain more social support from friends[23] and can buffer potentially stressful events after assessing them as stressful and inhibit their own problematic behaviors as much as possible[24]. In addition, the family environment is an important environmental factor that shapes an individual's developmental trajectory and influences his or her level of social adjustment[25]. According to Social Learning Theory, children often have strong observation and imitation abilities[26], and in the process of daily interaction with their parents, they can acquire corresponding values, cognitive patterns and behavioral styles through observation, and transfer them to subsequent interpersonal situations[27]. In a good FSBE, parents' positive communication such as encouragement, support, and praise are more likely to be accepted and recognized by their children[28], and such communication may be used by their children in school and social adaptation situations, thus enhancing the friendship ties among peers. Combining relevant theories and empirical studies, it is hypothesized that the FSBE may reduce NSSI behaviors by enhancing adolescents' FQ. Based on this, Hypothesis 2 is proposed: FQ plays a mediating role between FSBE and NSSI.

The Mediating Role of SBV

School bullying victimization (SBV) refers to the negative behaviors such as intentional verbal humiliation, extortion, assault, rumor defamation, and so on, which happen to adolescents in school premises frequently and within a certain period of time by one or more bullies[29]. As a traumatic event, SBV can lead to a series of adverse consequences, such as anxiety, depression, etc., and even suicidal ideation and behavior in severe cases[30]. According to the Experiential Avoidance Model (EAM), the main function of self-injurious behavior is to avoid or escape from the negative psychological experience that the individual is unwilling to accept[31]. Individuals who are bullied generally show a decrease in positive emotions and an increase in negative

emotions[32]. Self-injury, as an maladaptive coping strategy, makes victims more prone to resorting to self-injury behaviors to alleviate negative emotions, which, to some extent, will continuously reinforce the link between unpleasant emotions and self-injurious behaviors[33] and increase the likelihood of NSSI. In addition, a good family sports atmosphere can not only subconsciously shape individuals' sports values and health behaviors[34], but also enhance physical fitness, improve family functioning and social adaptability through family members' joint participation in sports activities[35], thus enhancing their own physical fitness and health while increasing their likelihood of coping with and resisting SBV[36]. On the contrary, when the family sports atmosphere is weak, parents' negative tendency in sports concepts and behaviors can become an important factor that hinders adolescents' health promotion through sports[37], which to a certain extent will reduce the level of physical self-esteem, and thus may increase the risk of becoming a target of school bullying victimization[38]. Combining relevant theories and empirical studies, it is hypothesized that the FSBE may reduce the occurrence of NSSI behaviors by decreasing the risk of adolescents' SBV. Based on this, Hypothesis 3 is proposed: SBV plays a mediating role between FSBE and NSSI.

The Chain Mediating Role between FQ and SBV

A good FSBE may reduce middle school students' risk of SBV by enhancing their FQ level, ultimately leading to a decrease in NSSI. According to the Ecological Systems Theory, peer friendship support, as an important micro-system influencing individual development, has a significant impact on multiple aspects of individual development[39]. Research has shown that high FQ provides adolescents with a sense of security and social support, and promotes positive social adaptation[40]. This also means that individuals with high levels of FQ are able to obtain stable social support, sense of security and peer resources, which provide protective factors for the development of their social behaviors[41]; whereas individuals who lack good FQ are more likely to be lonely, targeted, and more likely to be the target of bullying victimization. Other studies have shown that peer relationships are significantly negatively correlated with bullying behaviors[42]. Combining the above related theoretical and empirical studies, this study proposes Hypothesis 4: FQ and SBV are chain-mediated between FSBE and NSSI.

In summary, based on relevant theories and previous research, this study aims to explore the relationship between FSBE and NSSI, as well as the chain mediation effect of FQ and SBV (the hypothetical model diagram is shown in Fig. 1). It is intended to offer a novel perspective for preventing and reducing NSSI in middle school students.

Figure 1. Hypothetical Model Diagram.

Materials and Methods

Participants

The questionnaire was administered to students in four schools selected from two provinces in eastern and western China by using the convenience sampling method. Students completed the questionnaire through a

paper-based scale, and a total of 968 responses were received (with a response rate of 96.8%). These included 583 male students (60.2%) and 385 female students (39.8%). There were 107 first-year junior high school students (11.05%), 258 second-year junior high school students (26.65%), 109 third-year junior high school students (11.26%), 263 first-year high school students (27.17%), 138 second-year high school students (14.26%), and 93 third-year high school students (9.61%). There were 469 only children (48.5%) and 499 non-only children (51.5%).

Research Tools

Family Sports Behavior Environment Scale

Using the Family Sports Behavior Environment Scale revised by Yang[11], this study primarily focuses on parent-child participation in physical activity interactions. Therefore, only the items related to parent-child relationships — parental monitoring, parental involvement, and parental encouragement — comprising a total of 9 items, were selected from the questionnaire. The scale uses a 5-point scoring system (1 = strongly disagree, 5 = strongly agree). In this study, the Cronbach's α of the scale was 0.931, and the fit indices from the confirmatory factor analysis were X^2/df = 1.553, GFI = 0.990, NFI = 0.992, CFI = 0.997, and RMSEA = 0.024, all of which indicate acceptable model fit.

Friendship Quality Questionnaire

The FQ of middle school students was measured using Friendship Quality Questionnaire revised by Zhou et al[43], which consists of 18 items. A 4-point scale was used (1 = completely non-compliant, 4 = completely compliant). The questionnaire in this study demonstrated a Cronbach's α of 0.949. Confirmatory factor analysis yielded fit indices of X^2/df = 1.281, GFI = 0.981, NFI = 0.982, CFI = 0.996, RMSEA = 0.017, indicating that all fit indices were acceptable.

Victim Questionnaire

SBV in middle schools was assessed using Victim Questionnaire, revised by Zhang[44], which consists of 7 items. A 5-point scale was used (0 = none, 4 = more than 5 times). In this study, the questionnaire demonstrated a Cronbach's α of 0.911. Confirmatory factor analysis yielded fit indices of X^2/df = 1.192, GFI = 0.995, NFI = 0.996, CFI = 0.999, RMSEA = 0.014, indicating that all fit indices were acceptable.

Non-suicidal Self-injury Assessment Questionnaire

The study utilized the Adolescent Non-suicidal Self-injury Assessment Questionnaire developed by Wan et al[45], which is divided into two sub-questionnaires: the behavior questionnaire and the function questionnaire. This study selected the behavior questionnaire, which consists of 12 items. The scale uses a 5-point scoring system (1 = never, 5 = always). In this study, the Cronbach's α of the scale was 0.947. The fit indices of the confirmatory factor analysis were X^2/df = 1.492, GFI = 0.986, NFI = 0.990, CFI = 0.997, and RMSEA = 0.023, all of which indicate acceptable model fit.

Procedure and Data Analysis

Descriptive analysis, correlation analysis, and regression analysis were conducted on the data using SPSS 26.0. The mediation model was tested using the PROCESS program developed by Hayes. The significance level of the mediation effect was tested using the non-parametric percentile bootstrap method with bias correction. The analysis was conducted using Model 6 provided by Hayes.

Results

Common Method Bias Test

The commonly used Harman's single-factor method was employed to test for potential common method bias in the study. Forty-six items from four scales were included in an unrotated exploratory factor analysis. The results indicated the extraction of four factors with eigenvalues greater than 1. Specifically, the variance explained by the first factor was 34.88%, which did not meet the 40% threshold criterion, suggesting that there was no significant common method bias in this study.

Descriptive Statistics and Correlation Analysis

As shown in Table 1, FQ is significantly positively correlated with FSBE (β = 0.447, P<0.01), and NSSI is significantly positively correlated with SBV (β = 0.349, P<0.01); SBV (β=-0.268, P<0.01) and NSSI (β=-0.446, P<0.01) are significantly negatively correlated with FSBE, while SBV (β=-0.280, P<0.01) and NSSI (β=-0.493, P<0.01) are significantly negatively correlated with FQ.

Table 1
Descriptive Statistics and Correlation Analysis.

Variable	FSBE	FQ	SBV	NSSI
FSBE	1			
FQ	0.447**	1		
SBV	-0.268**	-0.280**	1	
NSSI	-0.446**	-0.493**	0.349**	1
Note: **P<0.01.				

Mediation Effect Test

As shown in Table 2, the PROCESS macro in SPSS was employed to test the chain mediation of Model 6 via the Bootstrap resampling method (with 5,000 repetitions). The chain mediating role of FQ and SBV in the relationship between FSBE and NSSI were examined after controlling for gender, grade level, and only-child status. The results of the regression analysis indicated that FSBE significantly and positively predicted FQ (β = 0.335, P < 0.001), whereas FSBE exerted a significant negative predictive effect on both SBV (β = -0.168, P < 0.001) and NSSI (β = -0.24, P < 0.001). Additionally, FQ had a significant negative predictive effect on SBV (β = -0.266, P < 0.001) and NSSI (β = -0.457, P < 0.001), and SBV (β = 0.201, P < 0.001) significantly and positively predicted NSSI.

Table 2
Regression Analysis of Chain Mediation Effect.

Variable	FQ			SBV			NSSI		
	β	se	t	*β*	se	t	*β*	se	t
Gender	-0.089	0.04	-2.215	-0.005	0.059	-0.083	0.031	0.053	0.589
Gradelev	0.006	0.013	0.495	-0.02	0.019	-1.019	-0.008	0.017	-0.478
Onlychil	-0.07	0.04	-1.763	0.037	0.058	0.631	0.017	0.052	0.317
FSBE	0.335	0.02	16.847***	-0.168	0.033	-5.057***	-0.24	0.03	-7.966***
FQ				-0.266	0.047	-5.64***	-0.457	0.043	-10.608***
SBV							0.201	0.029	6.943***
R	0.481			0.322			0.579		
R-sq	0.231			0.103			0.336		
F	72.5			22.204			80.884		
Note: ***P<0.001.									

As shown in Table 3, the results of the mediation effect test revealed that the mediating roles of FQ and SBV were significant, with a total mediating effect value of − 0.205 accounting for 46% of the total effect. Specifically, the mediating effect was transmitted through three mediating pathways as follows: (1) Indirect effect 1 (− 0.153) via the pathway of FSBE → FQ → NSSI, whose Bootstrap 95% confidence interval (LLCI = − 0.186, ULCI = − 0.121) did not include zero and accounted for 34% of the total effect, indicating a significant mediating role of FQ; (2) Indirect effect 2 (− 0.034) via the pathway of FSBE → SBV → NSSI, whose Bootstrap 95% confidence interval (LLCI = − 0.051, ULCI = − 0.018) did not include zero and accounted for 8% of the total effect, demonstrating a significant mediating role of SBV; (3) Indirect effect 3 (− 0.018) via the pathway of FSBE → FQ → SBV → NSSI, whose Bootstrap 95% confidence interval (LLCI = − 0.027, ULCI = − 0.011) did not include zero and accounted for 4% of the total effect, verifying a significant chain mediating role of FQ and SBV. Accordingly, a theoretical model diagram of the chain mediation was constructed based on the findings of this study (Fig. 2).

Table 3
Chain-mediated Effect Test.

Pathways	Effect	BootSE	BootLLCI	BootULCI	Total effect proportion
Indirect effect 1	-0.153	0.017	-0.186	-0.121	34%
Indirect effect 2	-0.034	0.008	-0.051	-0.018	8%
Indirect effect 3	-0.018	0.004	-0.027	-0.011	4%
Total indirect effect	-0.205	0.018	-0.24	-0.17	46%
Direct effect	-0.24	0.03	-0.3	-0.181	54%
Total effect	-0.445	0.029	-0.501	-0.389	100%

Discussion

The Relationship between FSBE and NSSI in Middle School Students

This study found that the FSBE can significantly and negatively predict NSSI in middle school students. This conclusion not only validates Hypothesis 1 but also is similar to previous research findings[46]. More importantly, it supports and extends Self-determination Theory. Specifically, in a positive FSBE, parents tend to respect their children's interests in sports and encourage the active exercise of autonomous decision-making during physical activities. This, to some extent, helps children experience a strong sense of will and choice, reducing resistance caused by feeling controlled. In this process, cooperation and encouragement between parents and children can build safe and intimate emotional bonds[47], and by achieving exercise goals, children can continuously surpass themselves, gain a sense of accomplishment, gradually build self-efficacy, and enhance their overall capabilities. Against this backdrop, the satisfaction of the three basic needs — autonomy, relatedness, and competence — further promotes the development of autonomous motivation in middle school students, encouraging them to actively participate in physical exercise and yield more positive behavioral outcomes[48], thereby reducing the occurrence of NSSI. Conversely, when these needs are obstructed, middle school students often experience a sense of being controlled and display a lack of motivation, making them more likely to engage in negative behaviors such as NSSI to avoid reality[49]. Therefore, a positive FSBE serves as a protective factor against NSSI in middle school students.

Mediating Role of FQ

This study found that FQ mediates the relationship between FSBE and NSSI among Chinese middle school students, a finding that validates Hypothesis 2. On the one hand, FSBE significantly and positively predicts FQ of middle school students, which is similar to the results of previous studies[50], and at the same time validates the Ecological Systems Theory. Focusing on the present study, in a good family sports environment, children tend to receive more encouragement, support and positive affirmation from their parents during sports interactions[51]; in this scenario, children will observe their parents' behavioral and

attitudinal patterns, imitate and internalize them subconsciously, and acquire positive interpersonal interaction traits, such as cooperation, respect, and tolerance, which can be transferred to daily peer interactions[52], thus enhancing the intimacy, support and cooperation among peers. In short, a good FSBE not only provides warmth and emotional support for middle school students, but also allows them to learn how to get along with others, which in turn enhances their FQ. On the other hand, FQ can significantly and negatively predict middle school students' NSSI, which is similar to the results of previous studies[53] and validates the Social Support Theory. High FQ tends to provide middle school students with the necessary social support to continuously improve their own intrinsic self-worth, which can help them cope with setbacks and failures more positively[54], and then reduce the tendency of self-injurious behaviors occurring due to failures. Other studies have shown that high-quality friendship relationships help adolescents form a positive view of friendship and gradually internalize it[55], which will make it more likely that they will choose to regulate when facing stress, such as confiding in others, and reduce the occurrence of non-adaptive ways such as NSSI.

The Mediating Role of SBV

This study found that SBV mediates the relationship between FSBE and NSSI among Chinese middle school students, which verifies Hypothesis 3. On the one hand, FSBE could significantly and negatively predict SBV among middle school students, which is similar to the results of previous studies[56]. Specifically, a good FSBE, with sports activities as the interactive carrier, can rely on the confrontational, cooperative and rule-based characteristics of sports activities to effectively shape the mental toughness of middle school students, while promoting their physical health development and improving their physical fitness level[57], which can provide middle school students with sufficient psychological resources and self-protection ability[58]. The risk of SBV can be reduced to a certain extent. Conversely, the lack of sufficient psychological resources and self-protection ability will increase the targeting and susceptibility of middle school students to bullying, and thus increase their risk of being bullied. On the other hand, SBV positively predicts NSSI among middle school students, which is similar to the results of previous studies[59] and validates the Experiential Avoidance Model. Focusing on the present study, when middle school students experience bullying in school, they usually face stress and psychological trauma triggered by adverse emotional reactions[60]; along with the accumulation of negative experiences, if they lack emotional regulation skills, they will be unable to effectively relieve their internal pain[61], which makes them more likely to resort to self-injury as an extreme way to avoid or relieve negative experiences[62]. In addition, when self-injury can effectively alleviate negative emotions and bring satisfaction, this negative reinforcement strengthens the link between unpleasant emotional stimuli and self-injurious behaviors[63], and such self-injurious behaviors may become an automatic escape response once middle school students experience unpleasant emotional experiences again.

Chain Mediating Role between FQ and SBV

This study found that FQ and SBV play a chain mediating role between FSBE and NSSI among Chinese middle school students, which not only verifies Hypothesis 4, but also is similar to the results of previous studies[64]. According to the Ecological Systems Theory, high FQ implies that middle school students can

establish deep trust and stable positive interactions with their peers, and such positive peer relationships provide individuals with emotional support and a sense of belonging[65], so that they can have a reliable psychological buffer when they encounter negative events. Meanwhile, these positive peer relationships also create a micro-environment of tolerance and mutual support in daily interactions[66], so that when middle school students integrate into such a positive peer atmosphere, their sense of self-worth and subjective well-being will be enhanced[67], and they will be less likely to display personal traits such as anxiety, isolation, and low self-esteem that make them vulnerable to bullying. Based on the analysis of the previous empirical study, in a high-quality FSBE, the positive interpersonal interaction traits observed and acquired by children during family sports interactions will subconsciously affect their interpersonal skills, and thus improve FQ among middle school students; and good FQ can provide middle school students with high-quality psychological resources and social support, which can help reduce the risk of SBV, and eventually reduce the risk of NSSI of middle school students.

Suggestions

Based on the findings of this study, valuable insights can be provided for the prevention and intervention of non-suicidal self-injury (NSSI) among Chinese middle school students:

(1) Continuously optimize the FSBE. First, proactively construct a parent-child interaction mode centered on physical activities, prioritizing cooperative team sports such as basketball, football and badminton. Emphasis should be placed on equal collaboration with children, and parent-child emotional bonds should be strengthened by achieving sports goals together, helping children imperceptibly acquire positive interpersonal traits such as cooperation and tolerance through sports. Second, parents should fully respect their children's sports interests and their need to make independent choices when the children take part in sports activities. They should abandon the performance-oriented approach in sports. They need to focus on the efforts their children put in and the progress they make in sports. They should adopt a guidance method with positive encouragement and provide their children with timely positive feedback. In this way, parents can help their children build a sense of accomplishment in sports and enhance their self-efficacy.Finally, parents should exert a demonstrative and leading role, develop a regular habit of physical exercise, set a good sports example for their children, and thus create a relaxed and pleasant family sports atmosphere.

(2) Promote the FQ of middle school students through home-school cooperation. On the one hand, at the family level, parents can realize the guidance and transfer of interpersonal skills by virtue of physical activities. They should encourage their children to flexibly apply the interpersonal traits such as cooperation, listening, tolerance and empathy acquired from parent-child sports to peer interactions. Meanwhile, in a harmonious family sports atmosphere, parents should take the initiative to listen to and help their children resolve conflicts and troubles in peer interactions. On the other hand, at the school level, systematic work to foster friendship should be carried out, including regularly holding theme-based class meetings for improving friendship quality with a focus on empathic expression, effective listening and conflict resolution. In addition, schools should actively organize campus sports activities and add more team cooperative sports events, guiding middle school students to consolidate peer relationships and improve friendship quality in the process of completing sports goals through collaboration.

(3) Reduce the risk of BSV among middle school students through multiple channels. First, in family sports activities, sports events with both confrontational and physical training value should be selected to improve middle school students' physical protection ability and psychological resilience against pressure in the face of bullying, thereby reducing the probability of them becoming targets of bullying. Second, schools should regularly provide anti-bullying training for faculty and staff to enhance their ability to identify school bullying behaviors. Teachers should conduct one-on-one communication with students on a regular basis to fully understand their peer interaction status, timely capture potential bullying signals and intervene in a timely manner. Finally, middle school students should be actively guided to establish stable and high-quality peer friendships, and students should be encouraged to provide timely emotional support and communication assistance when their peers encounter bullying, so as to effectively resolve conflicts among peers and prevent the escalation of conflicts into bullying incidents.

Limitations

(1)This study adopted convenience sampling method. Although it took into account variations in economic development levels and educational resource allocation across two Chinese provinces, the selected samples were exclusively drawn from secondary schools in provincial capitals or first-tier cities. The exclusion of rural secondary schools means that the study’s conclusions cannot fully represent the overall characteristics of the broader population of Chinese secondary school students, thus limiting its generalizability.

(2)The data of this study were mainly obtained through student self-reports. This method is prone to lead participants to conceal or exaggerate relevant behaviors and perceptions due to social desirability bias or privacy concerns, and this issue is particularly pronounced for highly subjective variables such as the family physical activity behavioral environment. Future research may incorporate objective monitoring tools (e.g., fitness trackers) to cross-validate relevant variables.

(3)This study used a cross-sectional design, which could only verify the covariation relationships between variables and failed to clarify the causal directionality and the temporal sequence of effects between variables. In the future, a longitudinal follow-up study design can be adopted to further explore the causal associations between variables through long-term data collection.

Conclusions

Based on the findings of this study, a chain mediation model was constructed to examine the serial mediating effect of FQ and SBV in the relationship between the FSBE and NSSI among Chinese middle school students. Specifically, it was found that the FSBE not only directly reduced the risk of NSSI among Chinese middle school students, but also mitigated the occurrence of such behaviors through the Chain mediating effects of FQ and SBV.

Declarations

Author Contributions

All authors contributed to the study conception and design. Guangpeng Ding: Conceptualization, Data curation, Investigation, Writing - original draft, Writing - review & editing. Nan Wen: Supervision, Writing - review& editing. Xiaowei Ma: Supervision, Data curation, Writing – review & editing.Xinchao Gao:Writing - original draft.

Ethical approval consent

This study involving human participants was approved by the Institutional Review Board of Yuncheng Vocational and Technical University. The study was conducted in accordance with the provisions of local legislation and institutional ethical requirements. Written informed consent was obtained from all participants prior to the commencement of the study.

Competing interests

The authors declare no competing interests.

Data availability

Data is provided within the supplementary information files.

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Figures

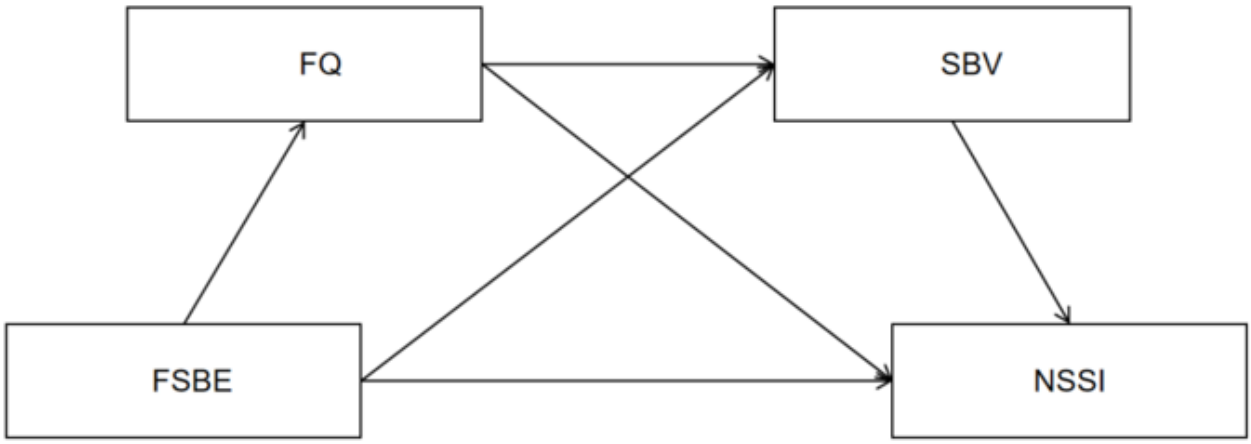


Figure 1

Hypothetical Model Diagram.

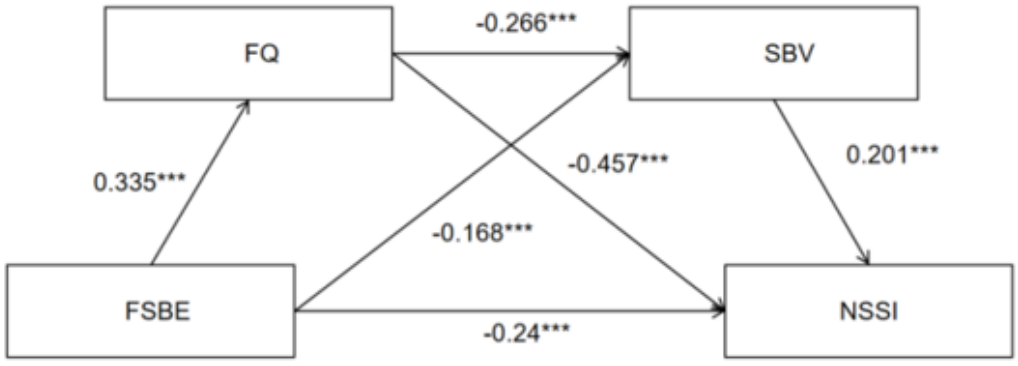


Figure 2

Chained Mediation Theoretical Model Diagram.