

The Relationship between Group Exercise Volume and Social Withdrawal Subcategories: the Mediating Role of Psychological Resilience

Dongyang Tan

Institute of Physical Education, Hunan Normal University, Changsha, Hunan, China

Abstract: This study investigated the relationship between the amount of group exercise and the three subcategories of social withdrawal (shy withdrawal, social apathy, and social avoidance) in a group of adolescents and further validated the mediating role of psychological resilience in this context. Based on a questionnaire survey of 534 secondary school students aged 13 to 18 years old, data were analyzed using multiple regression and structural equation modeling. The results showed that group exercise volume significantly and positively predicted psychological flexibility and cognitive reappraisal, and negatively predicted three kinds of social withdrawal behaviors, and psychological flexibility played a partial mediating effect between group exercise volume and social withdrawal. Among them, the mediating effects on shy withdrawal and social avoidance were more significant, while the effects on social apathy were mainly realized through the direct path. Further analysis revealed that grade level and gender had moderating effects in the path model, with middle school students and girls' psychological resilience showing stronger moderating effects in influencing social withdrawal. Based on the refinement of the types of social withdrawal behaviors, this study reveals the intrinsic mechanism of group exercise in promoting adolescents' psychological resilience and social adaptation, which enriches the perspective of the cross-study of educational psychology and physical education and provides empirical references for adolescent psychological interventions and school physical education curricula.

Keywords: Group Exercise; Social Withdrawal; Psychological Resilience; Adolescents; Mediating Effect

1. Introduction

In the process of adolescent socialization, the formation of social skills and the enhancement of emotional regulation play a key role. In recent years, as the pressure of education continues to rise and the amount of time spent with families decreases, more and more adolescents show different forms of social withdrawal behaviors, such as avoiding social situations, tending to be alone, and avoiding peer interactions. These behaviors not only affect the establishment of interpersonal relationships and group integration, but also have been confirmed by numerous empirical studies to be highly associated with psychological distress, including depression, anxiety, and lowered self-esteem, thus weakening the individual's social resilience and psychological resilience, and constituting a potential mental health hazard[3].

“Social withdrawal is not a one-dimensional behavioral manifestation, but rather a complex group of behaviors that encompasses different psychological mechanisms, such as motivation, emotional response, and social experience, etc. Nelson (2013) proposed a three-part approach, which suggests that social withdrawal can be subdivided into shy withdrawal, social apathy, and social apathy, and that social apathy can be subdivided into social withdrawal, social apathy, and social apathy[7]. (social apathy, and social avoidance. Individuals with shy withdrawal are socially motivated but avoid social situations due to sensitivity to negative evaluations, often accompanied by emotional reactions such as anxiety and nervousness; socially apathetic individuals prefer to be alone and do not actively avoid others, and usually lack significant emotional distress behind their behaviors; and socially avoidant individuals reflect a negative attitude toward socialization itself, often stemming from adverse social experiences or traumatic memories, and manifesting themselves as actively distancing themselves and avoiding

social situations (coplanar withdrawal). avoidance of social situations. Although studies have focused on the widespread presence of social withdrawal behaviors among adolescents, intervention pathways have mostly focused on the cognitive-behavioral therapy or family support levels, and lacked an integrative perspective that combines educational psychology and sports participation. As a form of physical activity that integrates cooperation, communication, and emotional regulation, team sports have unique advantages in enhancing psychological resilience and constructing social skills, which are especially suitable for adolescents' psychological construction needs. However, physical education has not been sufficiently emphasized in the current school education system, and the psychological prevention mechanism for adolescents with withdrawn behavior is still weak[12].

This study focuses on a group of adolescents aged 13 to 18 years old, and examines the predictive role of the frequency and intensity of their participation in group exercise on three types of social withdrawal behaviors, and further introduces psychological resilience variables to explore their mediating mechanisms between group exercise and social withdrawal. The study aims to reveal the role of group exercise in improving adolescents' social withdrawal behaviors, to make up for the shortcomings of the existing intervention models, and to provide theoretical support and practical references for the promotion of adolescents' mental health and the reform of school physical education curricula[11].

2. Background on the Reality of Adolescent Social Withdrawal

2.1 Prevalence and Consequences of Social Withdrawal in Adolescents

The adolescent stage is a critical period of rapid social development in which withdrawal behaviors occur frequently. Types of social avoidance, shyness and withdrawal and social apathy emerge gradually, causing far-reaching disturbances in psychological and behavioral systems. These behavioral patterns may lead to feelings of isolation, lowered self-esteem, emotional suppression, and even depression and suicidal ideation in adolescents (Kumar et al., 2023)[6]. In addition to emotional harm at the individual level, social withdrawal limits the

establishment and maintenance of interpersonal relationships, affects the quality of adolescents' interactions in peer networks (Zhou, 2006)[27], and consequently diminishes the availability of social support, interfering with the development of self-efficacy and the realization of social belonging (Chen & Liu, 2023)[4].

If social withdrawal behaviors are not moderated during the developmental process, the problem often continues into adulthood, further affecting occupational socialization, self-orientation, and family education styles (Shufang Wang, 2013)[26]. Empirical studies have shown that withdrawn adolescents are more likely to avoid teacher-student relationships, have learning disabilities, and be absent from group activities in school settings (Rubin et al., 2009)[8], potentially threatening academic motivation and performance.

The widespread distribution of withdrawal behaviors in the Chinese social context is supported by data, with a survey involving 2,142 elementary school students showing that more than 40% of students have a tendency to socially withdraw (Shi Yue & Liu Junsheng, 2014)[23], a percentage slightly higher than that of the same international study (Coplan et al., 2013)[5]. Changes in social structure and parenting styles have also further amplified the spreading effect of this problem. Against the backdrop of reduced family companionship time and weakened parent-child connections, it is increasingly common for parents in urban areas to transfer parenting tasks to grandparents or childcare institutions, making it difficult to form intimate attachments and suppressing emotional security and willingness to explore socially (Li Yiming, 2017; Li Lemin et al., 2020)[15,17]. The gradual superposition of social inadequacy and decreased psychological resilience constitutes the deeper social background of the frequent occurrence of adolescent withdrawal behaviors (Yanan Meng & Can Zhang, 2022)[20].

2.2 Adolescent Sport Participation Dilemma and Behavioral Social Disconnection

Sports participation among adolescents shows a declining trend, especially in the middle and high school stages, where academic pressure and promotion orientation become the main axes of daily life, sports time is compressed, and after-school group activities are significantly reduced[9]. The absence of group physical activity weakens the maintenance of physical

fitness and limits the opportunities for individuals to practice socialization in sports, reducing emotional regulation and the formation of a collective sense of belonging (Brière et al., 2018)[11].

In the real-life context of limited resources and marginalization of physical education in schools, it is often difficult for group sports to reach all students, especially for introverted and withdrawn adolescents, who lack appropriate opportunities for participation and psychological guidance pathways. These populations are precisely the most in need of building trust, expression, and social interaction skills through sports (Qiu Yue & Zhang Guoli, 2018)[10]. In the absence of effective intervention mechanisms, social disengagement behaviors are often hidden outside of the classroom and home for a long period of time, becoming a neglected psychological risk. Childhood stage interventions have been effective in demonstrating the mitigating effects of sports on withdrawal behaviors. For example, basketball games have been shown to enhance social interest and reduce isolation (Li, Sujuan, 2019)[16], but sports game-based interventions are difficult to sustain as one grows older. The psychological problems caused by sports deficits often begin to worsen in adolescence, but are difficult to be captured and responded to by the existing education system and family structure, a dilemma that requires more research to focus on the underlying mechanisms and propose practical pathways[22].

3. Theoretical Analysis of Social Withdrawal Behaviors and Psychological Resilience Mechanisms

3.1 Psychological Characterization of Three Subcategories of Social Withdrawal

Social withdrawal is not a single behavioral phenomenon, but covers psychological sub-structures with different motivations and manifestations. According to the structuration theory perspective, withdrawal behaviors can be distinguished into three categories: shy withdrawal, social apathy and social avoidance (Nelson, 2013)[7]. Shy individuals are usually socially motivated but avoid interactions due to sensitivity to evaluation or rejection. Individuals in this category often experience anxiety, nervousness, and avoidance tendencies, and are hypervigilant to external evaluations. In contrast, socially apathetic individuals do not avoid others,

but rather reduce the frequency of social interaction out of a preference for a state of solitude, with no significant emotional distress underlying their behavior (Coplan et al., 2013)[5]. Social avoidance, on the other hand, reflects a deeper denial and rejection of interpersonal interactions themselves, often stemming from past adverse social experiences or trauma, and is characterized by active detachment and avoidance of social stimuli (Jiang Li, 2014)[14]. In terms of cognitive and behavioral responses, these three types of withdrawal behaviors show differentiated adaptation paths. Shy individuals are emotionally disturbed but possess the potential for recovery, apathetic individuals are relatively stable but may face adaptation problems when confronted with group situations, and avoidant individuals are most vulnerable to emotional suppression, isolation, and the persistence of psychological problems (Zhou Zongkui et al., 2006)[27].

3.2 Theoretical Associations between Group Sports and Psychological Resilience and Social Competence

As an interactive activity that combines cooperation, communication, and goal-seeking, team sports provide an important context for adolescents to practice emotional regulation and social skills. In teamwork, competition, and rule-based constraints, adolescents need to continuously mobilize cognitive resources and regulate their emotional responses to enhance emotional awareness and reactive flexibility (Blake et al., 2021)[2]. This process not only enhances self-perception, but also builds self-confidence and a sense of belonging through continuous interactive feedback.

The effects of group exercise on psychological resilience can be summarized into three mechanisms: first, the enhancement of self-efficacy through the completion of goal tasks, which improves the individual's beliefs of control in the face of difficulties; second, the frustration and emotional fluctuations during exercise, which prompts adolescents to develop positive emotion regulation strategies such as cognitive reappraisal (Gross & John, 2003)[31]; and third, the fulfillment of belongingness in the context of collective support, which forms an effective social support system, thus improving the psychological resilience of the adolescents (Blake et al., 2021)[2]. effective social support system, thus enhancing emotional coping skills

(Baumeister & Leary, 1995)[24].

In addition, research has shown that group exercise is equally effective for special populations. For example, Ru et al. (2023) found that children with autism showed significant increases in socialization and frequency of interaction after participating in a group exercise intervention[21]. Together, these findings support the important role of group exercise in promoting psychological resilience and social adaptation[25].

In conclusion, group exercise not only exercises the body, but also promotes the establishment of psychological resilience through self-efficacy, emotion regulation, and social support, and provides a powerful psychological resource for adolescents to cope with social stress and withdrawal behaviors[28].

3.3 Theoretical Support for Psychological Resilience as a Moderating and Mediating Variable

In the face of social stress, psychological resilience, as a key psychological resource, helps individuals to regulate stress, maintain emotional stability and functional behaviors. Ma Weina et al. (2008) pointed out that psychological resilience consists of the dimensions of positive adaptation, goal adherence, and emotional regulation, and coordinates the relationship between cognitive resources and emotional responses, which is the internal basis for individuals to adapt to environmental stress[19].

In the regulation model, psychological resilience is regarded as a “bridge” connecting external stress and internal responses, and its strength directly determines an individual's coping ability (Lu Yao et al., 2023)[18]. Especially in adolescents, the use of cognitive reappraisal strategy can effectively improve psychological resilience and help reduce emotional fluctuations by reinterpreting negative events (Ji Yu, 2018), thus enhancing their resilience and adaptability in social situations[13].

In addition, psychological resilience not only regulates emotional changes, but also plays a

mediating role between “emotional regulation and psychological health”, providing stable adaptive support in the long term. Attribution theory further suggests that social adjustment fulfills both emotional needs and is a core process of constructing self-identity and social functioning, and that increased psychological resilience is a key mechanism in this process (Baumeister & Leary, 2017)[1].

Therefore, in the present research pathway, psychological resilience may both explain the mechanism of action of group exercise on social withdrawal and may modulate the effects of the intervention due to individual differences, with both mediating and moderating theoretical underpinnings[29].

4. Path Analysis of the Impact of Group Exercise on Social Withdrawal

4.1 Overview of Questionnaire Design and Research Methodology

This study used the convenience sampling method to randomly select 300 middle school students (13-15 years old) and 300 high school students (16-18 years old) each from Changsha Foreign Language School, totaling 600 people as the research subjects. After screening out invalid questionnaires, 534 valid questionnaires were finally obtained, with an effective recovery rate of 89.0%. Among them, 267 were junior high school students (132 boys and 135 girls) and 267 were high school students (131 boys and 136 girls). In order to ensure the quality of questionnaire completion, the questionnaires were distributed in paper form and supervised by the class teacher during the morning study time to be completed independently by the students, and randomly selected students who did not sit in a row to avoid communication interference[30].

The study used the following five scales as measurement tools, and all scales were tested by the Chinese version with good reliability and validity (see Table 1):

Table 1. Measurement Instruments and Their Reliability and Validity

Scale Name	Measured Variable	Number of Items	Scoring Method	Reliability Coefficient	Validity Information
Group Physical Activity Rating Scale (Revised PARS-3)	Group Exercise Volume	12	Intensity \times (Time - 1) \times Frequency, score range: 0-100	$\alpha = 0.85$	Expert-assessed content validity = 0.82
Emotion Regulation Questionnaire (ERQ)	Cognitive Reappraisal,	10	7-point Likert scale (1-7); higher scores	Cognitive Reappraisal	Confirmatory factor analysis indicates

	Expressive Suppression		indicate more frequent use	$\alpha = 0.79$, Suppression $\alpha = 0.73$	good model fit
Revised Cheek and Buss Shyness Scale (RCBS)	Shyness and Social Withdrawal	13	5-point Likert scale (1-5); higher scores indicate greater shyness	$\alpha = 0.88$	Good construct validity; significant discriminant validity
Liebowitz Social Anxiety Scale (LSAS)	Social Avoidance	24	Two dimensions: anxiety and avoidance; 0-3 points; higher scores indicate greater avoidance	$\alpha = 0.92$	Significant discriminant validity; good test-retest reliability
Preference for Solitude Scale (PSS)	Social Detachment	12	Dichotomous choice; preference for solitude scored as 1; higher scores indicate stronger solitude preference	K-R20 = 0.72	Good content and construct validity

The structure of the questionnaire included demographic information (gender, age, grade level) and five core scales. Among them, the Traditional Physical Activity Rating Scale (PARS-3) was revised by the research team to add a clear distinction between the type of physical activity (individual/group) engaged in by the participants to ensure an accurate measure of group sports participation. All scales adopt standardized guidelines and uniform instructions for filling in the scales to ensure the standardization and consistency of measurement[32].

4.2 Presentation and Comparative Analysis of Research Results

Based on the literature review and theoretical analysis, this study presents the following three core hypotheses:

Table 2. Comparison of Social Withdrawal Behaviors Between Junior and Senior High School Students (M±SD)

Category of Social Withdrawal	Junior High (n=267)	Senior High (n=267)	t-value	p-value	Cohen's d
Shyness Withdrawal	3.02 ± 0.76	2.87 ± 0.81	2.15*	0.032	0.19
Social Disinterest	6.42 ± 2.31	6.58 ± 2.35	-0.78	0.437	0.07
Social Avoidance	1.67 ± 0.58	1.85 ± 0.62	-3.42**	0.001	0.30

* $p < 0.05$, ** $p < 0.01$

The results showed that middle school students had a significantly higher level of shyness withdrawal than high school students ($t=2.15$, $p<0.05$), demonstrating higher sensitivity to negative evaluations in social situations; while high school students had a significantly higher level of social avoidance than middle school students ($t=-3.42$, $p<0.01$), demonstrating a stronger tendency to actively stay away from social situations. This result reflects the changing social characteristics of adolescents at different

H1: Group sports positively predict psychological resilience and positive emotion regulation (cognitive reassessment).

H2: Psychological resilience and positive emotion regulation negatively predict shyness withdrawal and social avoidance and positively predict social apathy.

H3: Psychological resilience and emotion regulation mediate the effects of group sports on the three subcategories of social withdrawal.

1) Differences in social withdrawal behaviors among middle and high school students

An independent samples t-test on the scores of middle and high school students on the three social withdrawal behaviors revealed significant differences between middle and high school students on shy withdrawal and social avoidance, while the differences were not significant on the social indifference dimension (see table 2).

developmental stages, with middle school students likely to exhibit more shy social withdrawal and high school students more conscious social avoidance behaviors[33].

2) Correlations among variables

Pearson correlation analysis was used to explore the correlations among the three subcategories of group exercise, psychological resilience, emotion regulation, and social withdrawal (see table 3).

The results of the correlation analysis tentatively support research hypothesis H1, that the amount of group exercise is significantly positively

correlated with psychological resilience ($r=0.48$, $p<0.01$), significantly positively correlated with cognitive reappraisal strategies ($r=0.36$, $p<0.01$), and significantly negatively correlated with expressive inhibition strategies ($r=-0.21$, $p<0.01$). Partially supporting Hypothesis H2, psychological resilience was significantly negatively correlated with shy withdrawal ($r=-$

0.45 , $p<0.01$) and social avoidance ($r=-0.47$, $p<0.01$), and was also negatively correlated with social indifference ($r=-0.12$, $p<0.05$) rather than positively correlated as expected. The amount of group exercise was significantly negatively correlated with all three types of social withdrawal behaviors, providing initial support for hypothesis H3.

Table 3. Correlation Matrix Among Research Variables

Variable	Group Exercise Volume	Psychological Resilience	Cognitive Reappraisal	Expressive Suppression	Shyness Withdrawal	Social Disinterest	Social Avoidance
Group Exercise Volume	1						
Psychological Resilience	0.48**	1					
Cognitive Reappraisal	0.36**	0.52**	1				
Expressive Suppression	-0.21**	-0.18**	0.03	1			
Shyness Withdrawal	-0.35**	-0.45**	-0.31**	0.38**	1		
Social Disinterest	-0.19**	-0.12*	-0.09	0.23**	0.21**	1	
Social Avoidance	-0.42**	-0.47**	-0.29**	0.32**	0.43**	0.25**	1

* $p < 0.05$, ** $p < 0.01$

3) Regression analysis of the relationship between amount of group exercise and social withdrawal

The next step was to test the predictive effect of group exercise volume on the three types of social withdrawal through multiple regression analysis (see table 4).

Table 4. Regression Analysis of Group Exercise Volume on Three Subtypes of Social Withdrawal

Dependent Variable	Predictor Variable	B	SE	β	t	p	R ²	F
Shyness Withdrawal	Constant	3.621	0.087	-	41.62	<0.001	0.123	74.36**
	Group Exercise Volume	-0.013	0.002	-0.35	-8.62	<0.001		
Social Disinterest	Constant	7.204	0.254	-	28.36	<0.001	0.036	20.01**
	Group Exercise Volume	-0.018	0.004	-0.19	-4.47	<0.001		
Social Avoidance	Constant	2.325	0.066	-	35.23	<0.001	0.176	113.69**
	Group Exercise Volume	-0.012	0.001	-0.42	-10.66	<0.001		

* $p < 0.05$, ** $p < 0.01$

The results of the regression analysis showed that the amount of group exercise had a significant negative predictive effect on all three types of social withdrawal, with the highest rate of explanation for social avoidance, followed by shy withdrawal, and a relatively low rate of explanation for social apathy. This suggests that group exercise participation affects different types of social withdrawal to different extents, with more pronounced ameliorative effects on active avoidance and fearful withdrawal, and

relatively limited effects on the type of social indifference[34].

4.3 Analysis and Interpretation of Mediated Pathway Modeling

This study employed Baron and Kenny's mediation effect testing procedure, combined with structural equation modeling analysis, to explore the mediating role of psychological resilience between group exercise volume and three types of social withdrawal behavior[35].

Table 5. Path Coefficients of Regression Analysis from Group Exercise Volume to Psychological Resilience and Social Withdrawal

Path	B	SE	β	t	p
Group Exercise Volume → Psychological Resilience	0.042	0.004	0.48	10.56	<0.001
Psychological Resilience → Shyness Withdrawal	-0.327	0.039	-0.34	-8.38	<0.001
Group Exercise Volume → Shyness Withdrawal (controlling for Resilience)	-0.006	0.002	-0.16	-3.95	<0.001
Psychological Resilience → Social Disinterest	-0.218	0.108	-0.08	-2.01	0.045
Group Exercise Volume → Social Disinterest (controlling for Resilience)	-0.015	0.004	-0.16	-3.75	<0.001
Psychological Resilience → Social Avoidance	-0.331	0.037	-0.35	-8.94	<0.001
Group Exercise Volume → Social Avoidance (controlling for Resilience)	-0.006	0.001	-0.20	-5.02	<0.001

According to the results of the path regression analysis (see Table 5), group exercise volume

significantly and positively predicted psychological resilience ($\beta = 0.48, < 0.001$), while psychological resilience significantly and negatively predicted both shy withdrawal ($\beta = -0.34, < 0.001$) and social avoidance ($\beta = -0.35, < 0.001$). The predictive effect on social indifference is weaker but still significant ($\beta = -$

$0.08, < 0.05$). After controlling for psychological resilience, the direct effects of group exercise volume on the three types of social withdrawal still significantly decreased, indicating that psychological resilience played a partial mediating role.

Table 6. Mediation Effect of Psychological Resilience

Path	Direct Effect (B)	Indirect Effect (B)	Total Effect (B)	Proportion Mediated	Bootstrap 95% CI
Group Exercise Volume → Resilience → Shyness Withdrawal	-0.006**	-0.014**	-0.013**	45.7%	[-0.018, -0.010]
Group Exercise Volume → Resilience → Social Disinterest	-0.015**	-0.003*	-0.018**	21.1%	[-0.006, -0.001]
Group Exercise Volume → Resilience → Social Avoidance	-0.006**	-0.008**	-0.012**	42.9%	[-0.010, -0.006]

* $p < 0.05$, ** $p < 0.01$, Bootstrap sample size = 5000

Bootstrap analysis (5,000 repeated samples, see Table 6) further validated the statistical significance of the mediating effect, with all indirect path confidence intervals excluding zero. Among these, psychological resilience accounted for 45.7% of the total effect on the “shy withdrawal” path, 42.9% on the “social avoidance” path, and only 21.1% on the “social indifference” path. This suggests that group sports, by enhancing psychological resilience, are more effective in reducing anxiety-driven withdrawal and active avoidance behaviors, while improvements in apathetic withdrawal are more attributable to direct social behavior participation rather than the reconstruction of psychological mechanisms.

To further examine whether grade level and gender moderate the “group sports → psychological resilience → social withdrawal” pathway, this study employed a multiple-group structural equation model analysis (see Table 7). The results showed that grade level had a significant moderating effect on both pathways.

On the “group exercise → psychological resilience” pathway, middle school students ($\beta = 0.52$) were more positively influenced by group exercise than high school students ($\beta = 0.45$) ($\Delta\chi^2 = 3.86, = 0.049$), possibly because they are in an earlier stage of developing social cognition and self-efficacy, making them more susceptible to external influences. In contrast, on the “psychological resilience → social withdrawal” pathway, the effect was stronger for high school students ($\beta = -0.41$ vs. $-0.32, = 4.21, = 0.040$), indicating that older students rely more on their own emotional regulation and cognitive mechanisms in social withdrawal[36].

In terms of gender, a significant moderating effect was only observed on the “psychological resilience → shy withdrawal” pathway, with females exhibiting a stronger inhibitory effect ($\beta = -0.40$) compared to males ($\beta = -0.29, = 5.13, = 0.023$). This finding suggests that females may be more sensitive to changes in internal psychological resources in shy social behavior, and the enhancement of psychological resilience has a more significant promotional effect on their social proactivity.

Table 7. Moderation Effects of Grade Level and Gender

Moderator	Path	Group	B	SE	β	$\Delta\chi^2$	p
Grade Level	Group Exercise Volume → Psychological Resilience	Junior High	0.048	0.005	0.52	3.86	0.049
		Senior High	0.037	0.005	0.45		
	Psychological Resilience → Shyness Withdrawal	Junior High	-0.339	0.053	-0.38	2.35	0.125
		Senior High	-0.300	0.057	-0.31		
	Psychological Resilience → Social Disinterest	Junior High	-0.155	0.159	-0.09	1.47	0.225
		Senior High	-0.290	0.146	-0.15		
	Psychological Resilience → Social Avoidance	Junior High	-0.271	0.050	-0.32	4.21	0.040
		Senior High	-0.397	0.055	-0.41		
Gender	Group Exercise Volume → Psychological Resilience	Male	0.045	0.005	0.51	2.92	0.087
		Female	0.038	0.005	0.44		

	Psychological Resilience → Shyness Withdrawal	Male	-0.259	0.053	-0.29	5.13	0.023
		Female	-0.403	0.060	-0.40		
	Psychological Resilience → Social Disinterest	Male	-0.188	0.156	-0.11	0.05	0.823
		Female	-0.213	0.156	-0.12		
	Psychological Resilience → Social Avoidance	Male	-0.326	0.055	-0.36	0.17	0.680
		Female	-0.347	0.053	-0.38		

In summary, this study empirically validated the mediating role of psychological resilience in the process of group sports influencing adolescents' social withdrawal, particularly in addressing shy and avoidant withdrawal. Additionally, the moderation results for grade and gender emphasize the necessity of implementing personalized sports psychological interventions, particularly focusing on strategies to enhance psychological resilience in different developmental stages and gender groups[37].

5. Conclusion

Synthesizing the results of the study, the validation of the research hypotheses is as follows:

Support for hypothesis H1: The amount of group exercise significantly and positively predicted psychological resilience ($\beta=0.48$, $p<0.001$) and cognitive reassessment ($\beta=0.36$, $p<0.001$).

Partial support for Hypothesis H2: Psychological elasticity significantly negatively predicted shy withdrawal ($\beta=-0.34$, $p<0.001$) and social avoidance ($\beta=-0.35$, $p<0.001$), but was a weaker negative predictor of social apathy ($\beta=-0.08$, $p<0.05$) than the expected positive prediction.

Hypothesis H3 was supported: psychological resilience partially mediated the relationship between amount of group exercise and social withdrawal behavior, and the mediating effect varied across types of withdrawal behavior (shy withdrawal 45.7%, social avoidance 42.9%, and social apathy 21.1%).

This study enriches the theoretical framework of social withdrawal research, subdivided and verified the differential pathways of group exercise's effects on different types of social withdrawal, and provides new perspectives for school physical education and adolescent mental health promotion. Future studies can further explore the comparative effects of group exercise and individual exercise, as well as the specific effects of exercise content on social withdrawal, so as to improve the intervention system of adolescent social development.

References

- [1] Baumeister, R. F., & Leary, M. R. (2017). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Interpersonal development*, 57-89.
- [2] Blake, H. T., Stenner, B. J., Buckley, J. D., & Crozier, A. J. (2021). Randomised controlled trial comparing two group-based exercise programmes (team sport vs circuit training) on men's health: study protocol. *BMJ Open Sport & Exercise Medicine*, 7(3), e001140.
- [3] Brière, F. N., Yale-Soulière, G., Gonzalez-Sicilia, D., Harbec, M.-J., Morizot, J., Janosz, M., & Pagani, L. S. (2018). Prospective associations between sport participation and psychological adjustment in adolescents. *J Epidemiol Community Health*, 72(7), 575-581.
- [4] Chen, Y., & Liu, X. (2023). Social Withdrawal in Adolescence: Developmental and Humanistic Perspectives. *Journal of Humanistic Psychology*, 00221678231155514.
- [5] Coplan, R. J., Rose-Krasnor, L., Weeks, M., Kingsbury, A., Kingsbury, M., & Bullock, A. (2013). Alone is a crowd: social motivations, social withdrawal, and socioemotional functioning in later childhood. *Developmental psychology*, 49(5), 861.
- [6] Kumar, B., Saxena, B., Gupta, P., Batra, R., Patel, J., & Ganapathy, K. (2023). Effects of social estrangement on young people's maturation: a review of the research. *Georgian Medical News*, (345), 196-202.
- [7] Nelson, L. J. (2013). Going it alone: Comparing subtypes of withdrawal on indices of adjustment and maladjustment in emerging adulthood. *Social Development*, 22(3), 522-538.
- [8] Rubin, K. H., Coplan, R. J., & Bowker, J. C. (2009). Social withdrawal in childhood. *Annual review of psychology*, 60(1), 141-171.
- [9] Thonhauser, G. (2022). Being a team player: Approaching team coordination in sports in dialog with ecological and praxeological approaches. *Frontiers in psychology*, 13,

- 1026859.
- [10] Yue, Q., Guo-Li, Z., Psychology, S. O. , & University, B.S. (2018). Effect of physical activity on the internal problems behavior of adolescents: the mediating effect of self-esteem. *Modern Preventive Medicine*.
- [11] Ding, X., Coplan, R. J., Deng, X., Ooi, L. L., Li, D., & Sang, B.. (2019). Sad, scared, or rejected? a short-term longitudinal study of the predictors of social avoidance in Chinese children. *Journal of Abnormal Child Psychology*, 47(7), 1265-1276.
- [12] Han, Q. The impact of team sports games on social withdrawal behaviors in children aged 4-6 [D]. Nanjing Normal University, 2021.
- [13] Ji Yu. Intervention of cognitive and emotional regulation on psychological resilience in college students [D]. Northeast Normal University, 2018.
- [14] Jiang Li. Development of adaptive functions and neural mechanisms of different types of social withdrawal[D]. Shanghai Normal University, 2014
- [15] Li, L., Dang, R., Liu, H., & Chang, F. (2020). The impact of parental company on the noncognitive abilities of adolescents: A quasi-experiment research with a view of family meals. *Population and Development*, 26, 88-98.
- [16] Li Shujuan. Intervention of group teaching in basketball games on social withdrawal of children [D]. Nanjing Normal University, 2019.
- [17] Li Yiming. The influence of family upbringing on children's social withdrawal behavior: the mediating role of parent-child attachment [D]. Jilin University, 2017.
- [18] Lu, Y., Liu, Y. F., Qiu, Y. Y., Li, M. J., & Li, J. (2023). Impact of residents' emotion regulation on the mental health in sudden public health events: The mediating role of resilience. *Chinese Journal of Health Psychology*, 31(10), 1447-1452.
- [19] Ma, W. N., Sang, B., & Hong, L. M. (2008). A review of research on psychological resilience and its mechanisms of action. *J. East China Normal. Univ. (Educ. Sci. Ed.)*, 26, 89-96.
- [20] Meng Yanan and Zhang Can. The Impact of Parental Emotional Absence on Left-Behind Children -An Affective Sociological Analysis Based on the Discourse of Left-Behind Children. *Journal of Youth and Children Studies*, 2022(08):16-24.
- [21] Ru, X. Y., Wu, S. H., He, M. Y., Song, B. H., & Liu, D. Z. (2023). Analysis of the Effect of Group Sports Intervention on the Social Behavior of Children With Autism Spectrum Disorder. *Modern Special Education*, (14), 45-51.
- [22] Shang, Q., Gm, J., Zhou, T., Yh, H., Xc, D., & Sang, B. (2021). The progress of cognitive behavioral therapy in the intervention of socially withdrawn children. *Psychological Exploration*, 41(04), 364-369.
- [23] Shi, Y., & Liu, J. S. (2014). Differences in coping styles in response to a social stressor among different subtypes of social withdrawal: person-centered analyses. *Journal of Bio-education*, 2(03), 157-162.
- [24] Song Chenning, Yu Tao, Liu Fangfang, et al. What is childhood social withdrawal behavior? [J]. *Adolescent Health*, 2024,22(02):62-63.
- [25] Wan Yue. Intervention research on social withdrawal behavior in 5-6 year old children by football games [D]. Shenyang Normal University, 2021.
- [26] Wang, S. F. (2013). Characteristics of Withdrawal Behavior in Young Children and Strategies for Correction. *New Curriculum*, (07), 122-123.
- [27] Zhou, Z., Zhu, T., Sun, X., & Liu, J. (2006). The relationship between Social Withdrawal types in Middle Childhood and Friendship and Loneliness. *Psychol Sci*, 29(03), 536-40.
- [28] Zhu, X. Y., Wang, H., Chen, M. H., He, M. Y., Zhao, F., & Liu, D. Z. (2024). Peer-Mediated Group Exercise Intervention to Improve Symptoms for Children with Autism Spectrum Disorder. *Chinese Journal of Clinical Psychology*, 32(05), 1181-1186+1140.
- [29] Zuo, E. L. (2016). Social information processing of social withdrawal children: theoretical model, empirical research and development trend. *Journal of Jilin Provincial Institute of Education*, 32(12), 103-105.
- [30] Fresco, D. M., Coles, M. E., Heimberg, R. G., Liebowitz, M. R., Hami, S., Stein, M. B., & Goetz, D. (2001). The Liebowitz Social Anxiety Scale: a comparison of the psychometric properties of self-report and clinician-administered formats. *Psychological medicine*, 31(6), 1025-1035.
- [31] Gross, J. J., & John, O. P. (2003).

- Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of personality and social psychology*, 85(2), 348.
- [32] Leary, M. R. (1983). Social anxiousness: The construct and its measurement. *Journal of personality assessment*, 47(1), 66-75.
- [33] Chen, X., Song, H. Q., & Huang, X. (2012). Reliability and Validity of the Chinese Version of Preference for Solitude Scale. *China Journal of Health Psychology*, 20(02), 307-310.
- [34] He, Y., & Zhang, M. (2004). Psychometric investigation of liebowitz social anxiety scale. *J. Diagn. Concepts Pract*, 3(5).
- [35] Huang, R., Ding, M., Huang, H. H., & Zhang, H. W. (2022). Mediating effect of exercise self-efficacy between kinesiophobia and amount of physical activity in patients with coronary heart disease. *Chinese Journal of Nursing Education*, 19(12), 1119-1123.
- [36] Liang, D. Q. (1994). Stress levels and their relationship with physical activity among college students. *Chin. J. Mental Health*, 1, 5-6.
- [37] Xiang, B. H., Ren, L. J., Zhou, Y., & Liu, J. S. (2018). Psychometric properties of Cheek and Buss Shyness Scale in Chinese college students. *Chin J Clin Psychol*, 26, 4.