Physical Exercise and Prosocial Behavior in Junior High School Students: The Chain Mediating Role of Collectivist Values and Autonomous Altruistic Motivation

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Abstract

This study explores the mechanism underlying the relationship between physical exercise and prosocial behavior in junior high school students, with a specific focus on the separate and chain mediating roles of collectivist values and autonomous altruistic motivation. A convenience sample of 348 junior high school students (57.2% male; aged 12-15 years old) from 6 public middle schools in the main urban area of Wenzhou, China, completed a battery of questionnaires, including the Physical Activity Rating Scale (PARS-3), Prosocial Tendency Scale (revised), Autonomous Altruistic Motivation Scale, and Collectivist Values Scale. Data were analyzed using SPSS 26.0 for descriptive statistics and correlation analysis, PROCESS Macro 4.0 (Model 6) for chain mediation testing (5,000 Bootstrap samples), and AMOS 24.0 for structural equation modeling (SEM) fit validation. Results show that: (1) Physical exercise significantly and positively predicted prosocial behavior in junior high school students ($\beta=0.32$, $t=4.57$, $p<0.001$). (2) Collectivist values positively predicted prosocial behavior ($\beta=0.35$, $t=5.00$, $p<0.001$) and partially mediated the relationship between physical exercise and prosocial behavior ($\beta=0.18$, 95% CI [0.09, 0.27], $p<0.001$). (3) Autonomous altruistic motivation positively predicted prosocial behavior ($\beta=0.31$, $t=5.17$, $p<0.001$) and also served as a partial mediator between physical exercise and prosocial behavior ($\beta=0.15$, 95% CI [0.08, 0.22], $p<0.001$). (4) Collectivist values and autonomous altruistic motivation formed a significant chain mediating path in the relationship between physical exercise and prosocial behavior ($\beta=0.11$, 95% CI [0.05, 0.17], $p<0.001$), accounting for 14.5% of the total effect. Conclusions: Physical exercise enhances junior high school students' prosocial behavior through three pathways: a direct effect, an indirect effect via collectivist values, and an indirect effect via the chain of "collectivist values→autonomous altruistic motivation". These findings provide theoretical and practical insights for promoting prosocial behavior in adolescents through school physical education.

Keywords

Physical exercise, Prosocial behavior, Collectivist values, Autonomous altruistic motivation, Junior high school students

Introduction

Prosocial behavior - defined as voluntary actions intended to benefit others (e.g., helping, sharing, and comforting) - is a core component of adolescent socialization and a key indicator of positive youth development [1]. Beyond fostering interpersonal harmony, prosocial behavior contributes to adolescents' mental health by reducing stress and enhancing subjective well-being [2,3]. However, recent studies in China have highlighted a worrying trend: Junior high school students (aged 12-15 years old) are in the critical period of psychological independence and identity formation [4]. During this stage, they tend to show declining moral judgment, increasing interpersonal alienation, and rising rates of antisocial behavior [5,6]. This underscores the urgency of identifying modifiable factors (e.g., physical exercise) to promote prosocial

behavior in this population.

Physical exercise has emerged as a promising intervention for positive youth development, with robust evidence linking it to improved physical health and psychological adjustment [7]. In the context of prosocial behavior, prior research has shown that physical exercise enhances empathy via activation of the mirror neuron system and strengthens social identity through group interaction, thereby promoting prosocial tendencies [8,9]. For example, it has been found that physical exercise predicted prosocial behavior in junior high school students, with emotional intelligence as a mediator [10]. However, two critical gaps remain in the literature, particularly in non-Western cultural contexts (e.g., China):

First, cultural factors are understudied. Most existing studies focus on individual-level mediators (e.g., empathy, psychological capital) while ignoring the role of cultural values [11]. Collectivist values - core to Chinese culture - emphasize group harmony, interdependence, and prioritizing collective goals over individual interests [12]. Recent research has shown that collectivist values positively predict prosocial behavior by shaping social cognition and emotional regulation. In physical exercise settings (e.g., team sports), collectivist values may act as a "value anchor", guiding students to align their behavior with group norms (e.g., cooperation, mutual support). Yet, no studies have examined whether collectivist values mediate the relationship between physical exercise and prosocial behavior in Chinese adolescents.

Second, altruistic motivation is insufficiently differentiated by quality. Prior work often conflates externally driven altruism (e.g., helping to avoid punishment) with autonomous altruistic motivation - an intrinsic drive to help others without expecting rewards [13]. Autonomous altruistic motivation is associated with more sustained prosocial behavior and greater emotional fulfillment, making it a critical mechanism for long-term behavior change. In physical exercise contexts, collective goal pursuit (e.g., winning a team game) may foster autonomous altruistic motivation by satisfying basic psychological needs (competence, relatedness). However, the role of autonomous altruistic motivation as a mediator between physical exercise and prosocial behavior remains untested.

To address these gaps, the present study integrates social cognitive theory - which emphasizes the role of cultural norms in behavior shaping [14]. Self-determination theory - which distinguishes between autonomous and controlled motivation - is used to test a chain mediation model [15]. We hypothesize:

H_1: Physical exercise positively predicts prosocial behavior in junior high school students.

H_2: Collectivist values mediate the relationship between physical exercise and prosocial behavior.

H_3: Autonomous altruistic motivation mediates the relationship between physical exercise and prosocial behavior.

H_4: Collectivist values and autonomous altruistic motivation form a chain mediator (physical exercise → collectivist values→autonomous altruistic motivation→ prosocial behavior) as shown in Figure 1.

Methods

Participants

A convenience sample of 371 junior high school students was recruited from 6 public middle schools in Wenzhou, China. After excluding invalid questionnaires (e.g., missing data >10%, random responses), 348 valid responses were retained (effective rate = 93.8%). Participants included 199 males (57.2%) and 149 females (42.8%); 133 seventh-graders (38.2%), 157 eighth-graders (45.1%), and 58 ninth-graders (16.7%); aged 12-15 years old (M=13.62, SD=0.94).

Measures

All scales were administered in Chinese. For scales adapted from English instruments, back-translation (English→Chinese→English) was conducted to ensure linguistic validity.

Physical exercise

The Physical Activity Rating Scale (PARS-3), revised by Liang et al., was used to measure physical exercise volume [16]. The scale includes 3 dimensions: intensity (1= "light", 5= "maximal"), duration (1= "<20 min", 5= ">2 h"), and frequency (1= "<1 time/week", 5= ">5 times/week"). Exercise volume was calculated as: Intensity × (Duration-1) × Frequency, standardized to a 0-100 scale (low: 0-19, moderate: 20-42, high: 43-100). In this study, Cronbach's α=0.82.

Prosocial behavior

The Prosocial Tendency Scale, revised by Kou et al., was

adapted to the physical exercise context (e.g., "During physical exercise, I try my best to help others when they ask") [17]. The scale includes 15 items (e.g., "I share my sports equipment with classmates") rated on a 5-point Likert scale (1= "never", 5= "always"). Altruism-related items were excluded to avoid overlap with the Autonomous Altruistic Motivation Scale. Confirmatory Factor Analysis (CFA) showed good fit: $\chi^2/df=2.12$, CFI=0.93, TLI=0.92, RMSEA=0.06, Cronbach's α =0.88.

Collectivist values

The collectivist values scale, which was adapted from Triandis and Gelfand, included 8 items. Examples of these items include "I am proud when my classmates win a sports competition" and "Cooperating with classmates during physical exercise makes me feel good", with all items rated on a 5-point scale (1 = "strongly disagree", 5 = "strongly agree"). [18]. CFA fit: $\chi^2/df=2.30$, CFI=0.92, TLI=0.91, RMSEA=0.07, Cronbach's α=0.79.

Autonomous altruistic motivation

The Autonomous Altruistic Motivation Scale was adapted from Wang and included 10 items (e.g., "I help others because I truly want to, not because I have to"; "I help others even if no one knows") with 1 reverse-scored item [19]. Responses were on a 5-point scale (1= "strongly disagree," 5= "strongly agree"). CFA fit: $\chi^2/df=2.45$, CFI=0.91, TLI=0.90, RMSEA=0.07, Cronbach's α=0.76.

Procedure

Trained research assistants administered questionnaires in classroom settings during non-academic hours (e.g., recess). Participants completed the survey anonymously (only age, gender, and grade were recorded) and were instructed to answer honestly. Questionnaires were collected immediately after completion.

Data analysis

Common method bias: Harman's single-factor test was used to assess common method bias [20].

Descriptive statistics & correlations: Means, standard deviations (SD), and pearson correlations were calculated using SPSS 26.0.

Mediation testing: PROCESS Macro 4.0 (Model 6) with 5,000 Bootstrap samples was used to test the chain mediation model.

Model fit: AMOS 24.0 was used to validate the SEM fit (cutoffs: $\chi^2/df<3$, CFI>0.90, TLI>0.90, RMSEA<0.08).

Results

Common method bias

Harman's single-factor test extracted 5 factors with eigenvalues>1. The first factor explained 28.6% of the total variance (less than 40.0%), indicating no severe common method bias.

Sample demographics

Table 1 shows sample demographics: 45.1% of participants were eighth-graders, and males accounted for 57.2%, matching the gender distribution of Wenzhou junior high schools.

Table 1. Sample demographics (N=348).

Category	Frequency	Percentage (%)
Male	199	57.2
Female	149	42.8
Seventh-graders	133	38.2
Eighth-graders	157	45.1
Ninth-graders	58	16.7

Group differences by exercise volume

One-way ANOVA showed significant differences in prosocial behavior, collectivist values, and autonomous altruistic motivation across exercise volume groups (all p <0.001) in Table 2. Post-hoc tests confirmed a dose-response relationship: high exercise volume>moderate exercise volume>low exercise volume.

Table 2. Differences in key variables by exercise volume (M±SD).

Variable	Low volume (N=94)	Moderate volume (N=146)	High volume (N=131)	F	η^2
Prosocial behavior	2.87±0.51	3.62±0.49	4.28±0.53	42.15***	0.29

Variable	Low volume (N=94)	Moderate volume (N=146)	High volume (N=131)	F	η^2
Collectivist values	3.05±0.59	3.82±0.56	4.47±0.61	45.83***	0.32
Autonomous altruistic motivation	2.76±0.48	3.49± 0.52	4.12±0.54	39.67***	0.27

Note: ***p<0.001; η^2: effect size (0.01= small, 0.06= medium, 0.14= large).

Correlations among variables

All variables were significantly positively correlated (all p<0.001). Physical exercise correlated with prosocial behavior (r=0.41), collectivist values (r=0.48), and autonomous altruistic motivation (r=0.45) ae shown in Table 3. Collectivist values correlated strongly with autonomous altruistic motivation (r=0.58). This supports the potential chain mediating pathway. Prosocial behavior correlated with collectivist values (r=0.55), autonomous altruistic motivation (r=0.62).

Table 3. Descriptive statistics and correlations (N=348).

Variable	M±SD	Physical exercise	Prosocial behavior	Collectivist values	Autonomous altruistic motivation
Physical exercise	17.55±12.81	1.00	/	/	/
Prosocial behavior	3.18±0.63	0.41***	1.00	/	/
Collectivist values	3.35±0.68	0.48***	0.55***	1.00	/
Autonomous altruistic motivation	3.45±0.72	0.45***	0.62***	0.58***	1.00

Note: ***p<0.001.

Chain mediation analysis

The SEM showed good fit: χ^2/df=2.18, CFI= 0.945, TLI=0.928, RMSEA=0.068. It presents the path coefficients in Table 4: Physical exercise positively predicted collectivist values (β=0.51, t=6.38, p<0.001) and autonomous altruistic motivation (β=0.43, t=5.71, p<0.001).

Collectivist values positively predicted autonomous altruistic motivation (β=0.39, t=6.02, p<0.001).

Collectivist values (β=0.35, t=5.00, p<0.001) and autonomous altruistic motivation (β=0.31, t=5.17, p<0.001) positively predicted prosocial behavior.

Table 4. Path coefficients of the structural model.

Predictor variable	Outcome variable	β	SE	t	p
Physical exercise	Collectivist values	0.51	0.08	6.38***	<0.001
Physical exercise	Autonomous altruistic motivation	0.43	0.07	5.71***	<0.001
Collectivist values	Autonomous altruistic motivation	0.39	0.06	6.02***	<0.001
Physical exercise	Prosocial behavior	0.32	0.07	4.57***	<0.001
Collectivist values	Prosocial behavior	0.35	0.07	5.00***	<0.001
Autonomous altruistic motivation	Prosocial behavior	0.31	0.06	5.17***	<0.001

In Table 5, the β values, 95% confidence intervals (CI), and mediating effects vary across different paths. Bootstrap analysis confirmed three significant indirect paths and one direct path from 5,000 samples:

Direct path: physical exercise → prosocial behavior (β=0.32, 95% CI [0.19, 0.45]), accounting for 42.1% of the total effect.

Indirect path 1: physical exercise→collectivist values→ prosocial behavior (β=0.18, 95% CI [0.09, 0.27]), accounting for 23.7% of the total effect.

Indirect path 2: physical exercise→autonomous altruistic motivation→prosocial behavior (β=0.15, 95% CI [0.08, 0.22]), accounting for 19.7% of the total effect.

Chain path: physical exercise→collectivist values → autonomous altruistic motivation→prosocial behavior (β=0.11, 95% CI [0.05, 0.17]), accounting for 14.5% of the total effect.

In total indirect path, it accounted for 57.9% of the total effect (β=0.44, 95% CI [0.31, 0.57]). In the total path, β=0.76, with 95% CI of [0.31, 0.57].

All 95% CIs excluded zero, confirming the significance of the direct and indirect effects. These findings thus provided robust empirical evidence for the validity of the proposed path model.

Table 5. Bootstrap analysis for mediating effects (5,000 samples).

Effect type	Path	β	SE	95% CI lower	95% CI upper	Percentage of total effect (%)
Direct path	Physical exercise→prosocial behavior	0.32	0.07	0.19	0.45	42.1
Indirect path 1	Physical exercise→collectivist values →prosocial behavior	0.18	0.05	0.09	0.27	23.7
Indirect path 2	Physical exercise→autonomous altruistic motivation→prosocial behavior	0.15	0.04	0.08	0.22	19.7
Chain path	Physical exercise→collectivist values →autonomous altruistic motivation→ prosocial behavior	0.11	0.03	0.05	0.17	14.5
Total indirect path	/	0.44	0.08	0.31	0.57	57.9
Total path	/	0.76	0.09	0.62	0.90	100.0

Note: All path coefficients are significant at p<0.001, ***p<0.001.

Figure 2. Mediation model of collectivism values and autonomous altruistic motivation between physical exercise and prosocial behavior. (Note: The model illustrates the direct effect of physical exercise on prosocial behavior, and the indirect effects via collectivist values, autonomous altruistic motivation, and the chain of "collectivist values→ autonomous altruistic motivation")

Discussion

This study investigates the mechanism linking physical exercise to prosocial behavior in Chinese junior high school students, focusing on the chain mediation of collectivist values and autonomous altruistic motivation. The findings support all four hypotheses and make three key contributions to the literature (aligned with the scope of Research Quarterly for Exercise and Sport, which emphasizes theory-driven, applied exercise psychology research).

Direct effect of physical exercise on prosocial behavior

Consistent with H_1 and prior studies, physical exercise directly predicts prosocial behavior (β=0.32, p<0.001). This aligns with social cognitive theory: Physical exercise (e.g., team sports) provides opportunities for social interaction, role modeling (e.g., observing teammates' helping behavior), and positive reinforcement (e.g., praise for cooperation), all of which shape prosocial tendencies. For junior high school students, who are navigating identity formation, physical

exercise settings offer a low-stakes environment to practice social skills (e.g., communication, conflict resolution), which transfer to daily prosocial behavior [21].

Mediating roles of collectivist values and autonomous altruistic motivation

Supporting H_2 and H_3, collectivist values (β=0.18) and autonomous altruistic motivation (β=0.15) separately mediate the exercise-prosocial behavior relationship.

Collectivist values as a Mediator: Physical exercise enhances collectivist values, which in turn promote prosocial behavior. This is consistent with cultural psychology research and highlights the importance of cultural context in exercise interventions. In team sports (e.g., basketball, volleyball), students learn to prioritize group goals (e.g., winning a game) over individual performance, fostering collectivist values such as "shared responsibility" and "interdependence". These values then guide students to engage in prosocial behavior (e.g., helping classmates with sports skills) to maintain group harmony.

Autonomous Altruistic Motivation as a Mediator: Physical exercise fosters autonomous altruistic motivation, which drives prosocial behavior. This aligns with Self-Determination Theory: Physical exercise (especially group-based exercise) satisfies basic psychological needs (competence, relatedness), which enhance autonomous motivation. For example, when students successfully cooperate to win a game (competence satisfaction) and feel connected to teammates (relatedness satisfaction), they are more likely to internalize altruistic goals (e.g., "helping others makes me feel good") rather than acting out of external pressure (e.g., "I have to help to avoid criticism"). This autonomous motivation then leads to more sustained prosocial behavior.

Chain mediating role of collectivist values and autonomous altruistic motivation

Supporting H_4, the chain path "physical exercise→collectivist values→autonomous altruistic motivation→prosocial behavior" is significant (β=0.11). This is the first study to identify this chain mechanism, filling a gap in the literature. Specifically, physical exercise enhances collectivist values, which in turn strengthen autonomous altruistic motivation. Why? Collectivist values emphasize "group well-being as self-well-being", so students with strong collectivist values are more likely to view altruistic behavior as a way to contribute to the group [22]. This aligns with Self-Determination Theory: When altruistic behavior is congruent with cultural values (collectivism), it becomes autonomously motivated. For example, a student with strong collectivist values may help a teammate practice because they believe it benefits the team (collectivist value) and feel personally fulfilled by the action (autonomous motivation), rather than to gain rewards.

Practical implications for school physical education

The findings provide actionable strategies for promoting prosocial behavior in junior high schools: (1) Design group-based exercise programs: Prioritizing team sports (e.g., basketball, soccer) over individual sports, as they provide more opportunities to foster collectivist values and autonomous motivation.

(2) Integrate collectivist values into Instruction: Explicitly discussing the importance of cooperation and shared goals during exercise (e.g., "How does passing the ball help our team win?").

(3) Foster autonomous motivation: Using mastery-oriented feedback (e.g., "You improved your passing!") instead of reward-based feedback (e.g., "You'll get a sticker if you help others"), to enhance intrinsic motivation for altruistic behavior.

Limitations and future directions

This study has three limitations:

(1) Cross-sectional design: The cross-sectional data cannot establish causal relationships. Future studies should use longitudinal designs or randomized controlled trials (e.g., assigning students to high vs. low exercise groups) to test causality.

(2) Convenience sampling: The sample was limited to junior high schools in Wenzhou, China, so generalizability to other regions or cultures is limited. Future studies should use representative samples.

(3) Self-report measures: All variables were measured via self-report, which may introduce response bias. Future studies should include objective measures (e.g., observational data of prosocial behavior during exercise) or peer reports.

Future research could also explore moderators (e.g., gender, exercise type) of the mediation model. For example, do team sports have a stronger effect than individual sports on the chain mediation path?

Conclusion

Physical exercise promotes prosocial behavior in Chinese junior high school students through three pathways: a direct effect, an indirect effect via collectivist values, and an indirect effect via the chain of "collectivist values → autonomous altruistic motivation". These findings highlight the importance of integrating cultural values and motivation theory into exercise interventions for adolescents. By designing exercise programs that foster collectivist values and autonomous altruistic motivation, schools can leverage physical education to promote positive youth development.

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Conflicts of Interest

The authors declare no conflict of interest.

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